Airedale
APPLIED THERMAL INNOVATION

TurboChill™ TCW

Water Cooled Compact Chiller
150-375kW
R134a
R1234ze(E)

Technical Manual

ecoDesign COMPLIANT

CE

bsi. ISO 9001 Quality Management FM00542

ISO 14001 Environmental Management EMS52086

Customer Services

Warranty, Commissioning & Maintenance

As standard, Airedale guarantees all non consumable parts only for a period of 12 months, variations tailored to suit product and application are also available; please contact Airedale for full terms and details.
To further protect your investment in Airedale products, Airedale can provide full commissioning services, comprehensive maintenance packages and service cover 24 hours a day, 365 days a year (UK mainland).
For a free quotation contact Airedale or your local Sales Engineer.
All Airedale products are designed in accordance with EU Directives regarding prevention of build up of water, associated with the risk of contaminants such as legionella.
For effective prevention of such risk it is necessary that the equipment is maintained in accordance with Airedale recommendations.
In addition to commissioning, a 24 hour, 7 days a week on-call service is available throughout the year to UK mainland sites. This service will enable customers to contact a duty engineer outside normal working hours and receive assistance over the telephone. The duty engineer can, if necessary, attend site, usually within 24 hours or less.
Full details will be forwarded on acceptance of the maintenance agreement.

CAUTION ⚠	Warranty cover is not a substitute for maintenance. Warranty cover is conditional to maintenance being carried out in accordance with the recommendations provided during the warranty period. Failure to have the maintenance procedures carried out will invalidate the warranty and any liabilities by Airedale International Air Conditioning Ltd.

Spares

A spares list for 1, 3 and 5 years will be supplied with every unit and is also available from our Spares department on request.

Training

As well as our comprehensive range of products, Airedale offers a modular range of Refrigeration and Air Conditioning Training courses, for further information please contact Airedale.

Customer Services

For further assistance, please e-mail: enquiries@airedale.com or telephone:

UK Sales Enquiries	+ 44 (0) 113 239 1000	enquiries@airedale.com
International Enquiries	+ 44 (0) 113 239 1000	enquiries@airedale.com
Spares Hot Line	+ 44 (0) 113 238 7878	spares@airedale.com
Airedale Service	+ 44 (0) 113 239 1000	service@airedale.com
Technical Support	+ 44 (0) 113 239 1000	tech.support@airedale.com
Training Enquiries	+ 44 (0) 113 239 1000	marketing@airedale.com

For information, visit us at our web site: www.airedale.com

Environmental Considerations

Freeze Protection

Airedale recommends the following actions to help protect the unit during low temperature operation. This also includes the units subject to low ambient temperatures.

Units with supply water temperatures below +5°C

Glycol is recommended when a supply water temperature of +5°C or below is required or when static water can be exposed to freezing temperatures.

Units subject to ambient temperatures lower than 0°C, a minimum of 1 of the following is required:

1. Glycol of an appropriate concentration (1) is used within the system to ensure adequate protection. Please ensure that the concentration is capable of protection at least 3K lower than the minimum operating ambient.
2. Ensure water/glycol solution is constantly circulated through all waterside pipework and coils to prevent static water from freezing.
3. Ensure that pumps are started and running even during shut down periods, when the ambient is within 3K of the solution freeze point (1) (i.e. if the solution freezes at 0°C, the pump must be operating at 3°C ambient).(2)
4. Additional trace heating is provided for interconnecting pipework.

(1) Refer to your glycol supplier for details.

(2) An actuated suction ball valve shall be fitted to protect the compressor from liquid migration.

Free Cooling Chillers

A minimum of 20% glycol concentration must be applied to all free cooling chillers. Concentration should be increased so that its capable of protection at least 3K lower than the minimum operating ambient.

Flow Control

Care to be taken when selecting a chiller within 5% of the evaporator minimum flow rate. The end user must ensure that flow variation does not fall below this minimum as the chiller will shut down.

Environmental Policy

It is our policy to:

- Take a proactive approach to resolve environmental issues and ensure compliance with regulatory requirements.
- Train personnel in sound environmental practices.
- Pursue opportunities to conserve resources, prevent pollution and eliminate waste.
- Manufacture products in a responsible manner with minimum impact on the environment.
- Reduce our use of chemicals and minimise their release to the environment.
- Measure, control and verify environmental performance through internal and external audits.
- Continually improve our environmental performance.

CE Directive

Airedale certify that the equipment detailed in this manual conforms with the following EC Directives:

Electromagnetic Compatibility Directive (EMC)	2014/30/EU
Machinery Directive (MD)	89/392/EEC version 2006/42/EC
Pressure Equipment Directive (PED)	2014/68/EU
Ecodesign	2009/125/EC

To comply with these directives appropriate national & harmonised standards have been applied. These are listed on the Declaration of Conformity, supplied with each product.

IMPORTANT ⚠	Some operations when servicing or maintaining the unit may require additional assistance with regard to manual handling. This requirement is down to the discretion of the engineer. Remember do not perform a lift that exceeds your ability.

Occupancy Note - Plant Rooms

In line with EN378-1 2016 section 4.2 the typical application of a TCW will be in plant rooms which can be determined as Class III location. The plant/machinery room can also be classed as an occupancy category B (supervised occupancy).

The refrigerant charge restriction is classed as A2 for R134a and A2L for R1234ze (E) both as per EN378-1 annex E which means that no charge restrictions apply. The flammability class A2 for R134a and A2L have a flammability class of 2 and 2L respectively and therefore still has no charge restrictions.

Health and Safety

IMPORTANT

The information contained in this manual is critical to the correct operation and maintenance of the unit and should be read by all persons responsible for the installation, commissioning and maintenance of this Airedale unit.

Safety

The equipment has been designed and manufactured to meet international safety standards but, like any mechanical / electrical equipment, care must be taken if you are to obtain the best results.

When working with any chillers ensure that the electrical isolator is switched off prior to servicing or repair work and that there is no power to any part of the equipment. Also ensure that there are no other power feeds to the unit such as fire alarm circuits, BMS circuits, crankcase heater permanent supplies etc.

CAUTION ⚠	Electrical installation commissioning and maintenance work on this equipment should be undertaken by competent and trained personnel in accordance with local relevant standards and codes of practice.

Refrigerant Warning

These Airedale chillers use R134a or R1234ze (E) refrigerant which requires careful attention to proper storage and handling procedures in accordance with EN 378. Maximum water temperature flowing through the chiller should be 42°C. All service personnel must have hydrocarbon refrigerant handling training.

Use only manifold gauge sets designed for use with refrigerants. Use only refrigerant recovery units and cylinders designed for the pressure category of the refrigerants.

The refrigerant used in this range of products is classified under the COSHH regulations as an irritant, with set Workplace Exposure Levels (WEL) for consideration if this plant is installed in confined or poorly ventilated areas.

A full hazard data sheet in accordance with COSHH regulations is available should this be required.

Refrigerants must only be charged in the liquid state.

The refrigerant must be stored in a clean, dry area away from sunlight. The refrigerant must never be stored above 50°C.

Global Warming Potential

The R134a refrigerant has a GWP of 1430 (Based on EN378-1 :2016 (100 year life)

The R1234ze (E) refrigerant has a GWP of 7 (Based on EN378-1 :2016 (100 year life)

Maximum and Minimum Operation Temperature (TS) and Pressure (PS)

Refrigeration

Allowable Temperature Range (TS), Min -20°C* to Max 120°C **

Maximum Allowable Pressure (PS), High Side 14.0 Barg

*Based on the refrigerant temperature in the unit off state in the lowest permitted ambient temperature.

**Based on the maximum allowable super heated refrigerant temperature.

Waterside

AllowableTemperature Range (TS), Min -20°C* to Max 40°C**

Maximum Allowable Pressure (PS), 10.0 Barg

*Based on the waterside temperature in the unit off state in the lowest permitted ambient temperature.

**Based on the waterside temperature in the unit off state in the highest permitted ambient temperature.

Pressure System Safety Regulations 2000

Refrigeration assemblies/systems may constitute a Pressure System as defined in the Pressure System Safety Regulations 2000.

Ecodesign Directive 2009/125/EC

The product range within this document is designed in accordance to the European Ecodesign Directive 2009/125/EC. The appendix at the rear section of the manual gives the product compliancy metrics. Products sold outside of the EU are exempt from this directive

Unit Operating Conditions

		Min	Max
Ambient	°C	-20	45
Evaporator Leaving Water Temperature	°C	5	18
Evaporator Return Water Temperature	°C	9	26
Condenser Leaving Water Temperature	°C	18	45
Condenser Return Water Temperature	°C	10	41

CAUTION ⚠	Care must be taken when working around the discharge pipe work of the unit. High surface temperatures may exist during unit operation. The refrigerant has a boiling point of -19°C.

Protective Personal Equipment

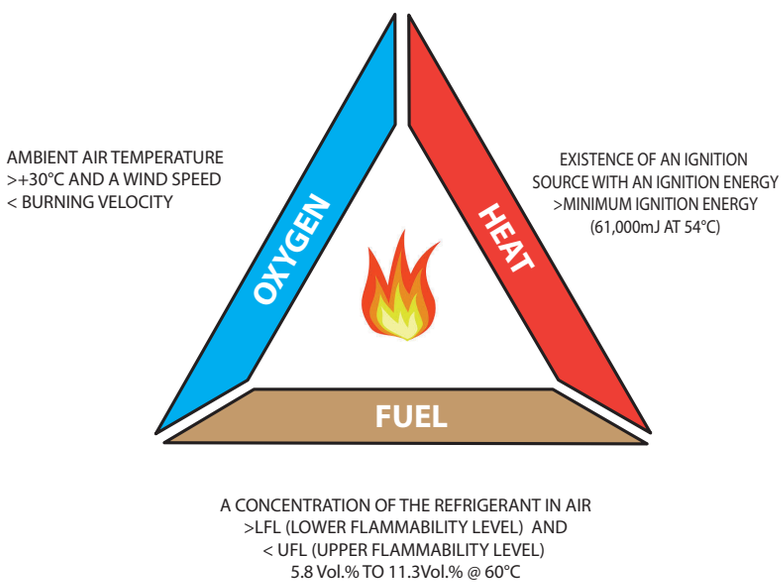
Airedale recommends that personal protective equipment is used whilst installing, maintaining and commissioning equipment.

Safe Operating Limits

The TurboChill R1234ze(E) chiller has operating limits set to ensure that the refrigerant does not become unstable. Certain aspects of the installation and design must be considered.
The installation of the unit is subject to various design aspects, see below.

R1234ze (E) Flammability

In the event of a leak the combination of the following 3 operating conditions detailed in the fire triangle MUST be avoided at all times. Failure to do this could cause a fire.

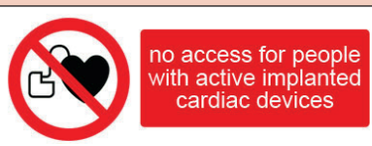


IMPORTANT ⚠	This refrigerant is not flammable as per the Material Safety Data Sheet (MSDS) “Hazards Identification” supplied by the refrigerant manufacturer.

NO SMOKING OR NAKED FLAME.

CAUTION ⚠	The machinery room where the chiller is installed shall be clearly marked indicating that smoking or naked lights are not permitted. Authorised personnel only. in accordance to EN378-3:2016,10.2.

IMPORTANT ⚠	To avoid any risk of injury, any work to be carried out on or around the compressor and magnetic check valve should be completed by personnel that do not have pacemakers fitted.



