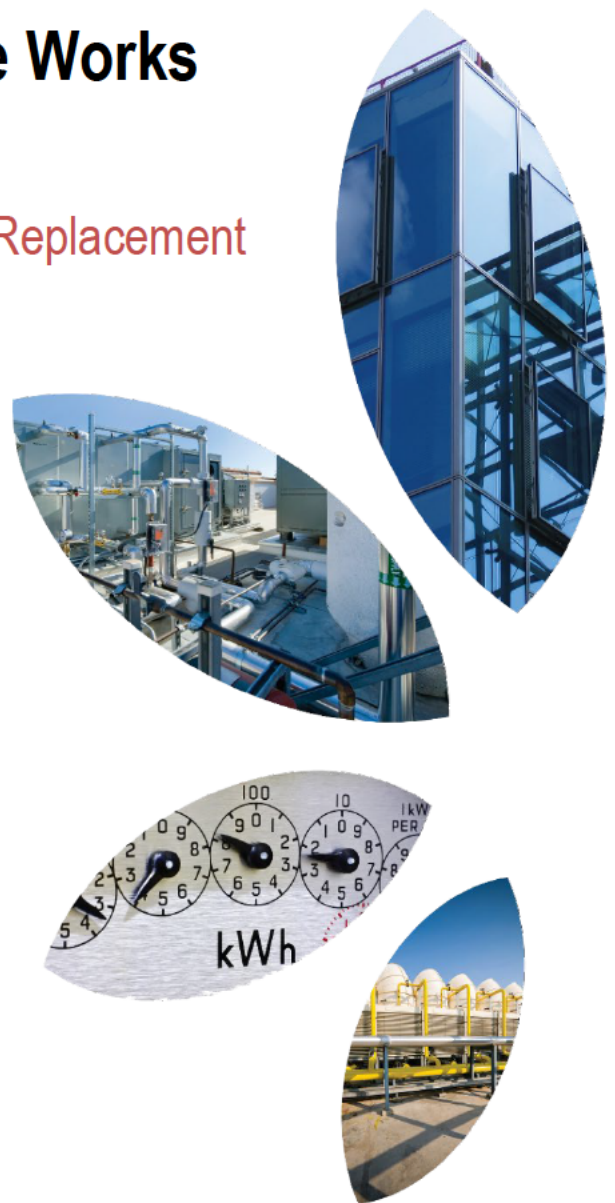


Harold Holt Swimming Centre Energy Efficiency Upgrade Works

Engineering Technical Specification

Mechanical Service System – Boiler Replacement

TSP-STNC.HHSC-MECH-01



Prepared for **Stonnington City Council**

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1. GENERAL CONDITIONS

1.1 INTENT

The documentation is to be read in conjunction with the Project's Contract and Design. Where these sources cover similar requirements, the Contractor shall allow for the more onerous requirement.

It is the intent of this document to call for finished work, installed, tested, ready for operation and of guaranteed performance.

Any materials, apparatus etc., not shown on the drawings but which are mentioned in this Specification and Standard Specification or vice versa, shall be supplied and installed at no extra cost. Any services, item of work or small detail not usually specified but inferred and necessary for the satisfactory operation of the system or installation, shall be provided by the Contractor without any additional expense to the Project Manager.

All materials and apparatus required for the work shall be new and of first quality and shall be furnished, delivered erected, connected and finished in every detail. Where no specific type of quality of material is specified, a first class standard article as approved by the Engineer, shall be provided.

All work carried out shall be performed in accordance with the best trade practice by competent tradesmen.

1.2 INTERPRETATION OF TERMS

In reading any document relating to this Contract the following terms shall have these meanings assigned to them:

Approved: shall mean approved in writing by the Project Manager, Architect or Engineer.

AHU: Air Handling Unit.

ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers

Authority: relevant statutory body or bodies responsible for the particular work specified

BAS or BMS: Building Automation System. The entire integrated management and control system as applied to a specific project or building.

COP: Coefficient of Performance.

EER: Energy Efficiency Ratio.

Contractor: the Contractor performing the works of this Contract.

Client or Council: Stonnington City Council or the Council's project representative.

Data (or objects): as any value, attribute, event, schedule, trend, alarm, calculation or result of logic that is available from anywhere in the entire system. Data can be either real-time (live) or historical datasets. Data is also referred to as 'objects' throughout this document.

Demolish: decommission, disconnect, make safe and remove from site referred and redundant existing equipment, without damage or impairment of any remaining systems or equipment.

Drawings: the drawings prepared by Engineer which shall be the design drawings referred to elsewhere.

DX: Direct Expansion.



FCU: Fan Coil Unit.

HVAC: Heating Ventilation and Air Conditioning

OA: Outside Air.

PAC: Packaged Airconditioning Unit

Project Consultant or Engineer: Ecosave Pty Ltd

Project Manager: the authorised representative managing the project.

Provide: to design, manufacture, supply, deliver, install, test, commission, warrant, guarantee, maintain, service, enter data for, and do all other things necessary to make the device, system, concept, method or requirement an integral part of the working installation.

Replace: de-commission, disconnect, make safe and remove from site existing equipment without damage or impairment of any remaining systems or equipment. Then provide new equipment equivalent to the existing and fully compatible with remaining systems or services.

Technical Specification or Specification: Ecosave Technical Specification (this document in its entirety)

The Work: shall mean the work to be carried out by the Contractor.

