

Section 2.2.1

HENRIETTA STOCKDALE NURSING COLLEGE

Specifications – HVAC - Water

BLOCK: B

SPECIALTY: T61 – PRIMARY / SECONDARY COOLING SOLUTIONS

VERSION: 01
DATE: 2024-08-07

Table of Contents

SECTION T61 – PRIMARY / SECONDARY COOLING SOLUTIONS.....	3
PART 1 - GENERAL.....	3
T61-1.1 Section Includes.....	3
T61-1.2 References.....	3
T61-1.3 Related Sections.....	3
T61-1.4 Scope.....	4
T61-1.5 Submittals.....	4
T61-1.6 Warranty And Maintenance Service.....	6
PART 2 - MATERIALS.....	7
T61-2.1 Manufacturers.....	7
T61-2.2 Chiller.....	7
T61-2.3 Chiller Set Motor Control Panel (MCC).....	14
T61-2.4 Chiller – Main TABS.....	17
T61-2.5 Electronic Control System.....	18
T61-2.6 Control Valves.....	19
T61-2.7 Heat Exchanger.....	20
T61-2.8 Pumps.....	21
PART 3 - EXECUTION.....	22
T61-3.1 Examination.....	22
T61-3.2 Preparation.....	22
T61-3.3 Installation.....	22
T61-3.4 Protection.....	22
T61-3.5 Delivery, Storage And Handling.....	22

SECTION T61 – PRIMARY / SECONDARY COOLING SOLUTIONS

PART 1 - GENERAL

T61-1.1 SECTION INCLUDES

- A. Water Cooled Chillers
- B. Air Cooled Chillers
- C. Chillers with Scroll Compressors
- D. Chillers with Screw Compressors

T61-1.2 REFERENCES

- A. EN 14825:2013: Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling — Testing and rating at part load conditions and calculation of seasonal performance.
- B. EN 14511-1:2017, Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 1: Terms, definitions and classification
- C. EN 14511-2:2007, Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 2: Test conditions
- D. EN 14511-3:2013, Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 3: Test methods
- E. EN 14511-4:2018: Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 4: Operating requirements, marking and instructions
- F. EN 60204-1, Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1, modified)

T61-1.3 RELATED SECTIONS

- A. T80 - Embedded Radiant Heating and Cooling System.
- B. Y10 - Pipe Lines.

T61-1.4 SCOPE

- A. Supply, delivery and installation of 2 (two) air cooled, two-pipe, heat pump chillers with partial heat recovery with integrated primary circulation pumps and a motor control panel.
- B. On site Rigging.
- C. All related work and line components to connect chillers to TABS mains and heat recovery pipes.
- D. Connection to the electrical supply provided by others.

T61-1.5 SUBMITTALS

- A. Detailed Computer Selection comprising of the following parameters:

- 1. RUNNING PERFORMANCE AT DESIGNED CONDITIONS

- (a) HEAT EXCHANGER USER SIDE

- i. Fluid inlet temperature (cooling mode) °C
 - ii. Fluid outlet temperature (cooling mode) °C
 - iii. Fluid type
 - iv. Fouling factor m²K/kW

- (b) HEAT RECOVERY EX. USER SIDE

- i. Fluid inlet temperature (cooling mode) °C
 - ii. Fluid outlet temperature (cooling mode) °C
 - iii. Fluid type
 - iv. Fouling factor m²K/kW

- (c) OUTDOOR CONDITION

- i. Air temperature (cooling mode) °C

- (d) COOLING (EN 14511)

- i. Cooling capacity kW
 - ii. Compressors power input kW
 - iii. Fans power input (cooling mode) kW
 - iv. Total power input kW
 - v. EER kW/kW

- (e) COOLING WITH HEAT RECOVERY (EN 14511 VALUE)