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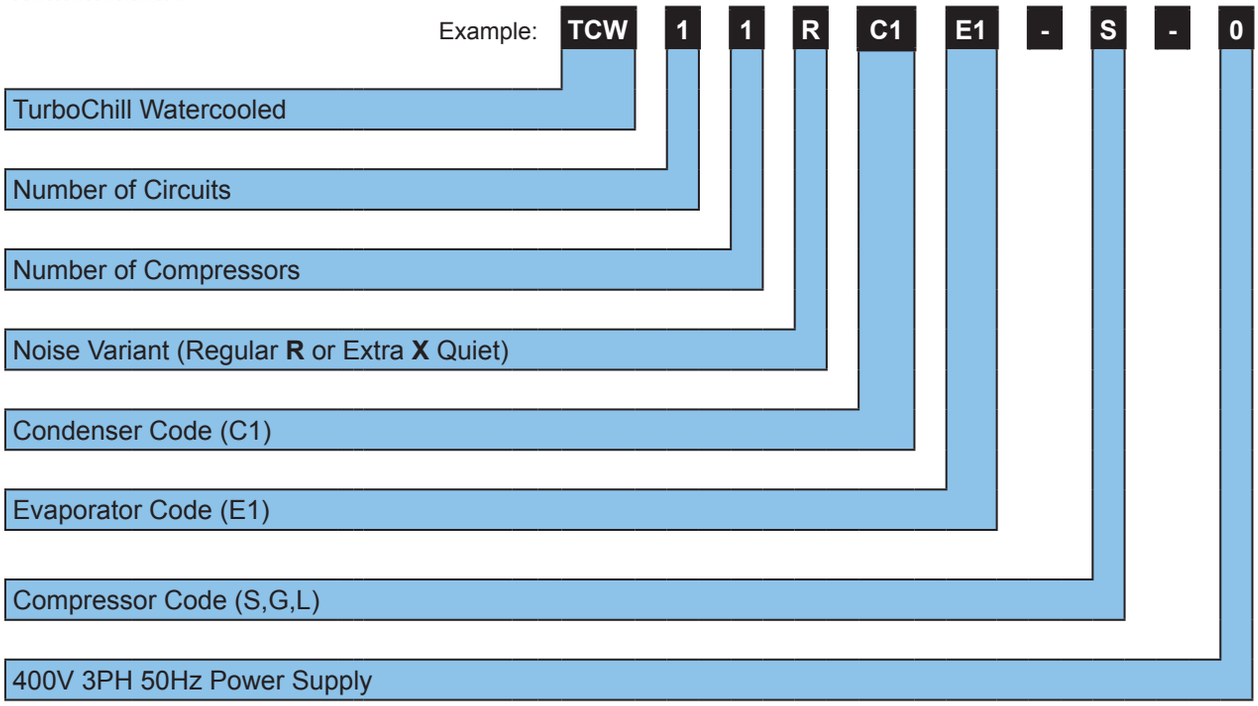
Specifier's Guide

Nomenclature



Introduction

The Airedale TurboChill Water Cooled chiller uses the technologically superior centrifugal TurboCor compressors. Designed for a cooling capacity of 150kW to 1488kW*, the nominal operating conditions are based on EN14511 rating conditions for water cooled chillers which are 12/7°C Evaporator and 30/35°C Condenser water temperatures.

Refrigerant

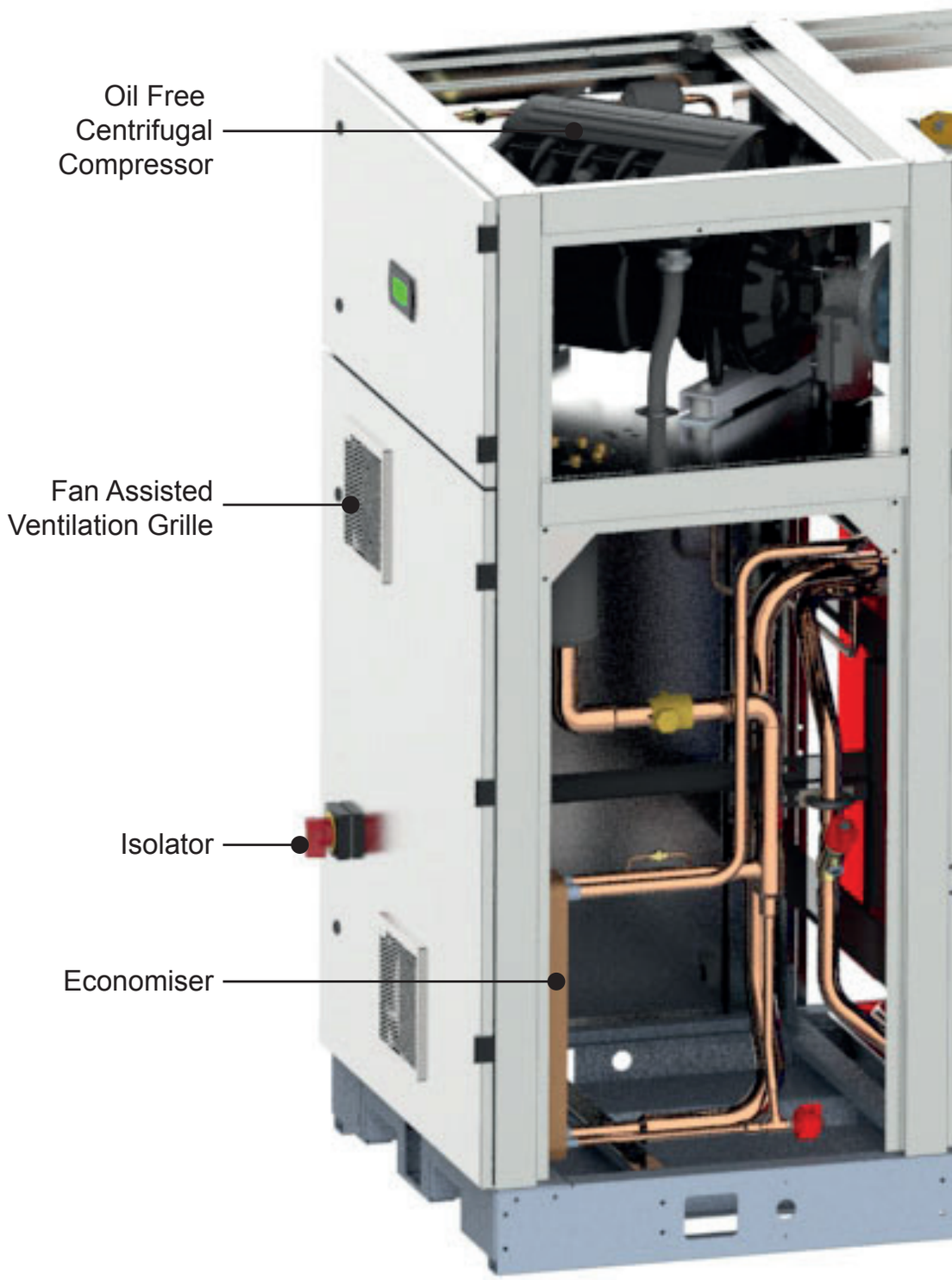
The range has been designed and optimised for operation with ozone benign R134a refrigerant or R1234ze(E) refrigerant.

Construction

The base shall be fabricated from galvanised steel to ensure a rigid, durable, weatherproof construction.
Unit panels shall be manufactured from galvanised sheet steel coated with epoxy baked powder paint to provide a durable and weatherproof finish.
Standard unit colour shall be Light Grey (RAL 7035).
The Compressor, Evaporator and Condenser shall be mounted on a rigid galvanised heavy-duty sub frame.
Electrical panels shall be situated at one side of the unit.**

*Capacity data based on minimum capacity of one module to maximum capacity of four modules.
**Only low noise (X) models will be supplied with enclosed panels.

Unit Overview



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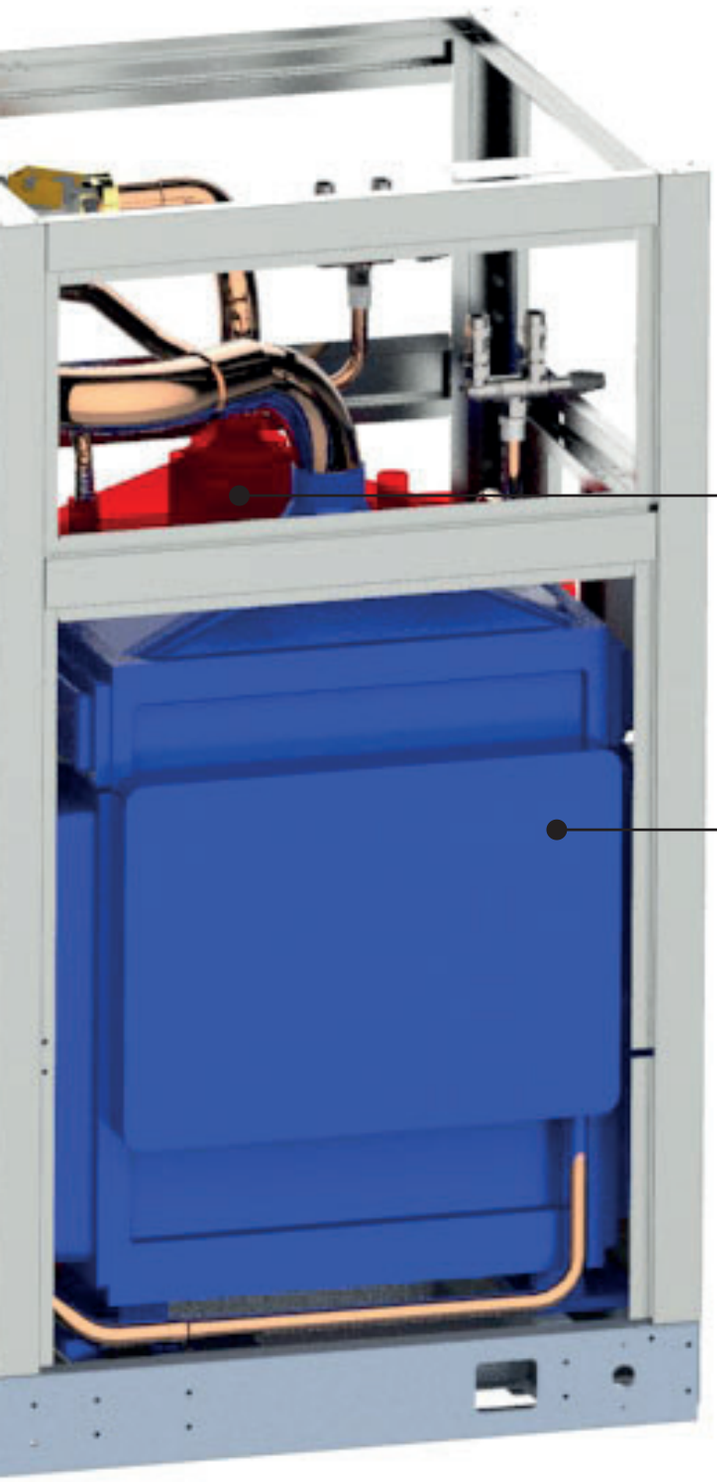

Condenser
Evaporator

Features

The TurboChill Water Cooled Chiller shall be supplied complete with:

- TurboCor Oil Free Compressor
- Microprocessor Control
- Compact Evaporator
- Compact Condenser
- Single Refrigeration Circuit
- Liquid Level Transmitters and Liquid Level Control Valves
- Maintainable Dual Pressure Relief Valves
- Electronic Expansion Valve
- Grooved Water Connections & Counter Pipe Assembly
- Differential Pressure Sensors across the evaporator and condenser offer the same protection as a Water Flow Switch.

Refrigeration

The refrigeration circuit is supplied with the following:

- Full operating charge of R134a or R1234ze (E) refrigerant
- Liquid injection cooling circuit fitted to each compressor as standard with Sight Glass, Filter Drier and Ball Valve
- Discharge Line Shut Off Valves
- Liquid Line Shut Off Valves
- Filter Driers with Replaceable Core
- Evaporator and Liquid Line Sight Glass
- Low Pressure Switch with Auto Reset
- 2 High Pressure Switches with Auto Reset per compressor
- Liquid Pressure Transducer
- Discharge Check (non return) Valve

Refrigerant Leak Detection System

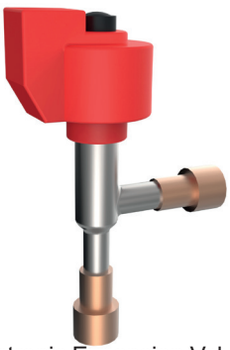
A factory calibrated leak detection system shall be fitted as standard.

Water/Glycol

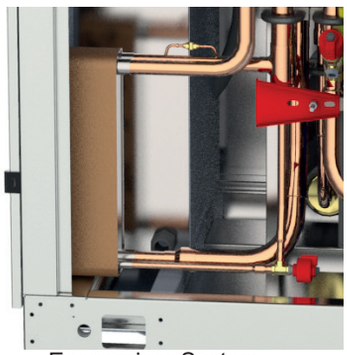
Each water glycol circuit shall be supplied with the following:

- Differential Pressure Sensor across the evaporator and condenser offer the same protection as Flow Switches
- Strategically placed Drain Valves

Refrigeration



Electronic Expansion Valve



Economiser System

		System Configuration		
		S	G	L
Refrigeration	Compact Evaporator with Integrated Sub Cooler	●	●	●
	Compact Condenser	●	●	●
	TurboCor Compressor	●	●	●
	R134a Refrigerant	●	–	●
	R1234ze(E) Refrigerant	–	●	–
	Electronic Expansion Valves	●	●	●
	Discharge Line Ball Valves	●	●	●
	Liquid Line Ball Valves	●	●	●
	HP/LP Transducers and Switches	●	●	●
	Suction Line Isolation Valve	○	○	○
	Liquid Line Injection Motor Cooling	●	●	●
	Filter Drier	●	●	●
	Evaporator Dual Pressure Relief Valve Assembly	●	●	●
	Condenser Dual Pressure Relief Valve Assembly	●	●	●
	Economiser	○	○	○
	Direct Leak Detection	●	●	●
	Premium Leak Detection	○	○	○
	Automatic Pump Down	○	●	○

● Standard Feature ○ Optional Feature – Feature Not Available

Evaporator

Adopting a compact design with a compact footprint and a significant reduction in refrigerant charge when compared to a flooded evaporator equivalent. The evaporator incorporates an intergrated subcooler as standard, further boosting its performance over other heat exchanger technologies.