VAV: Variable Air Volume

VRF: Variable Refrigeration Flow

VSD: Variable Speed Drive

1.3 AUTHORITIES

The Contractor shall install all services to the satisfaction of all authorities having jurisdiction over the performance and work to be constructed. The entire installation shall fully comply with the regulation of the following Authorities having jurisdiction over the works:

- Stonnington City Council
- Power Supply Authority
- Water & Sewage Service Provider
- Worksafe Victoria
- Heritage Victoria
- Metropolitan Fire Brigade (Victoria)
- Essential Services Commission (Victoria)
- Energy Safe Victoria
- Victorian Building Authority

1.4 STANDARDS

The Contractor shall install all services to the satisfaction of all authorities having jurisdiction over the performance and work to be constructed.

The entire installation shall be carried out in accordance with the requirements of this specification and accompanying drawings. The complete work shall also comply with the rules, regulations and requirements of:

AS 1055 Acoustics - Description and measurement of environmental noise



AS 1345	Identification of the contents of pipes, conduits and ducts
AS 1668.1	The use of ventilation and air conditioning in buildings Fire and smoke control in buildings
AS 1677	Refrigerating systems
AS/NZ 2107	Acoustics – Recommended design sound levels and reverberation times for building interiors.
AS 2885	Pipelines - Gas and liquid petroleum General requirements
AS/NZS 3000	Electrical Installation
AS 3666	Air handling and water systems of buildings -microbial control
AS 4041	Pressure piping
AS 4254	Ductwork for air handling systems in buildings
AS 5601	Gas Installations

Other Statutory Authorities having jurisdiction over the work.

In case of the drawings and specification conflicts the latest version of relevant standards, the latest version will take precedence.

1.5 HEALTH AND SAFETY

Ensure that the obligations imposed by all Health and Safety Legislation, Acts, Regulations and Codes of Practice are complied with at all times including:

- Being familiar with the requirements of those Acts, Regulations and Codes of Practice as applicable to the works.
- Ensuring that the specified works provides for all the safety of all personnel during construction, inspection, testing and subsequent operation of the system/s.
- Provide input into a site wide Risk Register for the identification of hazards, assessment of risks, and implementation of necessary risk control measures and devices and provision of information to ensure the safety of all personnel during construction, inspection, testing and subsequent operation of the system/s.
- Provide advice as to all potential hazards not adequately protected to the requirements of the Health and Safety Legislation, Acts, Regulations and Code of Practice.
- Provide all temporary or permanent screens, guarding, access facilities, safety notices, identification labels and safety clothing, footwear and equipment required for the execution, testing and maintenance of the works.
- Should hazardous materials be present or encountered, immediately notify the party responsible for site safety, of the location and any details prior to any handling or removal of hazardous materials.

For the purpose of the relevant Legislation the Contractor shall be the Designer, responsible for ensuring that the final design of the plant and equipment selections, shop drawings etc for the project enable all plant and equipment to be maintained, operated and replaced safely.

It is incumbent upon the Contractor to make himself familiar with the above acts and regulations and ensure compliance during the contract works.



1.6 HERITAGE CONSIDERATIONS

The existing building and site has heritage significance and this has been a key project element for the Client and design team. The Contractor shall incorporate the heritage requirements and to implement the Project in accordance with such, including incorporation in protocols, procedures and management methods. These requirements are further outlined in the a separate Heritage Management Plan.

1.7 DRAWINGS BY ENGINEER

The design drawings show approximate locations of fittings and items of plant only and shall be considered as diagrammatic and a guide only. The drawings, specification and other documents are intended to be mutually explanatory and complete, but all work entailed by the one, even if not by the other, shall be fully executed.

This Specification shall be read in conjunction with the services drawings, architectural drawings, other specification sections and all revisions, amendments, annexures and instructions issued by the Architect.

1.8 CONSTRUCTION SHOP DRAWINGS

Detailed shopping drawings are required by the Contractor for the Work. The Contractor must provide site validation of the design before selecting equipment and materials.

Responsibility for the compliance of the final installation to all manufacturer requirements and arrangements necessary for the final equipment routes and locations and allowances for all de-rating capacities rests with the Contractor. It is expected that full allowance for all necessary fixtures, fittings and minor offsets to fit pipe work around the structure etc. shall be allowed for in the tender cost.

1.9 SUBMISSION OF EQUIPMENT AND MATERIALS

Submit manufacturers technical data for all equipment prior to ordering, including detailed selections indicating equipment make, model number and technical data.

- Detailed design to proof the selection of equipment
- Selection of equipment not otherwise specified to comply with the specification.
- Manufacturer's product data sheet, installation manual and application instructions.
- Equipment schedule and bill of materials (BoM).
- Provide manufacturer's factory test report upon to Engineer's request.
- Site inspection and measurement, setting out and detailed dimensional design and documentation of the work to ensure the installation can be accommodated within the current site arrangements.

1.10 STAGING OF THE WORKS

The Contractor shall complete the relevant sections of the works within the proposed staged construction program. Upon the acceptance of the tender the Contractor shall prepare a program for the contract works based around the Project Manager's agreed program.



The Contract shall be based upon a guarantee that all materials and equipment required for the works can be supplied and installed in such time as to enable the works to be completed by the date for Practical Completion.

1.11 PROJECT MANAGEMENT

The Contractor is responsible for the complete delivery of each portion of the works, using this tender specification as a minimum reference document for compliance requirements. This includes the following project management aspects:

- Programming and scheduling of the work in consultation with the Project Manager. Programs shall be submitted in MS Project format or agreed alternative format.
- Completion of a detailed design within the overall system (or concept) design described by this specification and drawings.
- Reporting in writing, to the Project Manager, any discrepancies in the documentation for clarification.
- Project co-ordination and on-site commissioning.
- Management of project engineering and other documentation.
- Change management. Prepare a cutover plan and procedure for each portion of works.
- Attend site meetings

The hours of operation will normally be as per the site hours of trade, however certain works can only be undertaken after hours.