- i. Cooling capacity kW
 - ii. Recovery heat exchanger capacity kW

-
- iii. Total power input kW
 - iv. TER kW/kW
 - (f) SEER Official (Reg. EU 2016/2281)
 - i. SEER
 - ii. Performance η_s %
 - (g) HEAT EXCHANGER USER SIDE
 - i. Typology
 - ii. Quantity
 - iii. Fluid type
 - iv. Fouling factor m^2K/kW
 - v. Type of connections
 - vi. Diameter of connections
 - vii. Min flow l/s
 - viii. Max flow l/s
 - ix. K pressure drop
 - x. Water content l
 - (h) COOLING
 - i. Fluid inlet temperature (cooling mode) °C
 - ii. Fluid outlet temperature (cooling mode) °C
 - iii. Water flow l/s
 - iv. Pressure drop at the heat exchanger kPa
 - v. Available unit's head kPa
 - (i) COOLING + HEAT RECOVERY
 - i. Water flow l/s
 - ii. Pressure drop at the heat exchanger kPa
 - (j) HEAT RECOVERY EX. USER SIDE
 - i. Typology
 - ii. Quantity
 - iii. Fluid type
 - iv. Fouling factor m^2K/kW
 - v. Type of connections
 - vi. Diameter of connections
 - vii. Min flow l/s

-
- viii. Max flow l/s
 - ix. K pressure drop
 - x. Water content
 - (k) COOLING
 - i. Fluid inlet temperature (cooling mode) °C
 - ii. Fluid outlet temperature (cooling mode) °C
 - iii. Water flow l/s
 - iv. Pressure drop at the heat exchanger kPa
 - v. Available unit's head kPa
 - (l) FANS
 - i. Fans type
 - ii. Fans number
 - iii. Fans power input kW
 - iv. F.L.I. kW
 - v. F.L.A. A
 - (m) NOISE DATA
 - i. Frequencies Hz 63 125 250 500 1000 2000 4000 8000
 - ii. Sound power (spectrum) dB at the above frequencies
 - iii. Sound power level in cooling dB(A) 100
 - iv. Sound pressure level (spectrum) dB at the above frequencies
 - v. Sound Pressure dB(A) at 10m Distance
 - (n) ELECTRICAL DATA
 - i. Power supply V/ph/Hz
 - ii. F.L.I. - Max absorbed power kW
 - iii. F.L.A. - Max absorbed current A
 - iv. S.A. - Inrush current

B. Dimensional drawings, and confirmation that space as provided in plant room as per the tender drawings, is sufficient without modifications.

T61-1.6 WARRANTY AND MAINTENANCE SERVICE

A. Standard warranty from practical completion to final completion (12 months).

PART 2 - MATERIALS

T61-2.1 MANUFACTURERS

- A. Only suppliers with verifiable presence and track record in South Africa will be considered (>5 years).
- B. Substitutions and alternatives permitted.

T61-2.2 CHILLER

A. Structure

- 1. The structure shall be specifically suitable for outdoor installation, made with a hot-galvanised sheet steel base of adequate thickness, painted with polyester powders, the perimeter structure shall be composed of aluminium sections.

B. Panelling

- 1. The panelling shall be specifically suitable for outdoor installation in aluminium alloy which shall ensure total resistance to atmospheric agents shall be easily removable and made in such a way as to allow total access to the internal components to facilitate inspection and maintenance work.

C. Scroll Compressor

- 1. The chiller shall be air-cooled, air cooled remote condenser or water cooled as specified.
- 2. The unit shall be free of liquid refrigerant or oil slugging.
- 3. Lubrication shall be by means of mechanical oil pump, complete with oil heater.
- 4. Evaporators and water-cooled condensers shall be shell and tube design.
- 5. The water chiller shall be a complete packaged unit with all components mounted on a sturdy steel framework with cladding, panels, etc. to match the application.
- 6. Each chiller shall be complete with one or more compressor and motor units, water cooler condenser, expansion valves, refrigerant piping circuits, controls and control panel, as well as a full charge of refrigerant.
- 7. Evaporators shall be factory insulated.
- 8. Each evaporator unit shall be provided with a chilled water low temperature safety switch.

9. Compressor control shall be interlocked with a flow switch (with delay timer) in the chilled water circuit to prevent the unit operating with no water flow.
10. Operating control shall include for anti-recycling timing between compressor starts and capacity steps and low pressure starting.
11. Multiple compressor and refrigerant circuit units shall be provided with automatic controls for lead/lag switching and operating time balancing of compressor running hours.