Condenser

The similarly designed condenser also adopts the compact design, reducing footprint and refrigerant required for subcooling.

Economiser

Via the economiser, a portion of the refrigerant is evaporated and used to further sub cool the bulk of the liquid refrigerant via a plate heat exchanger. This extra sub cooling lowers the liquid refrigerant enthalpy allowing for a higher ratio of heat absorption in the evaporator; the overall effect is an increase in cooling capacity.
Should the option be selected refrigerant will flow through the economiser before the integrated subcooler, this will provide a reduction in liquid temperature prior to the subcooler which in turn shall reduce the level of additional suction superheat generated by the integrated subcooler.

Electronic Expansion Valves (EEV)

Electronic expansion valves differ to the normal thermostatic expansion valves in their ability to maintain control of the suction superheat at reduced head pressures. This can lead to significant energy savings particularly at reduced loading and low ambient temperatures. EEV step position, superheat setpoint, head pressure set point and other features can be viewed and adjusted via the microprocessor display.

Whilst offering versatile control at the full design duty of the unit, Thermostatic Expansion Valves (TEV) do not automatically optimise themselves to all operating conditions. Therefore, if the refrigeration system is operating at 40% or 50% of full load, especially at a lower ambient temperature than that for which the valve was sized, the conventional TEV must have the design head pressure available to ensure good refrigerant control. Maintaining an artificially high condensing pressure is normal in conventional systems.

Using an EEV allows for good refrigeration control whilst operating at part load and lower ambient conditions with a reduced condensing pressure. By fitting an EEV and adjusting the head pressure control setting an increase in the system EER (Energy Efficiency Ratio) of up to 30% can typically be seen.

EEVs differ from thermostatic expansion valves in their ability to maintain control of refrigerant flow and suction superheat at reduced head pressures. The turn-down rate of a typical EEV is superior to that of it's thermostatic equivalent, such that a reduced optimum condensing pressure can be maintained at low compressor load.

An EEV can operate effectively between 10-100% of its rated capacity.

Sight Glass

A liquid line sight glass is fitted to give an indication of the state of the refrigerant within the system. If the sight glass becomes yellow it is an indication that there is moisture in the system and the filter drier may need changing.

Liquid Line Ball Valves

Liquid line ball valves are fitted to ensure ease of maintenance during shut down periods.

Discharge Line Ball Valves

Discharge line ball valves are fitted to ensure ease of maintenance during shut down periods.

Filter Driers

Filter driers are fitted to ensure that the expansion device is protected from any potential contaminants and to absorb any unwanted moisture in the system. This can be serviced with changeable inner cores.

HP/LP Transducers and Switches

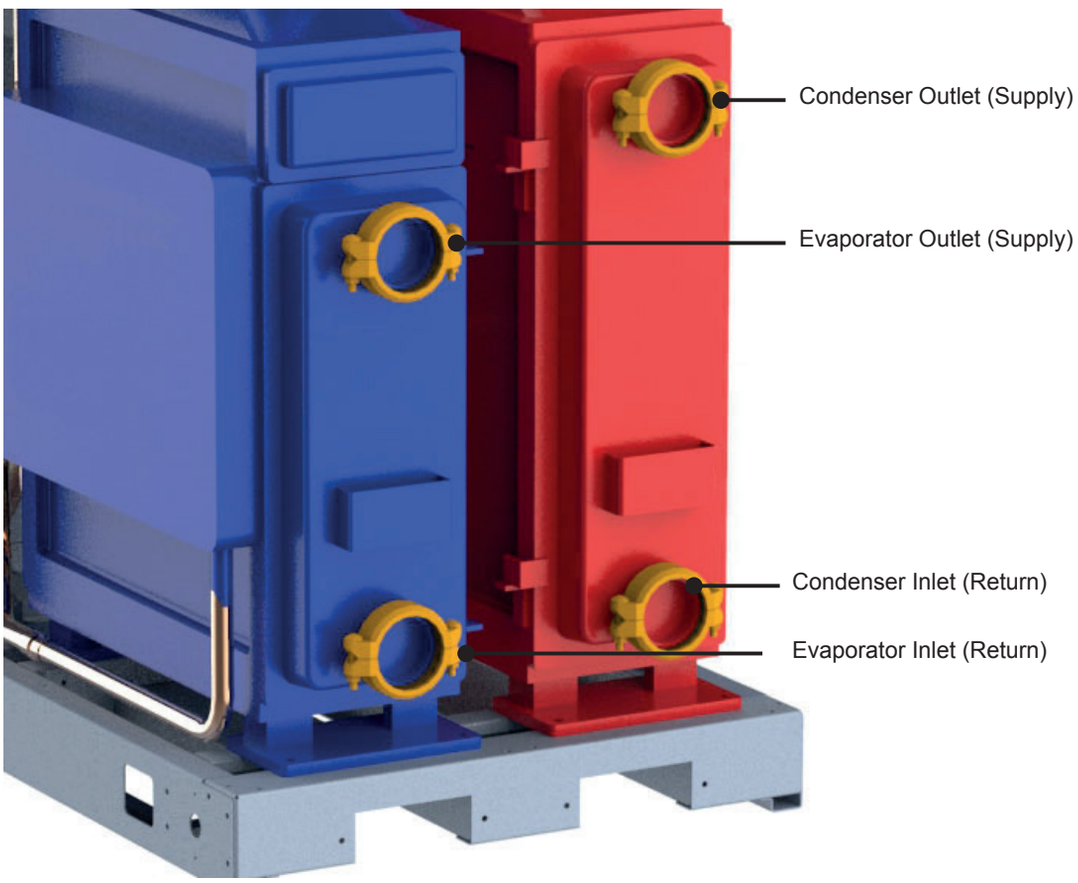
HP/LP Transducers and switches are fitted to the unit to protect against high or low pressures. High pressure switches are auto reset.

Leak Detection

A factory calibrated and fitted leak detection system shall raise an alarm when refrigerant gas is detected. The detector will be positioned close to the compressor section.

A premium package is available that monitors refrigeration parameters and determines if loss of refrigerant is occurring. This can detect which circuit is leaking from these parameters making an intelligent decision of potential shut-down of the unit.

Evaporator and Condenser



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		System Configuration		
		S	G	L
Evaporator/ Condenser	Evaporator Differential Pressure Switch	●	●	●
	Condenser Differential Pressure Switch	●	●	●
	Evaporator Water Temperature Sensors	●	●	●
	Evaporator Water Temperature Sensors	●	●	●
	Dual Pressure Relief Valves	●	●	●

● Standard Feature ○ Optional Feature ━ Feature Not Available

Dual Pressure Relief Valve

An auto resetting pressure relief valve assembly shall be provided for both the evaporator and condenser heat exchangers, opening on pressure rise above 14 barg. The dual shut-off valve assembly incorporates 2 pressure relief valves which can be individually shut off via a 3 way valve. This allows the maintenance of individual pressure relief valves without any requirement for refrigerant evacuation. Pressure relief valves have been sized to ensure that in the event of fire they can prevent excessive build-up of pressure within the evaporator and condenser. EN13136:2013 section 6.2.1 has been used to size valves accordingly.

External Fire

Fire is a hazard that these units have not been designed to operate under. However, the inclusion of various safety devices ensures that any damage due to fire is limited via the release of pressure in the form of gas discharge.
If concerns of the ability of the pressure relief valve to discharge in the event of a fire >107°C exist, then it is the responsibility of the end user to protect the pressure relief valve assembly from excessive external temperatures. This must however allow the pressure relief valve to discharge effectively and not act as a ‘choke’ (offer any resistance) when discharging.

Compressor

		System Configuration		
		S	G	L
Compressor	Vibration Isolating Rubber Mounts	●	●	●
	Suction Strainer	●	●	●
	Discharge Shut Off Valves	●	●	●
	Suction Shut Off Valves	●	●	●
	Line Reactor	●	●	●
	EMI/EMC Filter	●	●	●

● Standard Feature ○ Optional Feature ━ Feature Not Available

TurboCor Compressor

TurboCor centrifugal compressor supplied with as standard:

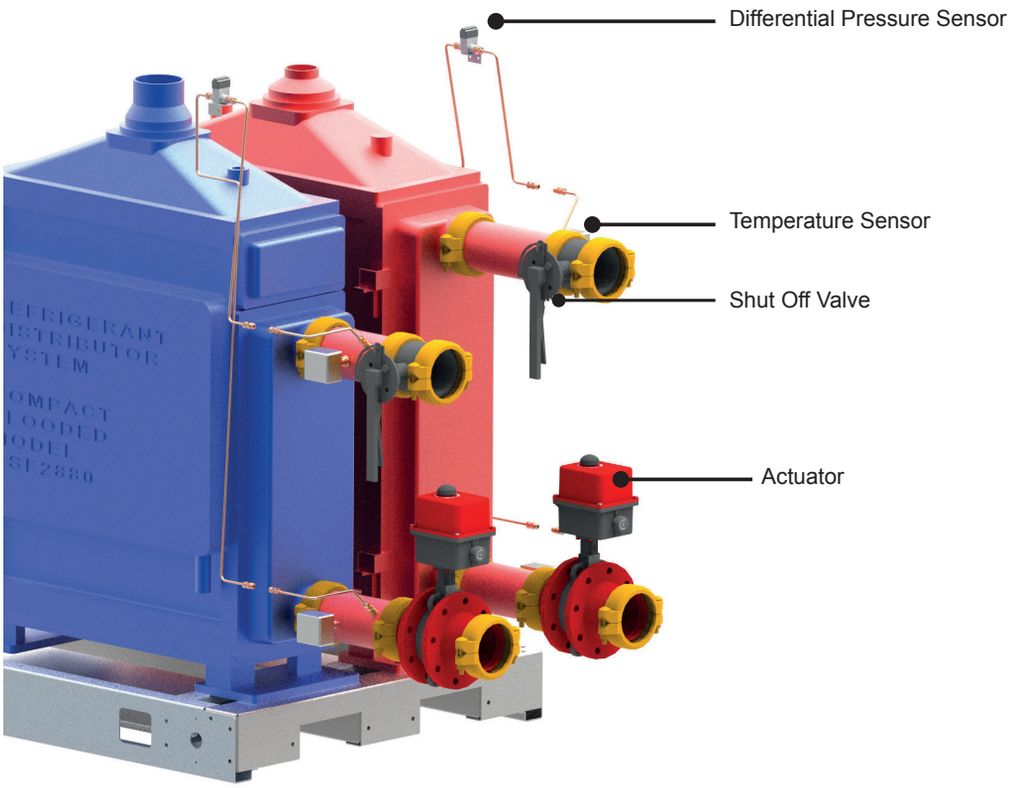
- Suction and discharge shut off valves
- Discharge non-return valve
- Line reactor (for removing additional impedance harmonics and voltage spikes in the ac waveform)
- EMI/EMC filter and comprising of:
  - o AC-DC rectifier
  - o DC capacitors
  - o DC-AC (IGBT) converter
  - o Motor/bearing management system and incorporated surge protection
  - o Soft start module
  - o Magnetic bearing system
  - o Compressors are mounted on Turbocor specially designed vibration reducing isolating rubber mounts
  - o Linear capacity modulation is provided by a variable frequency drive

IMPORTANT ⚠	Ensure single phase power supply is connected permanently to ensure that the system will isolate refrigerant and ventilate the compressor housing in the event of a leak being detected. A UPS permanent supply is required.

Key benefits of TurboCor compressor technology:

- Oil Free Operation.
- More efficient use of heat exchangers.
- No oil entrainment issues – pipe work can be optimised for performance not oil return.
- Variable speed operation offering exact capacity match and optimum part load performance.
- Magnetic bearing system constantly optimises shaft / impeller position.
- Small and light, only 132kg.
- No mechanical contact, very quiet operation.
- Very low start current, only 2A.
- The intelligent, self optimising compressor offers near silent, oil free operation and ultra efficient variable speed control.
- Turbocor compressor shaft and impellers levitate on a magnetic cushion eliminating friction and vibration resulting in the compressor running at a smooth and reduced sound spectrum.
- The TurboChill compressor's variable speed control offers 2 major benefits:
    - o Uses substantially less power at part load and gives accurate set-point control and exact capacity match
    - o The inbuilt electronic soft start produces a very low starting current of just 2A and eradicates the need to oversize electrical supply components on site

Waterside



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		System Configuration		
		S	G	L
Waterside	Differential Water Pressure Transducers*	●	●	●
	Grooved and Clamped Unit Terminations	●	●	●
	Manual and Actuated Isolation Valves	●	●	●
	Pump Interlock*	●	●	●
	Water Flow Switch*	○	○	○

● Standard Feature ○ Optional Feature ━ Feature Not Available

CAUTION ⚠	*Each feature is a flow proving device and 2 out of the 3 should be fitted to any unit to validate warranty.