1.12 SAMPLES AND SUBMISSIONS

The Contractor shall submit samples of the following equipment:

- All valve and pipe fittings
- All air registers, grills, and diffusers
- Thermal insulation sample pad
- Painting sample board, labels

Samples should be submitted in sufficient time to allow for comment without affecting the construction program. No additional costs will be permitted for delays or additional procurement costs caused by rejection of the samples.

1.13 COORDINATION OF CHANGEOVERS

For each item of equipment or subsystem that are brought into operation, the Contractor shall provide a qualified staff member at start-up the following morning to ensure that the equipment or subsystem starts correctly and operates as designed.

Any issues with operation of the equipment or subsystem must be addressed immediately before proceeding any further with the works. The contractor shall inform/report to the client regarding any issues and concerns that require action.

For critical items highlighted in the Risk Management Plan, the contractor shall develop strategies to address any issues that should arise during the changeover. These strategies should consider options to operate plant manually.



1.14 WORKMANSHIP

All service in the Work shall be installed by approved competent qualified first-class tradesmen, licensed as required for the particular service to be installed by the Authority having jurisdiction over the work.

1.15 RESTORATION OF SURFACES

The Contractor shall be responsible for the restoration of any finished surfaces or materials removed or damaged in the course of this Contract.

1.16 TEST AND COMMISSIONING

All systems and equipment shall be commissioned by suitably qualified and experienced tradesmen who shall operate and commission the units in accordance with the details and requirements of the equipment manufacturers.

Instruments used for measuring and testing shall be suitable for the task and approved by NEBB and which shall have been calibrated and certified by NATA approved laboratories.

All aspects of the systems shall be checked and measured, and copies of the signed sheets shall be forwarded to the Project Manager and copies shall be included in the Operating and Maintenance Manuals.

1.16.1 Equipment Commissioning

Commission equipment according to manufacturer's instructions.

Operate equipment steadily at full load and record the operating conditions, air/water flow rates and energy consumption. Also operate equipment at various part load points and check correct operation, recording operating conditions at each point.

1.16.2 System commissioning

Carry out a comprehensive water system commissioning and balancing, by a qualified technician, including:

- Measure system total water flow tests, including pressure differentials across all equipment
- Compare with readings of pump performance curves, both head/low and power/flow curves.
- Measure terminal flows via calibrated balancing valves annubars or control valves with published flow coefficients.
- Adjust the balancing valve to achieve the designed water flow. Record and mark the balanced positions.

Carry out a comprehensive air system commissioning and balancing, by a qualified technician. Measure total air flow and branch flows using Pitot tube and manometer. Cross check air supply equipment's performance curves against both static pressure and power consumption

1.16.3 Fire Mode Test

Fire mode tests shall be carried out according to relevant building codes and standards. Commission and test smoke control systems to AS/NZS 1668:1.

Coordinate with the fire service contractor and test fire alarm system is activated and that the air conditioning system functions correctly. Test fire dampers and smoke dampers to ensure they close fully with fans operating.



1.17 PRACTICAL COMPLETION

Prior to acceptance, it shall be demonstrated to the Project Manager that all aspects of the plant operate satisfactorily, including safety devices.

In addition, any necessary Council or other Authority approvals shall be obtained.

Two weeks notification of such tests shall be given to the Project Manager of the date and time the tests will be carried out. Should the commissioning or system not be complete by the date given, all costs associated with a re-test and witnessing thereof will be charged to the Contractor until the system is deemed practically complete.

1.18 OPERATING AND MAINTENANCE MANUALS

The contractor shall provide a complete set of operation and maintenance documentation for this project. Practical completion will not be granted until these are delivered in an acceptable format as detailed below.

The documentation shall include as a minimum:

- Scope of works
- System description
- Coordination drawings showing interface terminal numbers and cross-referenced wire numbers for all connections between the DDC equipment and other equipment.
- Itemised list of equipment installed indicating the make, model, serial number, size and range of operation – inclusive of manufacturer and associated contact details.
- A data sheet for each item of equipment in the system.
- Configuration Data detailing any user configurable parameters and a definition of what the configuration parameter affects.

Provide detailed operating instructions including:

- Starting up, operating and shutting down procedures for the installed or modified systems.
- Testing and commissioning results.
- Operating and maintenance Instructions.

Documentation should be submitted electronically on CD or USB drive with all documents in two formats, an Adobe pdf format and the native editable format as follows:

- Drawings: AutoCAD .DWG format: latest release at time of practical completion.
- Text: Microsoft Word format: latest release at time of practical completion.

1.19 TRAINING

The contractor shall provide training in the operation of the system. Training shall be for both the site operators and the BMS contractor.

Training notes including example scenarios shall be provided to each trainee for future reference.

1.20 FINAL CERTIFICATES

After commissioning of all services and completion of all works, the Contractor shall lodge all certificates as issued by all Authorities with the Project Manager, verifying that the installation has been, inspected, tested and approved by each relevant Authority.



Provide Certificate of Electrical Safety from a licensed electrician for all the electrical works undertaken in conjunction with these works.

Provide Certificate of Compliance for all plumbing, mechanical ventilation, heating, refrigeration, and air conditioning works carried out under this contract from licensed tradespersons.

1.21 DEFECTS LIABILITY PERIOD

The contractor shall warrant all works including equipment, materials, and installation against defects for a period of twelve (12) months from the date of Practical Completion.