D. Screw Compressor

1. The compressor shall be of the helical rotary screw type. Compressor shall be semi-hermetic, field rebuildable and shall utilise horizontal rotors. All the rotating parts shall be statically and dynamically balanced.
2. The chiller shall be able to unload to 25% of design capacity. Tenderers shall fully indicate in their tender any requirements to achieve this condition and shall allow for anything necessary to meet this requirement.
3. The motor shall be either suction or liquid refrigerant cooled and shall be suitable for operating on a 400 V 50 Hz supply. Motors shall have adequate thermal protection in the motor windings, one per phase, to protect against high motor temperature or overloading.
4. The impellers shall be fully shrouded and made of a high strength aluminium alloy. Impellers shall be statically and dynamically balanced and over-speed tested at 1.25 times impeller shaft speed. Rotors shall be of high grade steel alloy.
5. The compressor shall be equipped with an oil heater and a crankcase heater to evaporate refrigerant returning to the crankcase during shut down.
6. Every compressor shall be equipped with electronically thermistor protection on the motor, an oil pump, a sight glass and an internal safety valve.
7. Every compressor shall be equipped with a shut-off valve on both the suction and hot gas connections and each compressor shall be mounted on anti-vibration mountings on a base frame.
8. The compressor shall be equipped with an oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping and normal operation.
9. The compressor be equipped with automatic capacity reduction equipment consisting of capacity control slide valve.
10. Compressors shall start unloaded.

E. Starters (Screw Compressors)

1. The motor starter shall be a Star-delta closed transition. Motor starter shall have NEMA 1 gasket enclosure. Enclosure shall be constructed of 12 gauge steel minimum with the exception of doors, which shall be 14 gauge steel minimum.

-
2. Starter shall be unit mounted with ventilating louvres.
 3. Motor starters shall include incoming line provisions for the number and size cables shown on the drawings. Incoming line lugs shall be aluminium mechanical type. Connection directly to the contactors is not permissible.
 4. Contactors shall be sized properly to the chiller full load and locked rotor currents. Contactors shall have double break main contacts with weld resistant silver cadmium faces. Auxiliary interlocks that interface with the control panel shall be low resistance having palladium silver contacts.
 5. Each motor starter shall include a control power transformer with fused primary and secondary. Current transformers of the proper size, ratio and burden capacity shall be provided to provide a signal to the control panel and optional devices. Control relays shall be provided within the motor starter to interface with the control panel.
 6. Power wiring within the starter shall be type MTW copper stranded 90, C. Power wire bends shall show no evidence of nicking or insulation degradation. Control wire shall be type MTW copper stranded 90, C 14 gauge minimum.
 7. Starter shall include an advanced motor protection system incorporating electronic three phase overloads and current transformers. This electronic motor protection system shall monitor and protect against the following conditions:
 - (a) Three phase overload protection,
 - (b) Overload protection during start-up,
 - (c) Phase imbalance,
 - (d) Phase loss,
 - (e) Phase reversal,
 - (f) Low voltage,
 - (g) Distribution fault protection consisting of three-phase, current sensing devices that monitor the status of the current. Distribution faults of 1-1/2 electrical cycle duration's shall be detected and the compressor motor shall be disconnected within six electrical cycles,
 - (h) Under/over voltage protection.
 8. Alternately the advanced motor protection system can be furnished in the chiller control panel.
 9. The starter/control shall be designed and able to operate in temperatures up to 50, C.
 10. All field supplied wires, bus bars, and fittings shall be copper only.
 11. The following optional starter options shall be provided:

12. Circuit Breaker - Starter shall contain a circuit breaker capable of breaking currents up to its interruption capacity. The disconnect handles, both internal and external, shall be capable of being padlocked in the off position.
13. Amps and volts shall be displayed at the control panel or ammeters and voltmeters provided. Three ammeters shall be provided, one per phase. Ammeters shall be calibrated to indicate the inrush current. Three voltmeters shall be provided, each reading a phase-to-phase voltage.
14. If solid state starter is provided a Shunt-Trip Circuit Breaker shall be provided. Starter shall contain circuit breaker with shunt trip device capable of breaking currents up to its interruption capacity. Operating handle shall be located on the starter panel. The disconnect handles, both internal and external, shall be capable of being padlocked in the off position.

F. Refrigerant circuit

1. Each refrigerant circuit shall be provided with the following:
2. Liquid line and discharge shut off valves.
3. Filter dryer (replaceable core type).
4. Liquid line sight glass and moisture indicator.
5. Electronic or thermal expansion valve sized for maximum operating pressure.
6. Charging valve.
7. Discharge and oil line check valves.
8. Compressor suction and discharge service valves.
9. High side pressure relief valve.
10. Full operating charge and oil.
11. Unit factory leak tested at 1400 kPa.
12. Liquid line solenoid valve if the expansion valve does not close automatically on loss of power.
13. Capacity Modulation: Provide capacity modulation by either slide valve or unloader valves. Unit shall be capable of operation down to 25% of the full load work.