Flow Proving Device*

Evaporator and condenser differential pressure sensors facilitate low flow limiting and pressure drop monitoring via the microprocessor which shall be fitted to ensure correct unit water flow.

Pump Interlock*

Provision for a pump interlock is available within the control panel.

Water Flow Switch*

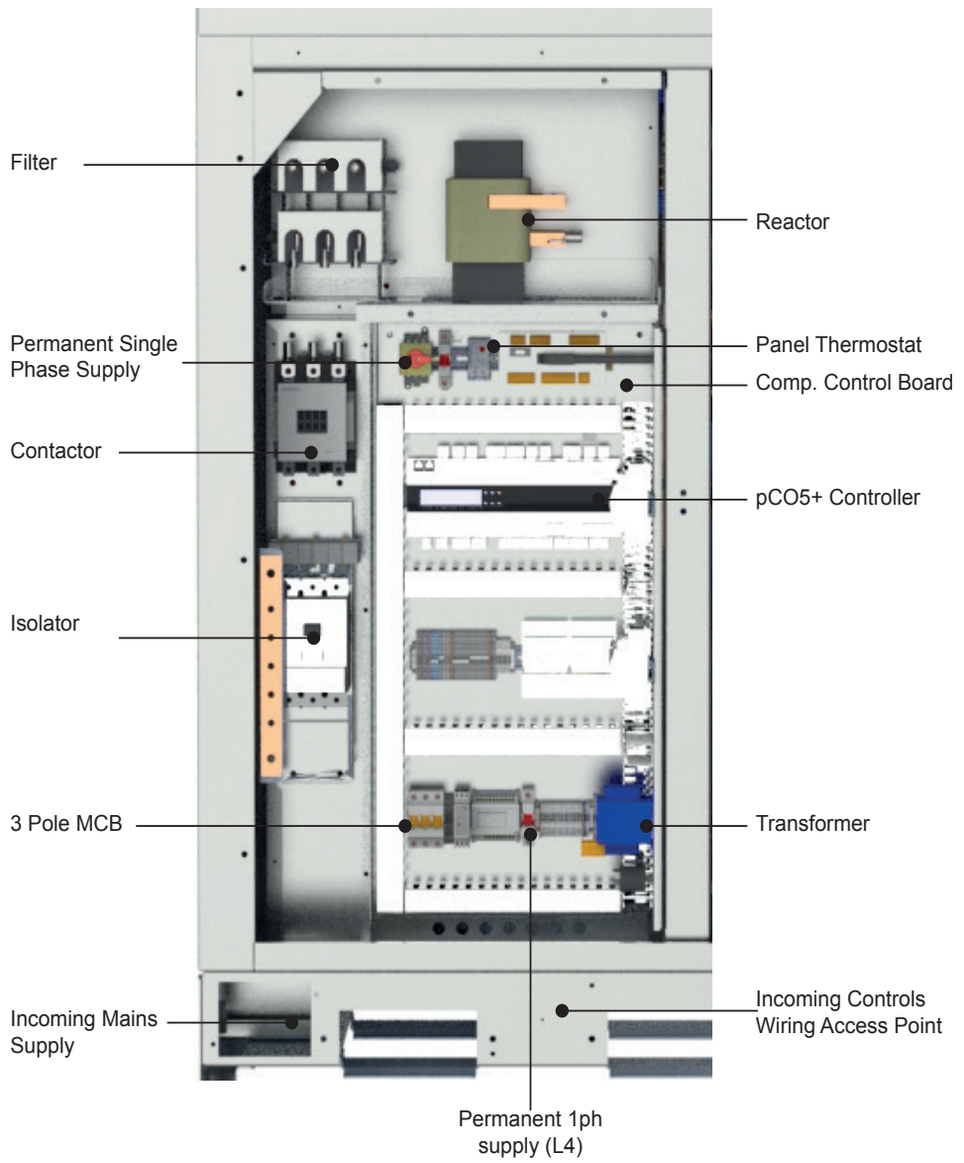
If selected, a water flow switch shall be fitted ensuring integrity of the cooling solution flow. The flow switch shall protect the chiller against low water flow conditions.

CAUTION ⚠	*Each feature is a flow proving device and 2 out of the 3 should be fitted to any unit to validate warranty.

Water Connections

Water inlet and outlet connections are of a grooved and clamped type construction, enabling easy pipework termination. The unit is supplied with a counter pipe and coupling assembly for quick installation. Water inlet and outlet are located at the end of the unit.

Electrical Panel View



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		System Configuration		
		S	G	L
Electrical	Electronic Soft Start	●	●	●
	Mains electric Isolator	●	●	●
	Ultracap Power Backup	●	●	●
	Control Panel Ventilation	●	●	●
	Ventilated Compressor Enclosure	–	●	–
	Phase Rotation Relay	●	●	●
	Energy Manager/Power Meter	○	○	○

● Standard Feature ○ Optional Feature – Feature Not Available

Electrical

An electrical power and controls panel is situated at the front of the unit and contains:

- Individual mains power isolator for the compressor
- Emergency interlock isolator handle
- Fully accessible controls compartment, allowing adjustment of control set points whilst the unit is operational
- Circuit breakers for protection of all major unit components
- Phase rotation relay incorporating phase loss protection (not fitted if energy manager selected)

The electrical power and control panel is wired to the latest European standards and codes of practice. Mains supply is 3 phase, a neutral is only required for permanent supply (L4). Separate 230V permanent supply (L4) is required for the controls and safety features.

IMPORTANT ⚠	TurboChill units are designed for indoor use only and must not be installed outside.

Electronic Soft Start

The electronic soft start enables the chiller compressor motor to be ramped to speed with the minimum full load current. Further benefits include removal of nuisance tripping, supply voltage dips and motor overheating. Main Electric Isolator To ensure complete unit isolation of the electrical panel during adjustment and maintenance a door interlocking isolator is provided as standard.

Ultracap UPS

Unit controls are maintained by an Ultracap. The Ultracap module is an external backup device for the controller. The module guarantees temporary power to the controller in the event of power failures and allows for enough time to keep the controller running with time to change power supplies.
The Ultra Capacitors are used to maintain the controller's main functions, to close the electronic valves in the event of mains power failures. Power will be maintained until mains power is reinstated for a maximum period of 10 minutes.
The module is made using Ultracap storage capacitors (EDLC = Electric Double Layer Capacitor), which are recharged independently by the module.
These ensure reliability in terms of much longer component life than a module made with lead batteries: the life of the Ultracap module is at least 10 years.

Phase Rotation Relay

A phase sequence relay shall be fitted for units containing 3 phase scroll compressors, to prevent possible damage by running the compressor in the wrong direction.

Energy Manager

Analysis of system energy consumption can be monitored via a dedicated LCD display. Unit parameters can be adjusted via the unit microprocessor control to affect energy usage in line with the system need.

Controls

		System Configuration S	G	L
Controls	Microprocessor with built-in display	●	●	●
	PGD1 Door Mounted Display	○	○	○
	7” PGDT Touch Display	○	○	○
	Modbus & Carel RS485, LON, pCOWEB & BACNET interface cards	○	○	○
	Integrated Chiller Sequence Manager	○	○	○
	Network Interface Control	○	○	○

● Standard Feature ○ Optional Feature ━ Feature Not Available

The units shall be supplied with a European ROHS Directive 2002/95/EC compatible microprocessor controller connected to an 8 x 22 back-lit LCD keypad display. LEDs shall not be acceptable. The microprocessor controller offers powerful analogue and digital control to meet a wide range of monitoring and control features including a real time clock and Industry standard communication port and network connections. All the boards feature a 16 bit microprocessor, and consequently the calculation power and operation processing speed have been significantly increased. Also featured are a visual alarm and the facility to adjust and display control settings by local operator for information and control.

Display/Keypad

The display keypad features a simple array of keys to navigate through the in-built menus.
With an 8 x 22 character (132 x 64 pixel) screen size, back lit in white for improved contrast, the larger screen shall provide for user friendly viewing and easy status recognition by displaying a combination of text and icons.
The default screen shall show the unit status without the need for interrogation and an easy to navigate menu structure for further interrogation and adjustment shall be provided.

Alarm Log

The controller shall log and allow viewing of not less than the last 200 conditions recorded in descending chronological order through the keypad display. The standard display keypad shall visually display operating alarms, however, as an optional extra, a display keypad with audible alarms is available.

BMS Interface Cards

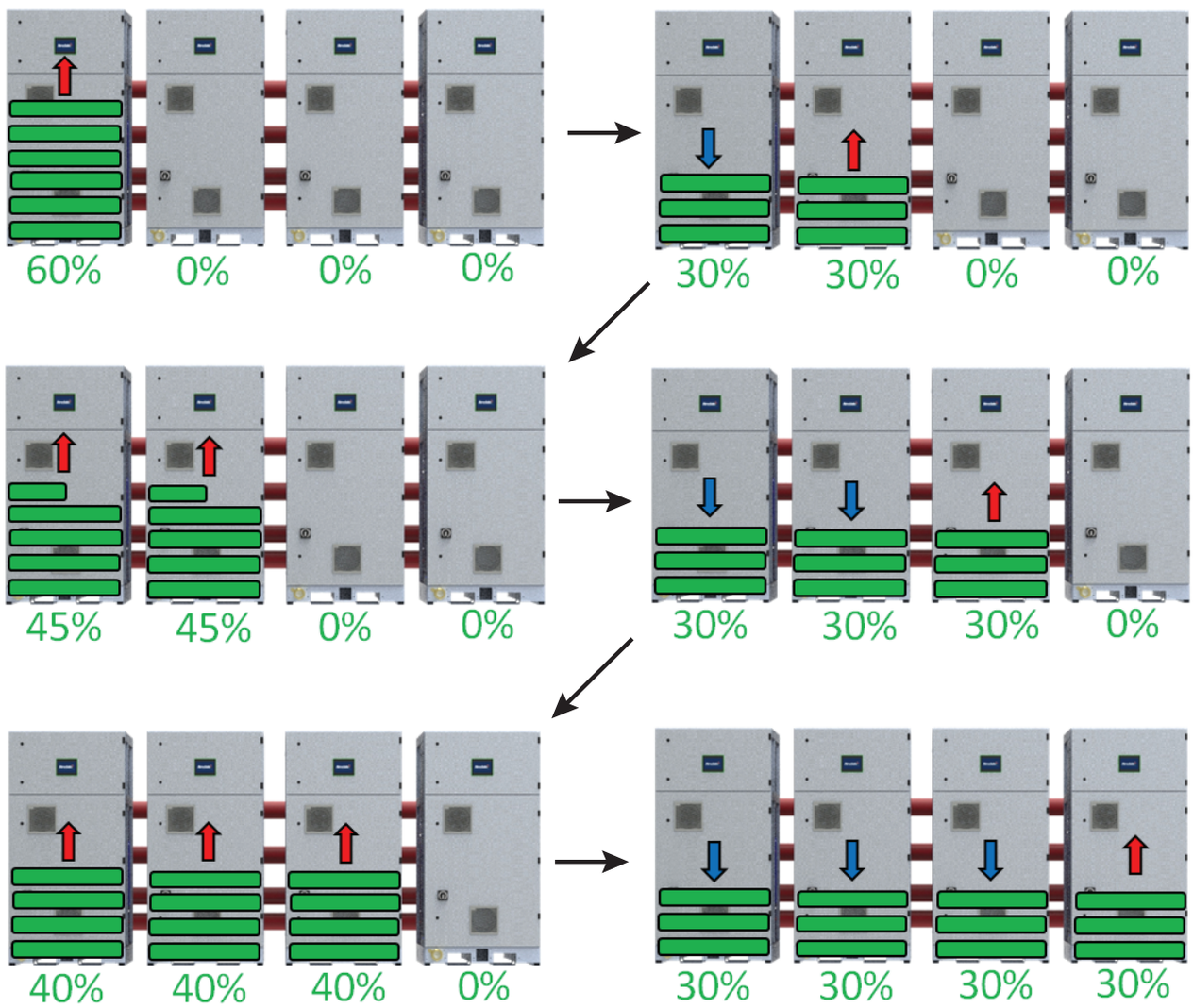
BMS cards provide an interface between the Airedale unit and the majority of BMS systems, they can be selected and factory fitted as a standard option (please contact Airedale). A wide range of protocols can be accommodated which include the following standard protocols; ModBus; Carel; SNMP; LonWorks; Metasys and BACnet.
Alternatively Airedale’s Ethernet TCP/IP based plug-in card, the pCOWEB, offers BACnet IP, Modbus IP and SNMP features.

Integrated Optimised Loading and Offloading Sequence

A sequence light control algorithm has been integrated into the unit strategy which will allow operation of up to 4 modules (circa 1.5MW). The loading sequence has also been optimised to maximise system EER for a given load, where multiple TCW modules will share the load evenly when possible.