Should a defect arise during the defects liability period, a work report detailing the actions taken during any visit shall be prepared and submitted at the end of the visit. The work report should be signed by facility management and a copy left on site. A second copy should be included with any invoice submitted for costs not covered under the Warranty.

The Contractor shall provide the following level of maintenance during the warranty period:

- Comprehensive maintenance and service on the complete works strictly in accordance with the equipment manufacturers' recommendations.
- Rectify any defects discovered or advised by stakeholders. The cost of labour is to be inclusive. The cost of replacement parts is inclusive when they have become faulty through normal wear and tear.
- Carry out the Performance Tuning requirements and associated reporting commitments

During the maintenance period, carry out routine maintenance, inspections and tests in accordance with authority requirements, the Building Code of Australia and referenced documents.



2. EXTENT OF WORKS

2.1 PROJECT DESCRIPTION

The work in this section comprises the supply, installation, testing and commissioning of mechanical services systems as detailed within this specification and drawings, together with such minor works as necessary to form complete and satisfactory system.

The work is for the Harold Holt Swim Centre, a flagship leisure centre in the city of Stonnington, VIC. The site is located 1409-1413, Glen Iris Vic 3146.

This mechanical services works is part of the site's Energy Efficiency Upgrades Project. Other building works including Lighting, Solar PV, BMS and Pool Services Upgrades will be implemented by other contractors.

2.2 SITE DESCRIPTION

Harold Holt Swim Centre is located at the corner of Edgar and High streets, Glen Iris VIC 3146. The Centre has various facilities to provide community with opportunities to improve their health and wellbeing. It is a two-storey building with several pools, health club, fitness studios and a café.

The complex consists of five pools, including an outdoor 50m pool, an indoor 25m lap pool and leisure pool enclosed by a full-height glass walled façade in the pool hall. The complex also houses a hydrotherapy pool, spa, sauna and multi-purpose room for aerobics and yoga classes apart from the health club and fitness studios.

The facility also consists of amenities including Gym, fitness, café, change rooms.

2.3 EXISTING OUTDOOR HEATING PLANT

There is a thermal heating plant serving the site's 50m outdoor pool, leisure pool, hydrotherapy pool and SPA. The heating plant is located at the outdoor pool plant and consists of one 770kW 'Modulex' condensing boiler and one 530kW 'Raypak' conventional natural gas boilers for heating up water. The designed hot water supply temperature from the boiler is 80°C. Heat from the hot water is transferred to swimming pool water via the heat exchanger of the corresponding pool. The design hot water temperature supplied to the pools is 49°C.

The hot water from boilers is circulated by three hot water pumps to heat exchangers. Each of them is equipped with a Variable Speed Drive (VSD).

2.4 SCOPE OF WORK

The work in this specification comprises the necessary authority approvals, supply, installation, testing & commissioning, operation and maintenance documents and certification of performance for mechanical services system on Drawings and Specification.

General

- Inspect the site to confirm the scope of work, identify site latent conditions, and informed Engineer any discrepancy between the Drawings and site conditions.
- Detailed and fully coordinated "Shop/Installation Drawings" and schedules of equipment demonstrating compliance with the specification, fully depicting the entire installation, for approval prior to equipment purchase or ductwork manufacture.
- Submission of shop drawings, selected equipment & materials.



- Provision of services as detailed in the Drawings and Specifications.
- Preparation of Installation Programme submitted for approval prior to equipment ordering.
- Coordinate with the site stakeholders and other contractors assigned by the Project Manager
- Manufacturer's product data sheets, factory test reports, certified drawings, upon request.
- Samples, where specified, prior to placing orders.
- Test & commissioning of new installed equipment and system. Provide required commissioning data and calibration certificates as required.
- As-installed drawings (electronic and hard copy) as further specified.
- Two sets of bound Operation and Maintenance Manuals incorporating as-installed drawings.
- Engineering certification by calculating the electrical performance of the systems relative to the specified requirements, prior to equipment ordering or manufacture.
- Provision of 12 months defect liability.

Replacement of Boiler

- Demolish existing old 'Raypak' boiler and its accessories. Remove the decommissioned waste off site and recycle.
- Supply and install one (1) off new 530kW condensing boiler as specified in the Equipment Schedule.
- Supply and install relevant boiler accessories.
- Provide exhaust flue and connect to the new boilers.
- Provide new pipework, pipe fittings, instruments, and insulation laggings as shown on the Drawings.
- Connect existing gas supply pipe, power supply, heating hot water pipe, and drainage pipe to the new boilers/heat exchanger
- Provide insulation laggings to new heating hot water pipe
- Flush, refill, and pressurise new heat hot water loop
- Test & commissioning. Coordinate with boiler supplier's technician to complete boiler commissioning

Pipe Modifications

- Supply and install universal thermal pockets as shown on the Drawings. Coordinate with BMS contractor to ensure the installed thermal pockets are compatible to the temperature sensors supplied by the BMS contractor.
- Supply and install tees with isolation valves in the main flow return pipes as shown on the Drawings. Coordinate with BMS contractor to ensure connections of the new pipe tees are compatible to the differential pressure sensors supplied by the BMS contractor.

2.5 COORDINATION WITH OTHER PARTIES

2.5.1 Power Supply Authority

No works in relation to power supply authorities are required in the Contract.



2.5.2 Communication Service Providers

No works in relation to communication service providers are required in the Contract.