G. Water Type Evaporator and Condenser

1. The evaporator and condenser shall be built in accordance with ANSI/ASHRAE 15- Safety Code for Mechanical Refrigeration.
2. Water boxes shall be designed for 1050 kPa maximum working pressure (gauge) and shall be flanged and gasket for easy removal and access to the tubes. The water boxes shall have grooved type water connections for easy field chilled water and condenser water connections.

3. Evaporator and Condenser tubes shall be internally enhanced and externally finned to achieve maximum efficiency. The nominal tube wall thickness shall be 0,70mm for both evaporator and condenser tubes.
4. Expansion valves shall be of the electronic type. Adjustable or float type refrigerant metering devices and thermal expansion valves (TXV) shall only be accepted if it will be inspected and adjusted by the manufacturer annually for the first five years of operation to assure equivalent reliability to an electronic expansion valve (EXV) system. A written report shall be forwarded to the owner each year over the first five years to confirm completion of calibration.
5. Units with multi-stage compressors shall incorporate an interstage flash vessel economizer in the refrigerant cycle.
6. Factory insulation will be 20mm foam insulation and cover all low temperature surfaces to include the evaporator and water boxes, suction line, and motor housing.
7. Units shall have the capability of storing the entire refrigerant charge in the condenser or shall have a pump-out system for each machine complete with a separate transfer pump, condensing unit and tank. Pump out systems shall be supplied and warranted by the chiller manufacturer. Pump-outs shall comply with the following:
 - (a) Pump-out tank(s) with ASME stamp capable of holding refrigerant charge when 80 percent full at 32°C.
 - (b) Separate charging connections for liquid and gas refrigerant.
8. Piping and valves between pump out and chiller to be supplied and installed by installing contractor. Contractor shall provide all piping, electrical equipment, and wiring required. Refrigerant piping shall be Type K hard-drawn copper with wrought copper fittings. Valves shall be pack-less type suitable for refrigerant use.

H. Air-Cooled Source heat exchanger

1. The heat exchanger shall be the fine oil type made by copper tubes mechanically bounded to aluminium fins. The aluminium fins shall be correctly spaced to guarantee optimum heat exchange efficiency.

I. Fans

1. Fans shall be of the axial electric type, with IP 54 protection class, with external rotor and plastic-coated aluminium blades. Housed in aerodynamic hoods complete with safety grille. 6 - pole electric motor with built-in thermal protection. The fan chamber to be divided into two sections for the independent management of defrosting cycles in the two circuits (only models with heat pump). Condensation control by means of a device for continuous adjustment of the fan rotation speed.

J. Pumps (where present)

1. Horizontal one-piece centrifugal pump with one impeller, axial suction and radial delivery, DIN GG20 cast iron body and AISI 316L stainless steel or cast iron impeller. The section of the shaft in contact with the liquid is made by stainless steel. Mechanical seal with components in ceramics, carbon and NBR elastomers. Three-phase electric motor with IP55 protection class, insulation class F, suitable for continuous service. Shut-off valves upstream and downstream from each pump to facilitate replacement operations without having to drain the hydraulic system. Automatic pump rotation system in the event of a breakdown without interrupting operation (only in units with a dual pump).

K. Controls

1. The chiller(s) shall be controlled by a stand-alone direct digital control (DDC) system. A dedicated chiller control panel with a clear language display is to be supplied with each chiller by the chiller manufacturer. The controller shall provide chiller capacity control in response to the leaving chilled water temperature.
2. The chiller control panel shall utilize an Adaptive Control Microprocessor which will automatically take action to prevent unit shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.
3. In all of the above cases, the chiller will continue to run, in an unloaded state, and will continue to produce some chilled water in an attempt to meet the cooling load. However, if the chiller reaches the trip-out limits, the chiller controls will take the chiller off line for protection, and a manual reset is required. Once the "near trip" condition is corrected, the chiller will return to normal operation and can then produce full load cooling.
4. The chiller control panel shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays, and switches. The panel shall be a complete system for stand-alone chiller control and include controls to safely and efficiently operate the chiller.
5. The chiller control panel is to be provided with the following digital type pressure readouts:

-
- (a) Evaporator refrigerant pressure
 - (b) Condenser refrigerant pressure
 - (c) The front of the chiller control panel shall be capable of displaying the following in clear language as standard:
 - (d) Entering and leaving evaporator water temperature
 - (e) Entering and leaving condenser water temperature
 - (f) Chilled water set point
 - (g) Electrical 3 phase current limit and percent RLA set point
 - (h) Electrical 3-phase current draw
 - (i) Chiller operating mode
 - (j) Condenser refrigerant temperature
 - (k) Elapsed time and number-of-starts counter
 - (l) Chiller compressor run status relay
 - (m) Diagnostics with time and date stamp
 - (n) Last 20 diagnostics with time and date stamp
 - (o) External chilled water set point input 2-10VDC/4-20mA
 - (p) External current limit set point input 2-10VDC/4-20mA
 - (q) Voltage readout
 - (r) Percent RLA output 2-10VDC
- 6. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel.
 - 7. The chiller control panel shall provide a limit relay output that shall energize whenever the unit is operating in a limit mode (for extended time periods).
 - 8. The chiller control panel shall provide a programmable soft load to prevent the chiller from achieving full capacity during the pull down period by imposing a ramped current limit, or a temperature pull down rate. Either can be adjusted to limit how fast the chiller can load after an initial startup.
 - 9. The chiller control panel shall provide a chilled water pump output relay that closes when the chiller is given a signal to start.
 - 10. The chiller control panel shall provide control of leaving chilled water set point with a minimum variation of chiller capacity.
 - 11. The chiller control panel shall provide input for leaving chilled water temperature set point based upon a 4-20Ma or 0-10 VDC signal from a building automation system.
 - 12. Each chiller shall be equipped with a BACnet/IP interface to interface with a BMS system.

T61-2.3 CHILLER SET MOTOR CONTROL PANEL (MCC)

A. Chiller Set to be Controlled: As indicated in chiller detail specification section.

B. MCC components:

1. Main Circuit Breaker (MCB): Slow curve type.
2. MCB Rating: As specified for chiller set.
3. Busbars: Yes, Copper if $I > 50$ Ampere.
4. Starters:
 - (a) Chillers: As specified in section 2.2-D for chillers,
 - (b) Chilled Water Pumps:
 - i. Electrical Motors ≤ 5 kW: D.O.L.,
 - ii. Electrical Motors > 5 kW: Star-delta, slip-ring or soft starter as per detailed specification.
 - (c) Auxiliary Contacts: Yes, to easily accessible terminal block for remote control.
5. Other MCC Equipment: MCB.
6. H.R.C. Fuses, Yes, if MCC MCB rupturing capacity \leq electrical feed system.
7. Ammeter: Yes, if motor power $\geq 7,5$ kW.
8. Wiring: Pre-wired in factory.
9. MCC Board Housing: Metal clad surface type, with framework, electrically continuous and bonded to earth.
10. MCC Board Doors: Hinged steel doors, braced, with flush-mounted lock and three keys.
11. Coating: Powder Coated.
12. Outdoor Boards: Weather Proof.
13. Board Layout and Wiring Diagrams: To be submitted to and approved by Consulting Engineer prior to manufacturing.

C. MCC WIRING

1. Labelling: Wiring marked at termination points accordance with wiring diagram by means of numbered ferrules.
2. Internal Wiring:

-
- (a) Insulation Material: PVC to SANS 1507.
 - (b) Strands: 7 per conductor.
 - (c) Voltage Grading: 660 / 1000 Volts.
 - (d) Colour Coding: BS 158.
 - (e) Wiring arrangement: Grouped and Laced.
 - (f) Wiring Joints: Not allowed.
 - (g) Bus- or Earth Bar Connections: Tinned copper cable lugs soldered or crimped to conductor ends.
 - (h) Bolting to Busbars: Cadmium-plated high-tensile steel bolts, nuts and spring washers.
 - (i) Conductors $>10 \text{ mm}^2$: Crimp lugs or ferrules.
 - (j) Wiring through other Cubicles: Only via conduit or ducting.
 - (k) Board Switched Off: No incoming live wiring accessible.
 - (l) Incoming Terminals: Screened.
 - (m) Control Circuit Wiring: In PVC trunking with slotted side, where feasible elsewhere in strapped harness with slack at panel doors.
 - (n) Control Circuit Interlocking: Auxiliary contact on circuit isolator.
3. Busbars:

-
- (a) Rating: Cu $\leq 1,55 \text{ A/mm}^2$, Al $\leq 1,0 \text{ A/mm}^2$.
 - (b) Surface: Tinned.
 - (c) Bracing and other Insulating Material: Non-hydroscopic.
 - (d) Orientation: Horizontal or Vertical.
 - (e) Horizontal Mounting: Longer dimension in vertical plane.
 - (f) Separate Compartment in Board: Yes.
 - (g) Extendable: Yes.
 - (h) Bolting to Busbars: Cadmium-plated high-tensile steel bolts, nuts and spring washers.
 - (i) Busbar Spacing: To SANS 1195 but not less than 50 mm.
 - (j) Bare Conductor Spacing: ≥ 40 between conductor and earth.
 - (k) Busbar Mounting: Porcelain or other approved insulators.
 - (l) Busbar Identification: 100 mm Phase colouring bands ≤ 300 mm apart.
 - (m) Earth Bar: Solid Cu near gland tray with 50% spare space.
 - (n) Small Lead Connections: 20 A fuse at busbar and 2 A fuse at item.
 - (o) Droppers: Fully Insulated.
4. Lamp Test Circuits:
- (a) Quantum: Yes, for each board.
5. Alarm Circuits:
- (a) Wiring: To each terminal strip or for remote alarm indication functions.
6. Earthing:
- (a) Quantum: Earth bars for each board.
 - (b) Free-Standing Boards: Continuous, full-length earth busbar.
 - (c) Item Earthed: All sections of board and all equipment.
 - (d) Hinged Doors: Earthed by means of flexible earth strap.
7. Terminals:

- (a) Assemblies: Metal mounting rail onto which terminal modules are fixed.
 - (b) Terminals on Cables $\leq 10 \text{ mm}^2$: Clamp Type. No clamp screws bearing directly on conductor allowed.
 - (c) Terminals on Cables $> 10 \text{ mm}^2$: Modules suitable for crimping lugs or ferrules.
 - (d) Insulating Barriers: Between poles rigid creep path suitable for 440V. 380 V between adjacent poles.
 - (e) Terminal size: Large enough to accommodate cable sizes specified.
 - (f) Terminal Marking: To working drawings and approved wiring diagrams.
 - (g) Spare Terminals: 20% for looping additional remote circuits.
8. Lightning Arresters:
- (a) Mounting: Directly on main earth bar with copper strapping.
 - (b) SANS Marking: Yes.

T61-2.4 CHILLER – MAIN TABS

A. Quantity: 2.

B. Design Conditions

- 1. Ambient Temperature Cooling: 40, C.
- 2. Ambient Temperature Heating: 0, C.
- 3. Altitude: 1200m.

C. Chiller Requirements

- 1. Chiller Type: 2-Pipe Heat pump, Condensing Heat Recovery, Air-Cooled.
- 2. Compressor Type: Screw / Scroll.
- 3. Refrigerant: Not specified. Low Global Warming Potential.
- 4. Cooling Capacity: 400 kW.
- 5. Total Power Input inclusive of fans and pump: 130 kW.
- 6. Electrical connection: 400-3N-50 (V-Ph-Hz).
- 7. Chilled Water Inlet Temp: 24, C.
- 8. Chilled Water Outlet Temp: 18, C.
- 9. Heating Capacity: 400 kW.
- 10. Total Power Input: 117 kW.
- 11. Warm Water Inlet Temp: 22, C.
- 12. Warm Water Outlet Temp: 28, C.

13. Condensing Heat Recovery: Partial – 150 kW.
14. Heat Recovery Supply Water Temperature: 45°C.
15. Heat Recovery Return Water Temperature: 40°C.
16. Condenser Fans: Axial.
17. Body Material: Powder Coated.
18. Fluid Type: Water, 100%
19. Operational Weight – including pump set: T.B.D kg
20. Size: 5080 mm x 2260 mm x 2450 mm
21. Communications: BACnet/IP

D. Pump Set:

1. Type: Internal, duty/standby
2. Matched set from chiller supplier.
3. Control and power: From Chiller.
4. Flow: 16 L/s @ 300 kPa
5. Flow Type: Variable Primary Flow.