As a single module ramps up to 60% demand, the second module becomes active and ramps up to 30% (minimum). As it does this, the first module shall ramp down to 30%, to share the load. This same process can be continued up to 8 modules. Once all modules are active they will load up equally as the system load increases. This loading strategy simply allows each module to operate at part load demand as much as possible, maximising efficiency.

Offloading occurs via the process described above, in reverse. All modules shall ramp down from 100% equally to the minimum possible demand (for each module), and then as one module is switched off the remaining modules ramp up to make up the difference to maintain a smooth reduction in cooling capacity. This strategy is continued until the system is at its minimum cooling capacity represented by one module at its minimum demand.



External

		System Configuration		
		S	G	L
External	Dedicated Compressor Enclosure	●	●	●
	Ventilated Compressor Enclosure (ATEX fans)	○	●	○
	Lifting Eye Bolts	●	●	●
	Pallet Truck Movability	●	●	●
	Acoustic Enclosure	○	○	○
	Anti-Vibration Mounts (pad type)	○	○	○

● Standard Feature ○ Optional Feature ━ Feature Not Available

Dedicated Compressor Enclosure

Units shall be supplied with dedicated compressor enclosure as standard.

Ventilated Compressor Enclosure

R1234ze units shall have ventilation with ATEX fans as standard, in compliance with safety standards.

Lifting Eye Bolts

M36 lifting eye bolts shall be fitted to the unit.

Sterling board L.A.T (Wooden Case) Packing

Units shall be supplied complete with additional L.A.T. corner protection and cross braces to afford extra transit protection. Sterling board heat treated man made material shall be used (including pallet) to comply with phytosanity import regulations. (Please contact Airedale for this option).

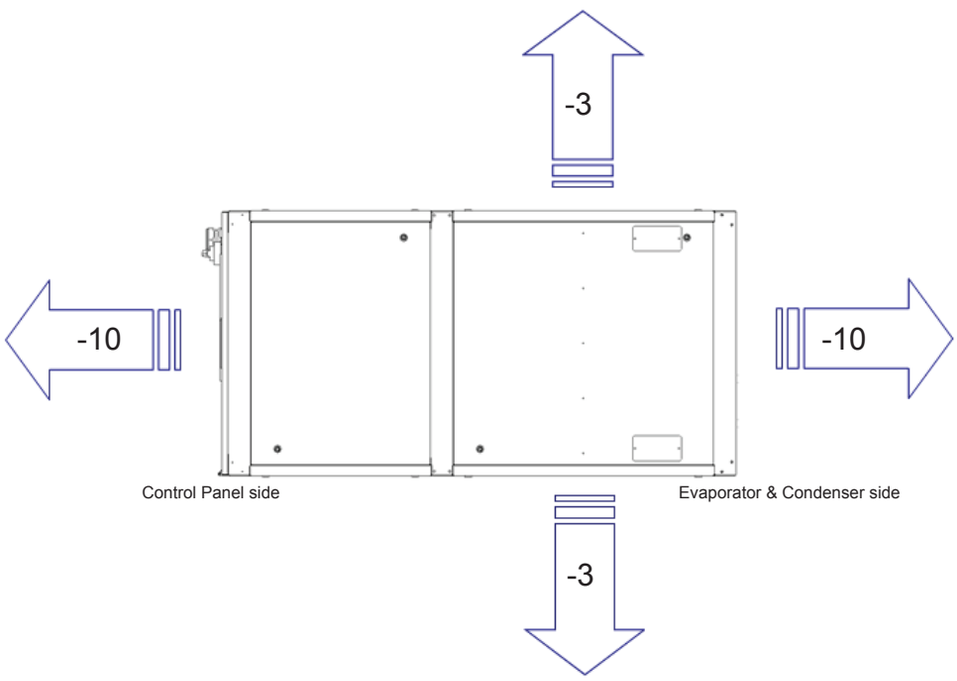
Performance Data

Measurement of Sound Data

All sound data quoted has been measured in the third-octave band limited values, using a Real Time Analyser calibrated sound intensity meter in accordance with BS EN ISO 9614 Part 1:2009. The Global sound data quoted is valid for noise emitted in the horizontal plane in all directions.
All Sound Power Levels quoted are calculated from measured sound intensity according to BS EN ISO 9614 Part 1: 2009.
Sound Pressure Levels are calculated from sound power using the expanded parallelepiped method according to BS EN ISO 11203: 2009.
Resultant performance figures obtained from test will be proven to not differ from the claimed figures by more than the allowable deviations specified in table 7 of section VII of Eurovent RS 6/C/003-2016 (A-weighted sound power; +3dBA).
Acoustic data is representative of the unit running at the nominal duty and conditions, under steady state operation.

Sound Directivity

The global sound measurements quoted in the following tables do not incorporate any directivity or denote any sound level heard at any given position surrounding the unit, rather they represent the total sound level radiating from the unit in all directions in the horizontal plane from source.



Design Data

Glycol

Glycol is recommended when a supply water temperature of +5°C or below is required or when static water can be exposed to freezing temperatures (lower than 3°C Ambient). This is specified further in the environmental consideration section at the front of this document.

$$Q = p \times \dot{m} \times Cp \times \Delta t$$

Where

Q = Cooling Performance (kW)
p = Density of cooling medium (kg/m³)
$\dot{m}$ = mass flow of cooling media (kg/s)
Cp = Specific heat Capacity (kj/kg K)
Δt = Temperature difference between Inlet and Outlet (K)

Ethylene Glycol Specific Heat

	Glycol Percentage / Freezing Point					
Temperature °C	0% / 0°C	20% / -7.8°C	25% / -10.7°C	30% / -14.1°C	35% / -17.9°C	40% / -22.3°C
0	4.21	3.77	3.68	3.59	3.50	3.40
5	4.20	3.78	3.69	3.60	3.51	3.42
10	4.19	3.79	3.71	3.62	3.53	3.44
15	4.19	3.80	3.72	3.63	3.54	3.45
20	4.18	3.82	3.73	3.65	3.56	3.47
25	4.18	3.83	3.74	3.66	3.57	3.49
30	4.18	3.84	3.76	3.67	3.59	3.50
35	4.18	3.85	3.77	3.69	3.60	3.52
40	4.18	3.86	3.78	3.70	3.62	3.54
45	4.18	3.87	3.79	3.72	3.63	3.55

Ethylene Glycol Density

	Glycol Percentage / Freezing Point					
Temperature °C	0% / 0°C	20% / -7.8°C	25% / -10.7°C	30% / -14.1°C	35% / -17.9°C	40% / -22.3°C
0	999.8	1035.7	1043.7	1051.8	1059.3	1066.8
5	999.9	1034.4	1042.4	1050.3	1057.8	1065.2
10	999.7	1032.9	1040.9	1048.8	1056.1	1063.5
15	999.0	1031.4	1039.2	1047.1	1054.4	1061.7
20	998.2	1029.7	1037.5	1045.3	1052.5	1059.7
25	997.0	1027.9	1035.6	1043.3	1050.5	1057.6
30	995.6	1026.0	1033.6	1041.3	1048.3	1055.4
35	994.0	1024.0	1031.5	1039.1	1046.1	1053.1
40	992.2	1021.8	1029.3	1036.8	1043.7	1050.6
45	990.2	1019.6	1027.0	1034.4	1041.2	1048.1

Correction Factors

		Glycol in System / Freezing Point ºC			
		10% / -3.2°C	20% / -7.8°C	30% / -14.1°C	40% / -22.3°C
Cooling Duty	Catalogue Data x by:	0.98	0.97	0.95	0.93
Input Power		0.99	0.98	0.96	0.95
Water Flow		0.99	1.02	1.04	1.07
Pressure Drop		1.05	1.20	1.38	1.57

Design Data

Glycol

Glycol is recommended when a supply water temperature of +5°C or below is required or when static water can be exposed to freezing temperatures (lower than 3°C Ambient). This is specified further in the environmental consideration section at the front of this document.

$$Q = p \times \dot{m} \times Cp \times \Delta t$$

Where

Q = Cooling Performance (kW)
p = Density of cooling medium (kg/m³)
$\dot{m}$ = mass flow of cooling media (kg/s)
Cp = Specific heat Capacity (kj/kg K)
Δt = Temperature difference between Inlet and Outlet (K)

Propylene Glycol Specific Heat

	Glycol Percentage / Freezing Point					
Temperature °C	0% / 0°C	20% / -7.1°C	25% / -9.6°C	30% / -12.7°C	35% / -16.4°C	40% / -21.1°C
0	4.21	3.93	3.86	3.79	3.72	3.64
5	4.20	3.94	3.87	3.81	3.73	3.65
10	4.19	3.95	3.89	3.82	3.75	3.67
15	4.19	3.96	3.90	3.83	3.76	3.69
20	4.18	3.97	3.91	3.85	3.78	3.70
25	4.18	3.98	3.92	3.86	3.79	3.72
30	4.18	3.99	3.94	3.88	3.81	3.74
35	4.18	4.01	3.95	3.89	3.82	3.75
40	4.18	4.02	3.96	3.90	3.84	3.77
45	4.18	4.03	3.97	3.92	3.85	3.78

Propylene Glycol Density

	Glycol Percentage / Freezing Point					
Temperature °C	0% / 0°C	20% / -7.1°C	25% / -9.6°C	30% / -12.7°C	35% / -16.4°C	40% / -21.1°C
0	999.8	1025.8	1031.0	1036.2	1040.7	1045.1
5	999.9	1024.3	1029.4	1034.5	1038.8	1043.1
10	999.7	1022.7	1027.6	1032.6	1036.8	1040.9
15	999.0	1020.9	1025.7	1030.5	1034.6	1038.7
20	998.2	1019.0	1023.7	1028.4	1032.3	1036.2
25	997.0	1017.0	1021.5	1026.1	1029.9	1033.7
30	995.6	1014.8	1019.2	1023.6	1027.3	1031.0
35	994.0	1012.6	1016.8	1021.1	1024.7	1028.2
40	992.2	1010.2	1014.3	1018.4	1021.9	1025.3
45	990.2	1007.6	1011.6	1015.6	1018.9	1022.2

Correction Factors

		Glycol in System / Freezing Point ºC			
		10% / -3.3°C	20% / -7.1°C	30% / -12.7°C	40% / -21.1°C
Cooling Duty	Catalogue Data x by:	0.97	0.95	0.91	0.88
Input Power		0.99	0.98	0.96	0.95
Water Flow		0.98	0.97	0.95	0.95
Pressure Drop		1.08	1.17	1.31	1.45

Technical Data

TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L

Mechanical

			TCW11RC1E1-S	TCW11RC1E1-G	**TCW11RC1E1-L**
Cooling Duty	(1)	kW	300	275	350
Nominal Input		kW	58.19	48.86	67.4
EER	(2)		5.16	5.63	5.19
ESEER	(3)		7.18	7.85	5.92
Capacity Steps		%	30-100%	30-100%	30-100%
Dimensions (H x W x L)	(4)	mm	2180 x 1300 x 1956	2180 x 1300 x 1956	2180 x 1300 x 1956
Machine Weight		kg	2253	2265	2265
Operating Weight		kg	2454	2467	2467
Construction Material/Colour			Base: Plain Galvanised Steel, Panels: Galvanised Sheet Steel Epoxy Baked Powder Paint, Light Grey (RAL 7035)		
Evaporator - Type			Compact - Shell and Tube		
Insulation			Class O		
Total Max. Water Flow		l/s	23.6	23.6	23.6
Total Min. Water Flow		l/s	1.6	1.6	1.6
Condenser - Type			Compact - Shell and Tube		
Insulation			N/A		
Total Max. Water Flow		l/s	27.7	27.7	27.7
Total Min. Water Flow		l/s	1.6	1.6	1.6
Compressor - Type			TurboCor - Oil Free Compressor		
Quantity			1	1	1
Capacity Control			Variable Frequency Drive (VFD) for Linear Capacity Modulation		
Refrigeration			Single Circuit		
Refrigeration Pre-charged			R134a	R1234ze	R134a
GWP			1430	7	1430
Charge (Total)	(5)	kg	83	83	85
CO2 Tonnes Equivalent			118.7	0.581	121.6
Refrigeration Control			Electronic Expansion Valve (EEV)		
Water System - Evaporator			Grooved Type Coupling and Pipe Assembly		
Water Inlet/Outlet			DN100	DN100	DN100
Water Volume		l	108.5	108.5	108.5
Min. System Water Volume		l	1530	1404	1782
Max. System Press		Barg	10	10	10
Flow Rate		l/s	14.2	13	16.5
Pressure Drop		kPa	29.6	25	40
Water System - Condenser			Grooved Type Coupling and Pipe Assembly		
Water Inlet/Outlet			DN100	DN100	DN100
Water Volume		l	93.5	93.5	93.5
Min. System Water Volume		l	1847	1663	2149
Max. System Press		Barg	10	10	10
Flow Rate		l/s	17.1	15.4	19.9
Pressure Drop		kPa	39.4	32.9	51.9

(1) Based on unit performance at 12/7°C evaporator, 100% water and 30/35°C condenser return/supply temperatures
(2) EER = Cooling duty/compressor input power
(3) ESEER based upon operating conditions as defined by the Eurovent Certification Company for water cooled chillers
(4) Nominal dimensions does not include waterside isolation valves external to unit
(5) Charge specified is without economiser option

Technical Data

TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L

Electrical

			TCW11RC1E1-S-0	TCW11RC1E1-G-0	TCW11RC1E1-L-0
Unit Data					
Nominal Run Amps	(1)	A	145	150	210
Maximum Start Amps	(2)	A	2	2	2
Mains Supply		VAC		400V (±10%) 3PH 50Hz	
Rec Mains Fuse Size		A	160	160	250
Max Mains Incoming Cable Size		mm²	70	70	185
Permanent Supply		VAC		230V (±10%) 1PH 50Hz	
Rec Permanent Fuse Size		A	16	16	16
Max Permanent Incoming Cable Size		mm²	6	6	6
Control Circuit		VAC		24V & 230V (±10%)	
Evaporator					
Immersion Heater Rating		W	270	270	270
Condenser					
Immersion Heater Rating		W	270	270	270
Compressor					
Quantity			1	1	1
Motor Rating		kW	87	92	130
Nominal Run Amps	(1)	A	145	150	210
Start Amps	(2)	A	2	2	2
Type Of Start				Electronic Soft Start	

(1) Based on full load conditions.
(2) Starting amps refers to the direct on line connections.