2.5.3 Building Trades

The demarcations between the Contractor and Building Trades are follows:

Provision by the Building Trades

- Fire rating of all penetrations.
- Door signage and hardware for switch rooms, main communications room, switchboard enclosures, communications cupboards/rooms, security and fire control rooms, risers, etc. to statutory requirements.
- Painting of conduits, cable trays, brackets, poles, etc. to architectural requirements.
- Provision of all rebates within walls and columns for flush mounting equipment including all switches, switch panels, wall boxes and the like.
- Riser cupboards with doors for light and power distribution boards, Telecom, security and data cabling.
- Ceilings structural reinforce suitable for typical floor fluorescent light fittings of 10 kg each.

Provision by the Contractor

- Provide proper mounting accessories, such as pipe & ductwork hangers, supports, isolations for the equipment be securely mounted in wall, ceiling and other building surfaces.
- Make good penetrations and wall chases in rendered walls and block work surfaces.
- Ceilings trimmed and formed with supports for equipment and recessed equipment fully accessible throughout.
- Repair, patching and making good around new luminaires in walls, floors, columns etc., and waterproof penetrations of vapour barriers or roof sheeting.
- Repair damaged ceiling tiles where lights are being repositioned or removed for new.

2.5.4 BMS Contractor

The demarcations between the Contractor and Mechanical Services Contractor are follows:

Provision by the BMS Contractor

- Provide requirements of the locations and space of the new field points and DDC.
- Connect the condensing boilers via High Level Interface(HLI) to the BMS
- Provide the specification of thermal pockets of the new temperature sensors.

Provision by the Contractor

- Replacement of the old outdoor “Raypak” boiler with a new condensing boiler
- Supply and install thermal wells for new temperature sensors in heating hot water loop.
- Add tees in heating hot water pipe and terminated with isolation valves, to for the installation of differential pressure sensor.



2.5.5 Electrical Services Contractor

The demarcations between the Contractor and Electrical Services Contractor are follows:

Provision by the Electrical Contractor

- Provide information of the existing power supply system
- Attend the mechanical services system test and commissioning

Provision by the Contractor

- Disconnect the old boiler's power supply.
- Connect the new boiler to the existing mechanical services board.
- Test and commissioning.

2.5.6 Fire Services Contractor

The demarcations between the Contractor and Fire Services Contractor are follows:

Provision by the Fire Services Contractor

- Fire rating of all penetrations.
- Review the fire services plan after the Project is completed.
- Attend the fire mode test during the commission of new BMS and reset fire control system after the test is completed.

Provision by the Contractor

- The mechanical installation shall not obstruct the existing fire services equipment such as sprinkler head, smoke detector, speakers, breaking glasses, fire detection interlock etc.
- The new penetrations resulted from mechanical services installations shall not detriment existing fire compartment and zoning.
- Carry to fire mode test as part of mechanical system commissioning.

2.5.7 Pool Service Contractor

The demarcations between the Contractor and Pool Service Contractor "Roejen Servicecs" are follows:

Provision by the Pool Service Contractor

- Provision of existing Pool Control Service O&M
- Attend test and commissioning of the modified heating system

Provision by the Contractor

- Supply and install thermal pockets on the secondary side(pool water side) of pool heat exchangers.
- Coordinate with pool service contractor during the test and commissioning of the modified heating hot water system.



3. CONDENSING HOT WATER BOILER

3.1 GENERAL

Supply and install a natural draft boiler of capacity as nominated in the Equipment Schedule or on the Drawings.

The boiler assembly shall be complete with all the components including burner, combustion chamber, heat exchanger, controls, insulation, safety controls and devices as required for such a boiler installation and in compliance with all relevant Australian Standards and AGA requirements.

The boiler shall be condensing type of water heating equipment and be capable of the performance and specified in the Equipment Schedule.

The water heater provided shall produce not less than the capacity nominated when operating at or within the design temperatures, flow and/or pressure conditions.

3.2 COMPLIANCE

The boiler's design and installation shall comply with, but not limited, the following standards

- AS 3100, Approval and test specification - General requirements for electrical equipment
- AS 1375, Industrial fuel-fired appliances
- AS 3814, Commercial gas-fired appliances
- AS 1853, Automatic oil and gas burners
- AS 4552, Gas fired water heaters for hot water supply and/or fired appliances for central heating
- AS 5601, Gas installations

The boiler and its auxiliaries shall be approved by all safety authorities.

For any complex gas installations defined by the gas safety authority, gas installation application must be provided for both the consumer piping installation and the appliance.

3.3 PERFORMANCE

Otherwise specified, the boiler's thermal efficiency shall not be less than 93% at 60°C/80°C of flow/return temperature. Efficiency is measured to BS 845.1 Methods for assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids using results based on gross calorific value.

The boiler shall be low-emission type, able to operate under all conditions and deliver less than 14ppm of NOx in the emissions.

Otherwise specified, the boiler shall be low noise in operation with maximum sound level of 52 dB(A).

3.4 CONSTRUCTION

The boiler shall be suitable for internal or external mounting as specified in the Equipment Schedule and the Drawings.

The boiler shall be modular in arrangement for efficient operation and commonality of parts with all equipment housed in a weatherproof enclosure. Each module has its own combustion chamber with a burner, modulating fan, gas valve, flame and ignition control device, temperature sensor for local temperature control and safety thermostat.



The water heaters shall be forced draft downflow arrangement so that condensation is directed to the smoke manifold at the base on the unit.

The casing shall be 'Colourbond' coated galvanized steel for long life in exposed environments.

The construction of the boiler assembly shall include the following for ease of maintenance and servicing:

- East lift off panels providing full access to the water heater compartment.
- Individual Combustion View Ports for each burner.
- Convenient top lift access to fore side of casing for inspection and cleaning.

Insulation of the boiler shall be non-allergic synthetic wool.