E. Sundries:

1. Hail Screens: Yes

F. MCC:

1. Quantity: 1.
2. Chillers on MCC: 2.
3. Domestic Hot Water Pumps on MCC: 2.
4. MCC Isolator: 600 kW

T61-2.5 ELECTRONIC CONTROL SYSTEM

1. Type: Proprietary to chiller supplier
2. Protocol: BACnet/IP capable
3. Switch Gear Mounting: DIN-Rail
4. I/O: Wired to terminal blocks
5. Wiring Routing: Inside slotted trunking
6. Wire Ends: Boot laced matching wire gauge
7. Common wiring: Colour-coded as per schedule below:

Function	Colour
220 V Live	Red
220V Neutral	Black
Earth	Green / Yellow
15 V DC	Orange
24 V AC	Brown
Controller Common	Grey
Analogue Input	Pink
Analogue Output	Purple
Binary Input	Cyan
Binary Output	Blue

8. Sources: All I/O, NC and NO
9. Wire numbering: Unique number per wire
10. Safety cut-out: 24 VAC Multi-pole relay
11. Panel lights: LED
12. Loom wiring: Spiral bound
13. Control wiring: 24 V maximum
14. Control wiring numbering: Both ends
15. Control wiring size: 1,5mm², 2-core
16. Milar screen: Yes
17. Daisy chain connections: To last device
18. Bases: Only Finder 92, 94 and 97 series

T61-2.6 CONTROL VALVES

A. Valve bodies

1. Valve body: Cast Iron
2. Working pressure: 1200 kPa
3. Type: 3-way by-pass
4. Water temperature: 2°C to 75°C
5. Valve stems: Stainless Steel
6. Packing: Spring loaded Teflon "V" rings

7. Pressure drop: Maximum 40 kPA in fully open position
8. Valve fixing: Screwed \leq 50mm \leq Flanged

B. Valve actuators

1. Compatibility: With valve body
2. Spring return: Yes, to NO position
3. Actuator type: Synchronous reversible or magnetic
4. Output: Proportional
5. Power: 24VAC or DC
6. Reaction speed: Compatible with sensors and controllers selected
7. Maximum travel: Hardware or software field adjustable
8. Actuator housing: Die-cast aluminium or heat resistant plastic
9. IP Protection: 54
10. Operating temperature range: -10°C to 60°C

T61-2.7 HEAT EXCHANGER

A. Type: Plate and Frame

B. Capacity: 150 kW

C. Fluid: Water

D. Hot Water Temperature

(a) In: 45°C

(b) Out: 40°C

E. Cold Water Temperature

1. In: 28°C

2. Out: 28,5°C

F. Flow Rates:

1. Hot Water: 7 L/s

2. Cold Water: 40 L/s

G. Plates: Titanium

H. Frame Plate: Mild steel, epoxy coated

I. Nozzles: Titanium

J. Gaskets: EPDM

T61-2.8 PUMPS

- A. Application: Chiller de-superheating circuit
- B. Type: End-suction centrifugal
- C. Arrangement: Duty / Standby
- D. Duty:
 - 1. Flow: 7 L/s
 - 2. Pressure: 300 kPa
- E. Flow-Type: Constant (
- F. Control: From main Chiller MCC
- G. Switchgear: Y- Δ

PART 3 - EXECUTION

T61-3.1 EXAMINATION

- A. Chillers will be factory tested and test certificates will be supplied.
- B. Test witnessing: Testing of chillers will be witnessed by consulting engineer prior to shipping to South Africa.

T61-3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

T61-3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and the requirements of authorities having jurisdiction.
- B. Anchor all components firmly in position.
- C. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch up paint recommended by the manufacturer; make imperfections invisible to the unaided eye from a distance of 5 feet.
- D. Test for proper operation and adjust until satisfactory results are obtained.
- E. Double handling of chillers on site will not be allowed.
- F. Install in accordance with manufacturer's instructions and the requirements of authorities having jurisdiction.

T61-3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

T61-3.5 DELIVERY, STORAGE AND HANDLING

- A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

-
- B. Protect from damage due to weather, excessive temperature, and construction operations.
 - C. Rates for delivery of equipment are to be inclusive of hoisting and placing equipment on grade or elevated levels. Contractors are advised to study tender drawings at tender stage to determine costs and include in their tendered rates.