Sound Data

		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall [dBA]
TCW11RC1E1-S	Power	77.5	73.0	73.3	76.1	85.4	83.2	78.2	76.6	88.7
	Pressure @ 10m	45.8	41.3	41.6	44.3	53.6	51.4	46.5	44.8	57.0
TCW11RC1E1-G	Power	61.3	61.3	66.2	78.0	86.9	81.6	80.0	79.3	89.5
	Pressure @ 10m	29.5	29.5	34.4	46.2	55.2	49.9	48.3	47.5	57.8
TCW11RC1E1-L	Power	61.3	61.3	66.2	78.0	86.9	81.6	80.0	79.3	89.5
	Pressure @ 10m	29.5	29.5	34.4	46.2	55.2	49.9	48.3	47.5	57.8

1) dB(A) is the overall sound level, measured on the A scale.
2) All sound data measured at nominal conditions: Water in/out 12/7°C at 30°C ambient.

IMPORTANT ⚠	The Sound Pressure data quoted is only valid in free field conditions, where the unit is installed on a reflective base. If the equipment is placed adjacent to a reflective wall, values may vary to those stated, typically increasing by 3dB for each side added.

Technical Data
Mechanical

TCW11XC1E1-S - TCW11XC1E1-G - TCW11XC1E1-L

			TCW11XC1E1-S	TCW11XC1E1-G	TCW11XC1E1-L
Cooling Duty	(1)	kW	300	275	350
Nominal Input		kW	58.19	48.86	67.4
EER	(2)		5.16	5.63	5.19
ESEER	(3)		7.18	7.85	5.92
Capacity Steps		%	30-100%	30-100%	30-100%
Dimensions (H x W x L)	(4)	mm	2180 x 1300 x 1956	2180 x 1300 x 1956	2180 x 1300 x 1956
Machine Weight		kg	2358	2370	2370
Operating Weight		kg	2559	2572	2572
Construction Material/Colour			Base: Plain Galvanised Steel, Panels: Galvanised Sheet Steel Epoxy Baked Powder Paint, Light Grey (RAL 7035)		
Evaporator - Type			Compact - Shell and Tube		
Insulation			Class O		
Total Max. Water Flow		l/s	23.6	23.6	23.6
Total Min. Water Flow		l/s	1.6	1.6	1.6
Condenser - Type			Compact - Shell and Tube		
Insulation			N/A		
Total Max. Water Flow		l/s	27.7	27.7	27.7
Total Min. Water Flow		l/s	1.6	1.6	1.6
Compressor - Type			TurboCor - Oil Free Compressor		
Quantity			1	1	1
Capacity Control			Variable Frequency Drive (VFD) for Linear Capacity Modulation		
Refrigeration			Single Circuit		
Refrigeration Pre-charged			R134a	R1234ze	R134a
GWP			1430	7	1430
Charge (Total)	(5)	kg	83	83	85
CO2 Tonnes equivalent			118.7	0.581	121.6
Refrigeration Control			Electronic Expansion Valve (EEV)		
Water System - Evaporator			Grooved Type Coupling and Pipe Assembly		
Water Inlet/Outlet			DN100	DN100	DN100
Water Volume		l	108.5	108.5	108.5
Min. System Water Volume		l	1530	1404	1782
Max. System Pressure		Barg	10	10	10
Flow Rate		l/s	14.2	13	16.5
Pressure Drop		kPa	29.6	25	40
Water System - Condenser			Grooved Type Coupling and Pipe Assembly		
Water Inlet/Outlet			DN100	DN100	DN100
Water Volume		l	93.5	93.5	93.5
Min. System Water Volume		l	1847	1663	2149
Max. System Pressure		Barg	10	10	10
Flow Rate		l/s	17.1	15.4	19.9
Pressure Drop		kPa	39.4	32.9	51.9

(1) Based on unit performance at 12/7°C evaporator, 100% water and 30/35°C condenser return/supply temperatures
(2) EER = Cooling duty/compressor input power
(3) ESEER based upon operating conditions as defined by the Eurovent Certification Company for water cooled chillers
(4) Nominal dimensions does not include waterside isolation valves external to unit
(5) Charge specified is without economiser option

Technical Data

TCW11XC1E1-S - TCW11XC1E1-G - TCW11XC1E1-L

Electrical

			TCW11XC1E1-S	TCW11XC1E1-G	TCW11XC1E1-L
Unit Data					
Nominal Run Amps	(1)	A	145	150	210
Maximum Start Amps	(2)	A	2	2	2
Mains Supply		VAC		400V (±10%) 3PH 50Hz	
Rec Mains Fuse Size		A	160	160	250
Max Mains Incoming Cable Size		mm²	70	70	185
Permanent Supply		VAC		230V (±10%) 1PH 50Hz	
Rec Permanent Fuse Size		A	16	16	16
Max Permanent Incoming Cable Size		mm²	6	6	6
Control Circuit		VAC		24V & 230V (±10%)	
Evaporator					
Immersion Heater Rating		W	270	270	270
Condenser					
Immersion Heater Rating		W	270	270	270
Compressor					
Quantity			1	1	1
Motor Rating		kW	87	92	130
Nominal Run Amps	(1)	A	145	150	210
Start Amps	(2)	A	2	2	2
Type Of Start				Electronic Soft Start	

(1) Based on full load conditions.
(2) Starting amps refers to the direct on line connections.

Sound Data

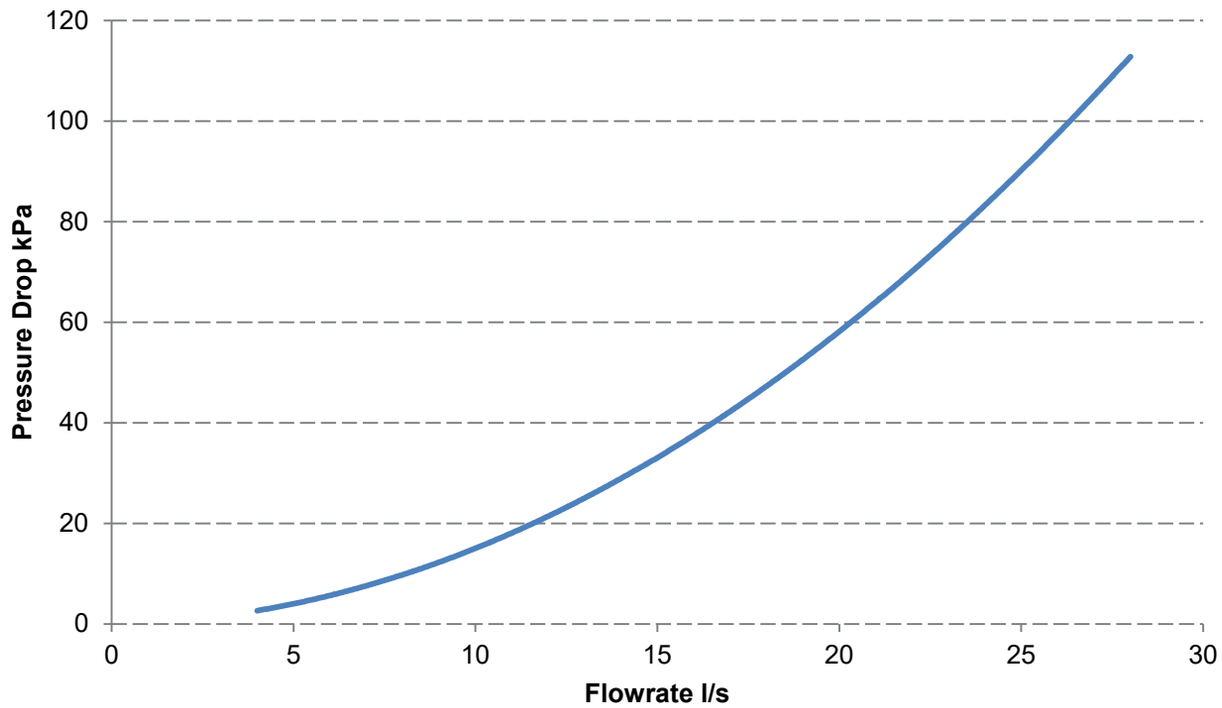
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall [dBA]
TCW11XC1E1-S	Power	69.1	70.4	68.0	68.0	75.7	73.8	63.1	58.2	78.8
	Pressure @ 10m	37.3	38.7	36.2	36.3	44.0	42.1	31.4	26.4	47.0
TCW11XC1E1-G	Power	54.1	58.7	61.0	70.2	78.0	71.0	65.2	60.9	79.5
	Pressure @ 10m	22.4	27.0	29.3	38.5	46.2	39.3	33.5	29.1	47.8
TCW11XC1E1-L	Power	54.1	58.7	61.0	70.2	78.0	71.0	65.2	60.9	79.5
	Pressure @ 10m	22.4	27.0	29.3	38.5	46.2	39.3	33.5	29.1	47.8

1) dB(A) is the overall sound level, measured on the A scale.
2) All sound data measured at nominal conditions: Water in/out 12/7°C at 30°C ambient.

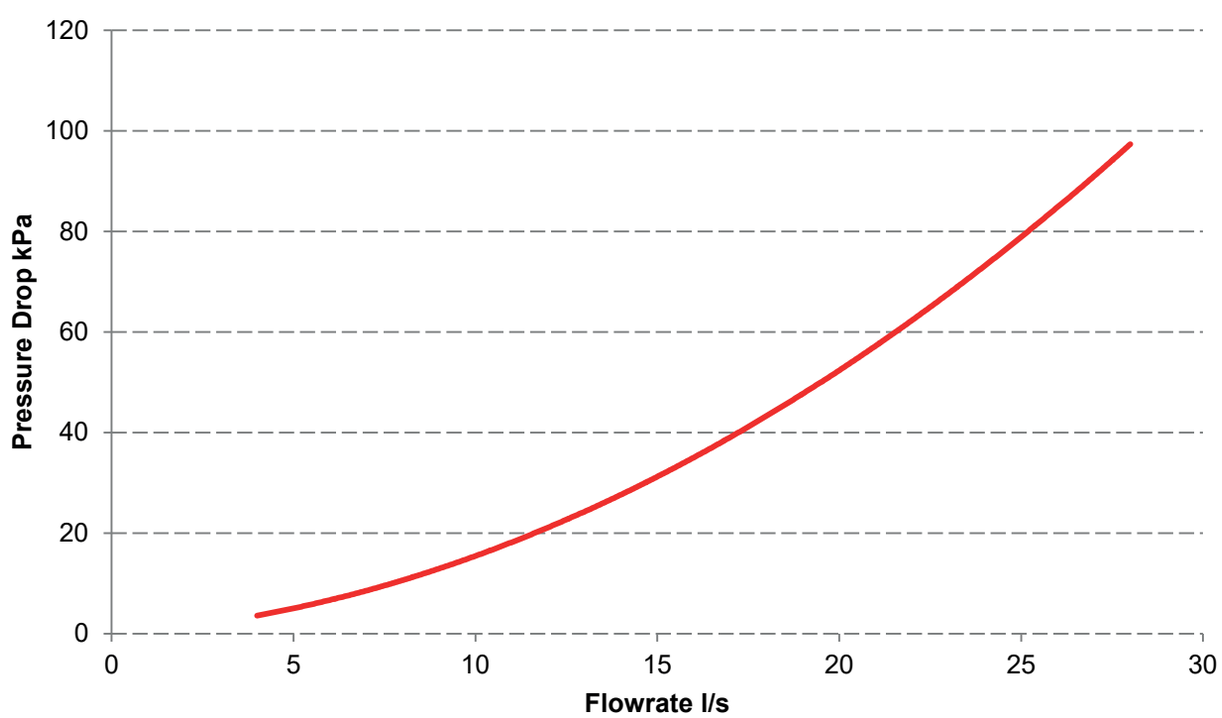
IMPORTANT ⚠	The Sound Pressure data quoted is only valid in free field conditions, where the unit is installed on a reflective base. If the equipment is placed adjacent to a reflective wall, values may vary to those stated, typically increasing by 3dB for each side added.