3.5 BURNER AND GAS TRAIN

The burner shall be suitable for firing natural gas complete with all gas control equipment to the approval of the AGA and in accordance with AS1853 or AS1375.

The burner shall be pre-mixed modulating burner type with high temperature radiating metallic fibre mesh. Pre-mixing occurs in the pre-combustion chamber prior to entering the sealed combustion chamber. Each chamber shall be sealed and have its own fan and gas valve for each module, the control strategy shall vary the burner modules output on the demand of the heating load.

Burner gas train(s) must be supplied with the boiler to suit to boiler burner's operation. Each burner gas train assembly shall be in complete compliance with relevant gas regulations for boilers of this capacity. The gas trains shall incorporate the following minimum basic equipment.

- Isolating valve
- Gas pressure regulator
- Block valve - electronically operated
- Modulating gas flow control valve

The burner shall be capable of properly and efficiently operating with gas supply at a minimum pressure of 1.1 kPa and a maximum of 3.5 kPa. The burner gas train must be correctly sized to ensure that the burner achieved can achieve the gas input within above pressure range.

3.6 HEAT EXCHANGER

The heat transferring component of the boiler shall be made of stainless steel or aluminum silicate material for high heat transfer, resistance to thermal shock and corrosion in the condensing environment.

The boiler shall be designed to recover waste heat from flue gases. The waste gases flow through this condensing heat exchanger which cools and condenses the vapours into a liquid.

3.7 CONTROLS

The boiler's control must be capable of operating independent to external inputs. Boilers are able to continue operating when communication with the centralized control system is interrupted.

Boiler heating capacity shall be modulated through variable speed fans and air/gas ratio control valves.

The boiler's controls shall comply with local Gas Supply Authority code AS3814 and Australian Gas Association approved components, including the following:



- Modulating control system
- High limit safety thermostat
- Operating thermostat
- Flow switch mounted in the pipework, interlocked with burner controls
- Outdoor temperature reset control
- Gas pressure regulator and pilot valve
- Condensate level sensor
- All necessary temperature and pressure relief valves
- Provision for Run and Fault status
- Weatherproof for outdoor installation (as appropriate)

Boiler controller shall be compatible to communicating with Building Automation System or other control system via High Level Interface (HLI) such as Modbus, BACnet.

On-board control panels shall be mounted on the front of the unit for ease of viewing and access.

3.8 AUXILIARIES

3.8.1 EXHAUST FLUE

Provision of a pre-fabricate exhaust flue from the boiler. The flue shall be made of stainless steel with insulation and be compliant to relevant regulatory requirements and the manufacturer's recommendations.

3.8.2 CONDENSATE DRAIN NEUTRALISER

Provision of a condensate neutralizer kit for the supplied condensing boiler. The neutralizer must be able to raise the pH of the condensate to a neutral level before it is discharged to drain. The neutralizer shall be prefilled with sufficient neutralization agents for boiler's operation for at least 24 months.

3.9 INSTALLATION

The boiler shall be located and mounted in accordance with the requirements of the manufacturer and authorities' requirements. The installation shall be complete with the following as minimum:

- Ventilation and outside air makeup
- Flues from the boiler discharging to outside terminating in an approval cowl.
- Connection the flow and return heating hot water system using vibration isolation.
- Gas connection using approved shut off and isolation valves.

Provision the following components in the heating hot water system, to ensure efficient operation of the boiler:

- Air and dirt separators
- Expansion tanks, pressure relief devices, makeup water system
- Corrosion control and water treatment

The boiler shall be fully commissioned to the manufacturer's recommendations and authorities' requirements by an approved commissioning agent including all submissions to relevant authorities. If required, the water heater manufacturer shall be available for full commissioning of the water heater and system to satisfactory operation and gain approval for type B appliance by local authorities.

Flue outlet systems which both discharge the products of combustion to and draw the combustion air from the plantroom or directly from outside of the room.



The flue shall have a trap fitted for the discharge of the condensation. The flue shall be well sealed to stop any element of flues gas or condensation escaping using either a welded seam SS316 stainless steel or polypropylene heat proven plastic.

3.10 TEST AND COMMISSIONING

On completion, start up and test run boilers at rated load under the supervision of the boiler manufacturer's representative as follows:

- Test operation of automatic combustion controls by separately operating all safety and operating devices on the water heater.
- Test flame failure relays:
 - Shut off gas or oil supply to simulate loss of fuel supply.
 - Remove scanner eye to simulate flame or pilot failure.
 - Check that operating and safety devices function correctly and in the correct sequence.
- Check the setting and operation of operating thermostats and safety thermostats. Set safety thermostats 3°C above normal operating temperature.

Submit a detailed report on each of the acceptance tests.

- Following the application and acceptance process required by gas safety authorities, Contractor shall organize a post-installation inspection and commissioning by an inspector by gas safety authority.



4. PIPING, VALVES AND FITTINGS

4.1 GENERAL

Provide complete operating pipework systems as described as follows and as shown on drawings complete with all necessary fittings, supports, sleeves, valves, etc.

Provide all pipework accessories required for a complete installation, unless specifically excluded.

All pipework systems shall be suitable for its respective service under the actual operating conditions of temperature and pressure.

4.2 PIPE SCHEDULE

Provide pipework materials for the various services scheduled as required in the following table:

Heating hot water piping	Material:	Copper (<=Dn100) Copper/Steel (>DN100)
	Design Pressure:	1.0 MPa
	Operating Temperatures:	0°C to 95°C
Natural gas piping	Material:	Cooper or seamless steel
	Design Pressure:	AS 5601
	Operating Temperatures:	0°C to 50°C
Drains Vents	Material:	Copper (exposed) UPVC (ceiling space, plantroom, undercoverd)
	Design Pressure:	100 kPa
	Operating Temperatures:	-10°C to 40°C

4.3 STEEL PIPING

For closed loop clean water system, in which water does not contact with the atmosphere, the following standards apply:

AS 1074 Steel tubes and tubulars for ordinary service.