Waterside Pressure Drop

Evaporator



Condenser



Graphs represent performance at 100% water.

Minimum System Water Volume Calculations

METHOD 1
(Preferred Method)

Where the system permanent heat load is known, the minimum water volume in litres $\mathbf{V}_{min}$ is:

$\mathbf{V}_{min}$ **=** Water Flow Rate (litres/min) x Minimum Compressor Run Time (min) x Chiller Loading Factor (CLF)

Where

Vmin is the minimum water volume in llitres

Minimum Compressor Run Time is 2 minutes

$$\text{Chiller loading factor} = \frac{\text{Minimum Turndown x MHL x 1.2}}{\text{Permanent Heat Load}}$$

Example: 750kW output at 30/35°C Condenser and 7/12°C Evaporator

Permanent Heat Load = 300kW

Minimum Turndown = 7.5% (4 modules)

$$\text{Vmin} = \frac{750 \times 60}{3.9 \times 5} \times 5 \times \frac{0.075 \times 750 \times 1.2}{300} = 2163 \text{ Litre}$$

METHOD 2

Where the system permanent heat load is unknown:

$$\mathbf{V}_{min} = \frac{\text{Water Flow Rate (litres/hour) x Min. Turndown x 1.2}}{\text{Maximum number of Compressor starts (per Hour)}}$$

$$\text{Vmin} = \frac{\frac{kW \times 3600}{CP \times \Delta t} \times \text{Min turndown} \times 1.2}{\text{Maximum number of Compressor starts(per hour)}} = 1038 \text{ Litre}$$

Minimum Turndown

1 Module - 30%
2 Modules - 15%
3 Modules - 10%
4 Modules - 7.5%

Example: 750kW output at 30/35°C Condenser and 7/12°C Evaporator

Minimum Turndown = 0.075 (7.5% 4 modules)

$$\frac{\frac{750 \times 3600}{3.9 \times 5} \times 0.075 \times 1.2}{12} = 1038 \text{ Litre}$$

Technical

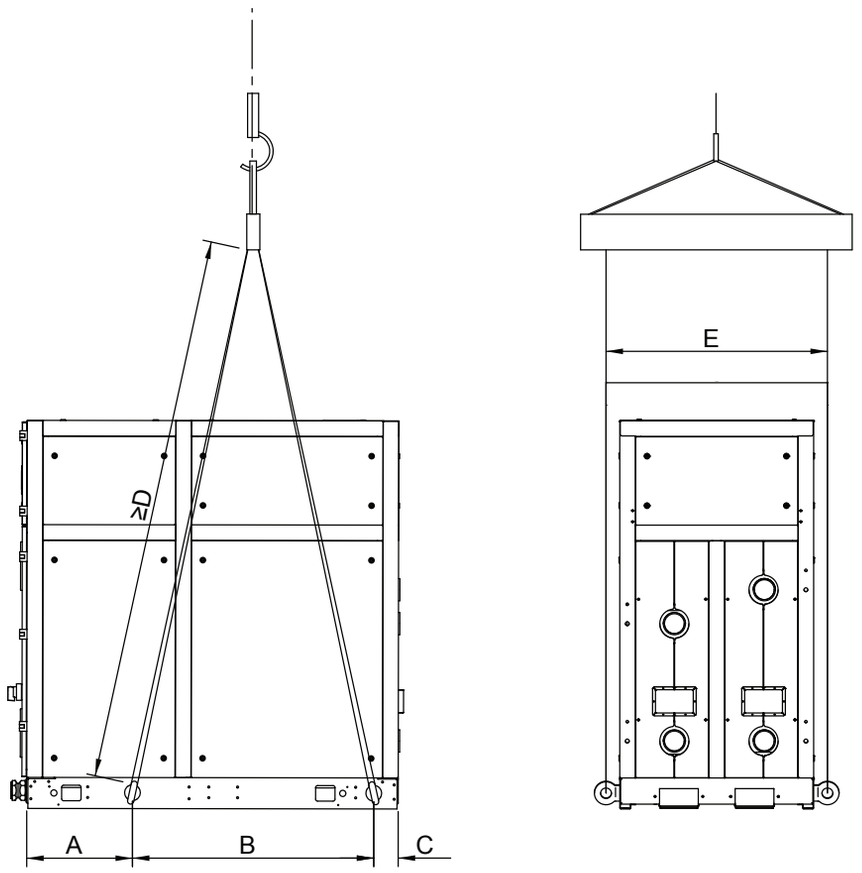
Installation Data

Lifting

- Employ lifting specialists
- Local codes and regulations relating to the lifting of this type of equipment should be observed
- Use the lifting eye bolts provided
- Use the appropriate spreader bars/lifting slings with the holes/lugs provided
- Attach 4 lifting slings to the 4 lifting eye bolts, each chain and eye bolt must be capable of lifting the whole chiller
- Lift the unit slowly and evenly
- If the unit is dropped, it should immediately be checked for damage and reported to Airedale Service

CAUTION ⚠	Only use lifting points provided.

The unit should be lifted from the base and where possible, with all packing and protection in position. If any other type of slinging is used, due care should be taken to ensure that the slings do not crush the casework.

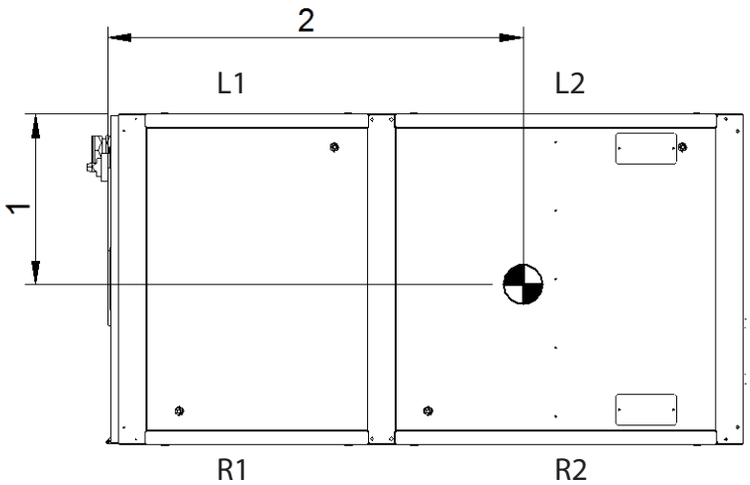


Unit	Eye Bolt Size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
ALL MODELS	35	550	1245	126	3000	1142

CAUTION ⚠	ALL work MUST be carried out by Technically Trained competent personnel. Prior to connecting services, ensure that the equipment is installed and completely level.

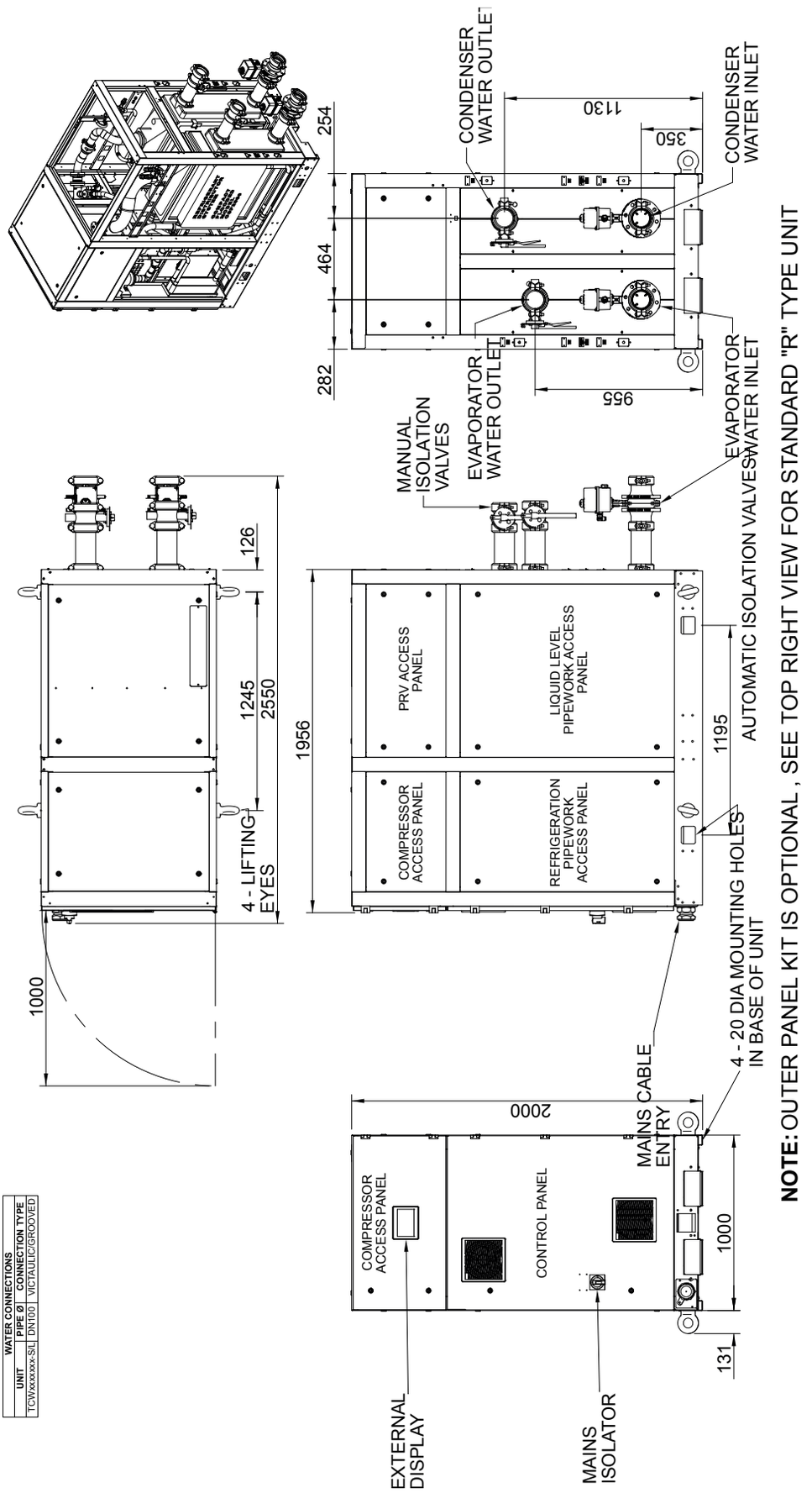
Installation Data

Centre of Gravity



	Lifting Mass	Operating Mass	L1	L2	R1	R2	CoG 1	CoG 2	Lifting CoG	
	kg	kg	P1	P2	P3	P4	mm	mm	x	y
TCW11RC1E1-S	2253	2465	405	815	410	830	505	1225	500	1220
TCW11RC1E1-G	2265	2477	410	820	420	830	505	1220	500	1220
TCW11RC1E1-L	2265	2477	410	820	420	830	505	1220	500	1220
TCW11XC1E1-S	2358	2570	435	840	440	855	505	1215	500	1220
TCW11XC1E1-G	2370	2582	440	845	445	855	505	1215	500	1220
TCW11XC1E1-L	2370	2582	440	845	445	855	505	1215	500	1220

Dimensions



WATER CONNECTIONS		
UNIT	PIPE Ø	CONNECTION TYPE
TCWxxxxxx-SIL	DN100	VICTAULIC/GROOVED

NOTE: OUTER PANEL KIT IS OPTIONAL , SEE TOP RIGHT VIEW FOR STANDARD "R" TYPE UNIT

Module Installation

The compact evaporator and condenser shall be designed for a single refrigeration circuit. The compact design lends itself to a modular application as can be seen below.

Multiple Modules

TCW Module removal/installation

Each module shall be a complete packaged water cooled chiller independent of adjacent modules; multiple modules can be linked together via a common waterside to increase plant capacity as required.

The design shall allow suitable access to major components, if in a multiple module installation sufficient space between each module will be required to access components.

In the event that multiple modules are installed directly next to each other, due to small space claim requirements, each module can be disconnected from the common waterside and withdrawn for maintenance and or replacement with extra long 2m pallet truck wheels suitable for 2.5 tonnes.