ASTM A53/A53-07 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded And Seamless.

For welded pipe, use bevelled butt-weld fittings. Use sweep tees and long radius elbows with centreline radius equal to 1.5 times pipe diameter.

For fabricated pipe fittings, use steel of the same grade and wall thickness as the pipe.

4.4 COPPER PIPING

For heating or cooling water system applied in building applications, the following piping material standards apply:

AS/NZS 1571 Copper - Seamless tubes for airconditioning and refrigeration

AS 1432 Copper tubes for plumbing, gasfitting and drainage applications

Piping wall thickness shall comply with the following table:



Nominal Diameter	Closed system	Open system
Up to 15 mm	1.0 mm	1.2 mm
20 mm	1.2 mm	1.4 mm
25-65 mm	1.6 mm	1.6 mm
80-125 mm	1.6 mm	2.0 mm
150-200 mm	2.0 mm	2.6 mm

A minimum of joints shall be made in the piping systems. Permanent joints shall be brazed for copper pipework. Non-permanent joints shall be provided at connections to equipment tanks, drip trays, flexible connections valves.

4.5 CONDENSATE DRAIN

Provide condensate pipework from each and every drain point provided on the air conditioning units to the nearest drain point. Piping materials conform to the "Pipe Schedule" of this document. All pipes shall be graded with a minimum fall of 1:100.

The condensate pipework shall incorporate a 75 mm P or S trap at the unit. If pipework passes through the roof a proprietary "deck-tite" seal shall be installed of a size suitable for the pipework. All joints to be sealed air-tight with adhesive and tape in accordance with manufacturers recommendations.

4.6 PIPE SUPPORTS

Provide adequate support and anchoring to allow for expansion and contraction. Provide hanger and supports within 600mm of direction change and at intervals as scheduled. Where possible pipes shall be grouped and hung on pipe racks consisting of shaped steel frames fixed to walls, ceilings or structure generally.

Pipe support spacing shall not exceed:

Pipe Size Nominal (mm)	Support Spacings (m)		
	Copper Pipe	Steel Pipe	Non-Metallic Pipe
Up to 15 mm	1.2	1.5	0.800
20 mm	1.5	2.0	1.2
25-65 mm	2.5	3.0	1.5
80-125 mm	3.0	4.0	2.0
150-200 mm	4.0	5.0	3.0
Above 200 mm	Calculation must be submitted for approval by the Engineer		

Support spacing shall be sufficiently close to enable pipe systems to have continuous fall to vents/drains.

Where pipelines are insulated, hangers shall be placed on the outside of the insulation. At each hanging point a suitable heavy gauge sheath shall be wrapped around the insulation. Sheaths shall be 200mm long on pipes up to 63mm diameter and 300mm long on pipes 75mm diameter and over. Sheaths shall be of sufficient thickness to support the pipe and its contents without deforming. Sheaths shall be installed over any insulation or wrapping. Where pipes are not insulated, direct contact between dissimilar metals shall be prevented by means of approved separating gaskets.



4.7 PIPE JOINTS

Flanges or unions shall be provided where it is necessary to make such joints for the installation or removal of a particular length of pipe or item of equipment.

Use flanged joints for flanged equipment or valves. Flanges shall be welded front and back and shall be faced, turned on edges and boltholes drilled and spot faced.

Use screwed joints only on pipes size under or equal to 65mm. Fit at least one union at each screwed valve of any type including control valves, and additional unions to ensure that each valve may be readily removed.

Jointing materials used between flanged faced shall be of good quality 1mm thick rubber insertion for cold water applications; and temperature-proof gasket sheet for heating hot water applications systems. For all external threads of screwed joints made on steel lines and fittings use PTFE tape.

4.8 SOLDER, WELDING AND BRAZING

The jointing of pipes and the attachment of flanges shall be carried out by silver soldering with minimum 15% silver content and brazing with phosphor bronze.

Remove scale and any gross oxidation by emery cloth, filing or grinding. Care shall be taken in preparation of the joints to ensure surfaces are thoroughly clean and close contact made when surfaces are pressed together to induce effective capillary action.

4.9 PIPE SLEEVES

Pipe sleeves are required at all building penetrations including wall, floor or roof penetrations. Sleeves shall be type A copper where pipes pass outside the building. Insulation shall be continuous through the sleeve. The gap between the outside of the insulation (or pipe, if bare) shall be sealed airtight with high density insulation. Where fire rating is required, high temperature mineral wool packing shall be used.

Where pipes penetrate floors, the sleeves shall extend 75mm above the floor level, for waterproofing. Suitable trimming collars shall be installed around all pipes where they pass through walls, ceilings or concrete slabs.

Where pipe penetrations are through fire compartment wall, the penetrations must be sealed by fire-rated materials.

4.10 PIPEWORK INSTALLATIONS

Install all pipework in an approved manner to meet structural and architectural conditions, and coordinate with other contractors to avoid any interference.

Provision shall be made for the expansion and contraction of pipes so that they will remain aligned and will not be damaged due to build-up of stresses or cause damage to other equipment or structures.

Provide adequate clearance between pipework and equipment or machinery to facilitate maintenance. Overhead clearances shall be at least 2000mm over access ways in plant rooms. Where pipes run close to walls, floors or ceilings, a minimum distance of 50mm shall be maintained between the pipes or their insulation and the nearest surface. Pipes shall be positioned such that all valves, controls, etc. installed are readily accessible and can be easily and properly operated.



All connections to equipment shall be installed with flanges or unions to facilitate installation and maintenance, and to comply with the requirements of the equipment manufacturer.

Before installation, clean piping and remove loose scale, burrs, fins and obstructions.

During pipe installation, prevent the entry of foreign matter into the piping system by temporarily sealing the open ends of pipes and valves using purpose-made covers of pressed steel or rigid plastic.

4.11 VALVES

Provide all valves, fittings and accessories necessary for operation, control and maintenance of the systems.

Selection of valves must be considered for the applications and followed the specified in the Drawings. The type of valves to be used must be in accordance with the table below and also the manufacturer's instructions.

Type of valve	Standards	Application
Gate valves	Bronze: AS 1628 Cast Iron: AS 2638.1	Straight-through flow. Isolation only (open/closed). Not for throttling or flow control.
Non-return valves	Bronze: AS 1628 Cast Iron: AS 2638.1& AS 2638.2	Auto swing automatically.
Butterfly valves	Cast iron: AS 2129	Isolation or throttling, manual or flow control.
Globe valves	Bronze: AS 1628	Isolation, throttling or flow control.
Ball valves	Bronze: AS 1628	Isolation only (open/closed). Limited throttling. Use of control ball valve shall be approved by the Engineer.
Strainer	Bronze alloy or cast iron, Y type.	Upstream of boiler, chiller, pump, heat exchanger, control valves, for protection from debris and objects accidentally left in the pipework.
Reduced pressure zone valve (RPZ)	AS 2845 Bronze alloy or stainless steel	Backflow prevention device to prevent contamination of the water supply system
Balancing valve	BS EN 12266-1 Copper alloy or cast iron. Pre-calibrated. Measuring accuracy at design flow: $\pm 5\%$.	Isolation, throttling, flow measurement and venting.
Motorized control valves	Body construction requirements same to above valve type. Measuring accuracy at design flow: $\pm 5\%$.	Flow control, pressure reducing, pressure sustaining.
Pressure relief valves	AS 1271 Bronze alloy or cast iron	Relief automatically.



4.12 FITTINGS

Provide all valves, fittings and accessories necessary for operation, control and maintenance of the systems.

Type of Fittings	Requirement
Pressure gauge	Gauge's full range shall be is 150 to 200% of the designed working pressure. 100mm diameter with chromium plated brass cases. Each gauge shall be fit a petcock valve for isolation.
Automatic air vent	Automatic vents shall be with isolating valve and discharge to a nearby drain point. Install automatic air vent at the highest point of water pipe system no matter if it is shown on the Drawings.
Test plus	Provide brass test plugs with screw cap at the inlet/out of individual equipment (Chiller, Boiler, Pump, heat exchanger, coils) no matter if it is shown on the Drawings.
Thermometer pockets	Provide immersed thermometer pockets for thermometers or temperature sensors in water pipes. Pockets shall capable of fitting in 10mm interior diameter pipe and weld in place projecting deeply into the pipe. Incline pockets in vertical pipes to hold fluid.
Tundish	Provide tundishes to all drains from hot water heaters, automatic vent, pressure relief valves.

Drain pipework shall be installed to grade to air vents and drains to enable complete pipework systems to be rapidly vented on commissioning, and fully drained for maintenance.

All pipes shall be graded with a minimum fall of 1:100.

Provide air vents to all high points in water systems and drains at all low points so that there can be no possibility of air locks and the system can be drained easily.

Drains in the water circulating systems shall consist of 20mm valved drain-offs with hose bib attachment threads. Drain lines shall be run to waste in 20 diameter copper and shall be provided with screwed unions to facilitate cleaning.

4.13 INSULATION AND LAGGING

Insulating materials used within buildings shall comply with all requirements of BCA Section J with respect of R-value.

All materials used within ductwork, shafts, attenuating chambers, and the like shall be Non-combustible class and shall comply with AS/NZS 1668.1 requirements having indices not greater than the following, as determined with AS 1530 Part 3:

- A spread of flame index number no greater than 0.



- A smoke developed index number not greater than 3.

4.14 WATER TREATMENT

The piping of each system shall be thoroughly flushed out before the system is placed into operation. Flushing shall be carried out using a water, solvent and corrosion inhibitor solution.

When the system is flushed, all equipment, heat exchangers, heat transfer coils must be bypassed. After the flushing, clean all strainers and filters, then fill the whole system for water treatment.

Water treatment shall be conducted by a qualified and experienced water treatment specialist. Water treatment solution and program shall be submitted for approval by the Engineer.

The water treatment programme for the condenser water system micro biological control shall be in accordance with AS 3666.



APPENDIX EQUIPMENT SCHEDULE

	Specification	Submission
Equipment Designation	BL-G-2	
Equipment Name	Boiler	
Type	Condensing	
Manufacturer	-	
Model Number	-	
Fluid	heating hot water	
Output (kW)	570 kW	
Gas Input (MJ/hr)	2,210 MJ/hr	
Thermal Efficiency (60°C/80°C)	93%	
Gas Pressure (kPa)	1.1kPa - 2.75 kPa	
Control Type	modulating	
Turn Down Ration	1:5	
Water System Pressure (kPa)	Max. 0.6 kPa	
Water Outlet Temperature	80°C	
Water Inlet Temperature	60°C	
Sound Level (dBA)	52 dBA	
Communication Interface	Modbus or BACnet	
Installation	Outdoor	