Packing

Due to the compact footprint of the modules and movability via pallet trucks, they can fit into a standard series 1 shipping container, for example an ISO 1AAA (40 foot high cube) container shall accommodate 10 off modules (circa 3.7MW total nominal cooling capacity)

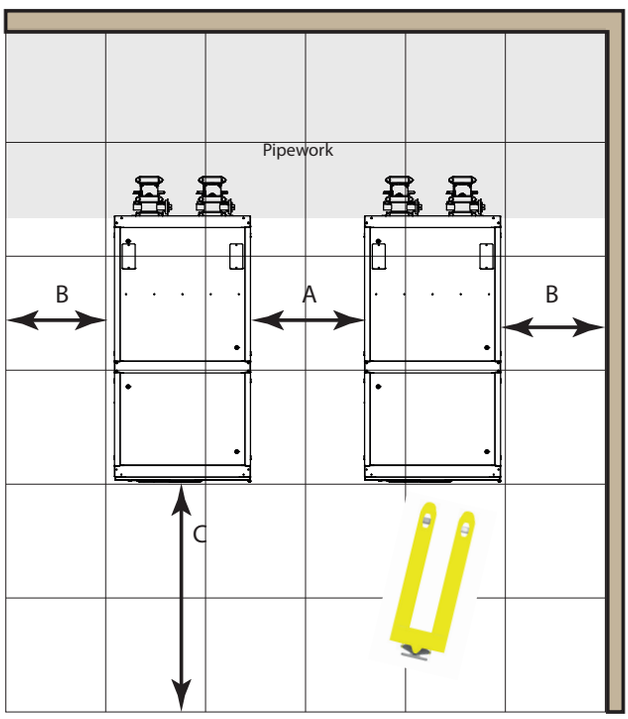
Positioning

The installation position should be selected with the following points in mind:

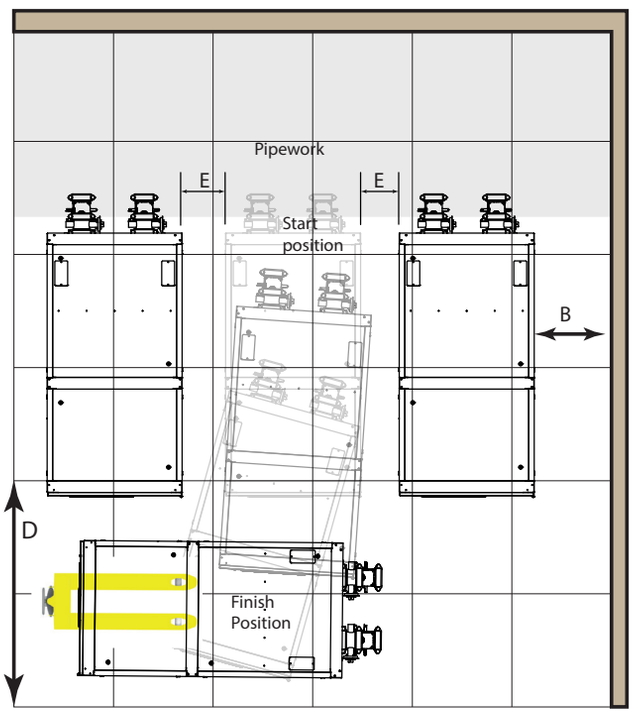
- Position on a stable and even base, levelled to ensure that the compressor operates correctly
- Levelling should be to +/- 5mm
- Observe maintenance clearances
- Pipe work and electrical connections are readily accessible
- Increase maintenance clearances for side-enclosed or multiple unit applications
- Increase space for maintenance with pallet truck wheels with the base suitable for truck movement.

Clearance

Should the chiller be installed standalone/unable to move the unit, provison must be made for maintenance around the chiller. The following minimum clearance is required:



Units unable to move



Moveable

A - Clearance between units - 800mm

B - Clearance between unit and external walls - 800mm

C - Clearance for chiller - 2000mm

D - Clearance for chiller maneuverability - 3000mm

E - 50mm

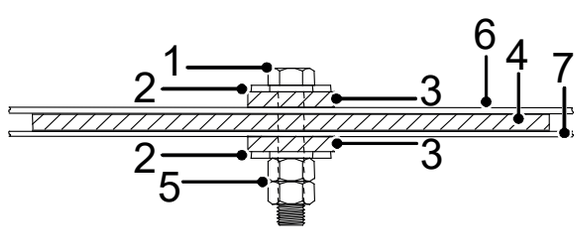
Provision of 500mm is recommended above the unit for maintenance purposes.

Anti Vibration Mounting Pad Type

Pad Type

Components/Installation

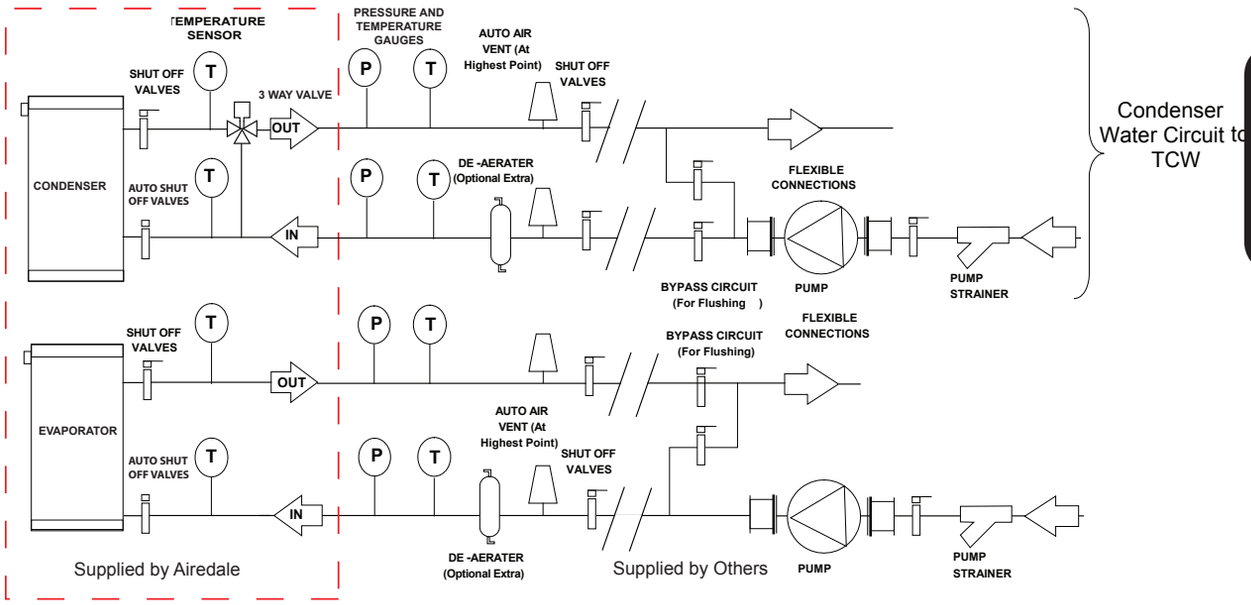
1. M16 Bolt (Not Supplied)
2. Washer (Not Supplied)
3. Fixing Pad 6173231
4. Anti Vibration Pad 6173223
5. 2 x M16 Nut (Not Supplied)
6. Unit Base
7. Unit Mounting Plinth



IMPORTANT ⚠	If the unit is mounted on a plinth, suitable fixings must be used.

Standard Recommended Pipework Installation

CAUTION ⚠	The following installation recommendations should be adhered to. Failure to do so may invalidate the chiller warranty. Parts are supplied by others with the exception of the three way head pressure control valve.



Condenser Head Pressure Control

To ensure correct operation of the chiller a 3-way mixing valve shall be installed on the condenser supply water leg. The aim is to maintain the design head pressure setpoint throughout the operation of the chiller at various loading stages and ambient conditions.

For example the 3-way bypass valve on a chiller running at minimum load in a low ambient condition would be expected to be bypassing a portion of the flow to increase head pressure on the refrigerant circuit.

The 3-way bypass valve should be commissioned at part load initially to ensure correct operation.

CAUTION ⚠	Full design water flow MUST be maintained at all times for the evaporator only. Variable water volume is NOT recommended and will invalidate waranty. The correct operation of the flow proving device is critical if the chiller warranty is to be valid.

The following components are fitted within the chiller unit as standard:

- Temperature sensors
- Drain point
- Auto air vent

Pressure Relief Valve Discharge Piping

Considerations must be made when designing pipework for PRV venting. This must be designed in accordance to EN378-3 Section 5.8 Piping and ducting.

Caution must be taken to ensure excessive pressure drop in the pipework is avoided.

- All piping and ventilation ducting which passes through walls, ceilings and floors of machinery rooms, shall be sealed where it passes through the walls or floors. The sealing shall have fire resisting properties at least equivalent to the wall, ceiling or floor.
- Discharge pipes from relief valves, safety valves and fusible plugs may diffuse the charge into the air by adequate means but away from any air intake to the building or discharge into an adequate quantity of a suitable absorbing material.
- Relief devices for refrigerant in group A1 (R134a refrigerant) may discharge into the machinery room provided the system charge is less that the limit set in Annex C of prEN378-1:2013. Such discharges of refrigerant should take place so that persons and property are not endangered.

Head Pressure Control Valve Assembly

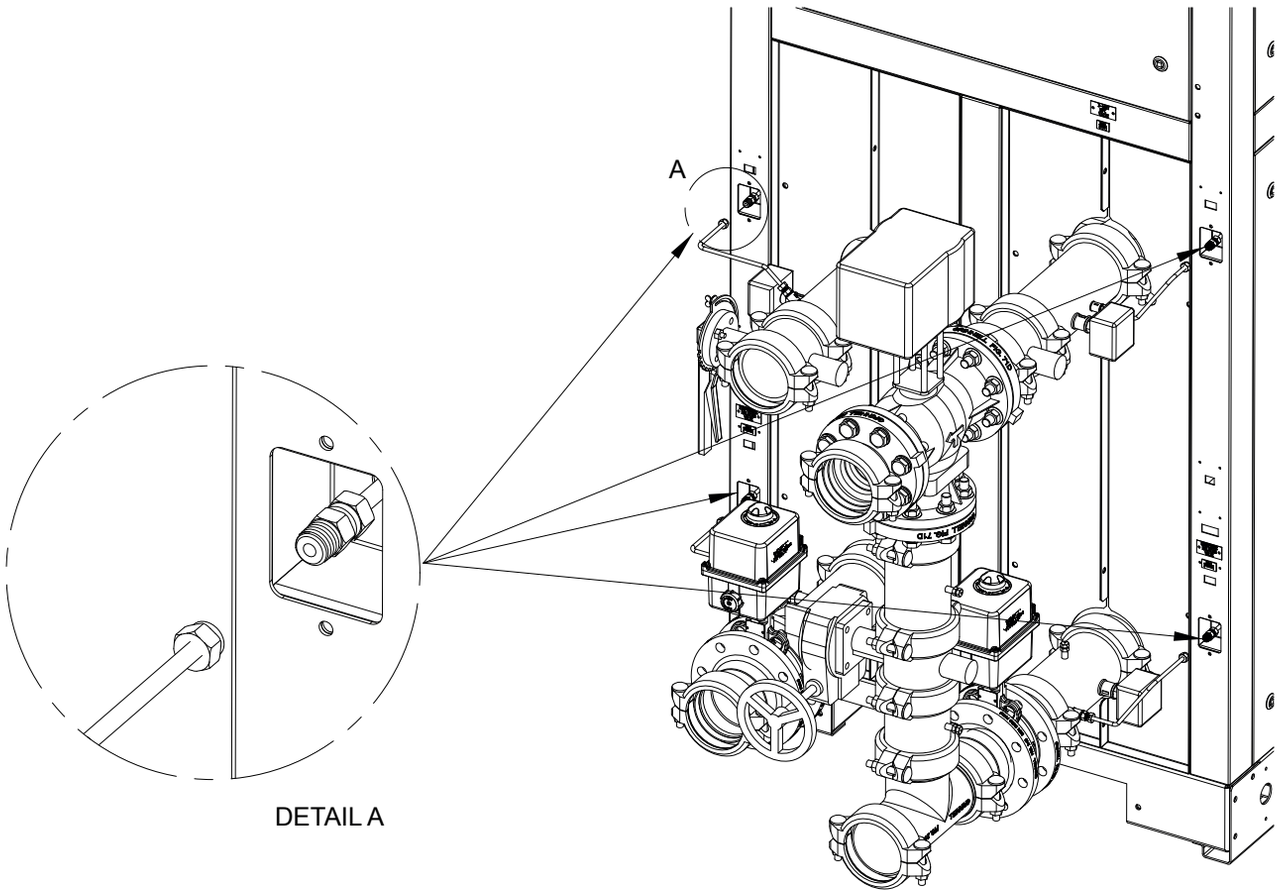
The head pressure control valve shall be available with three sizes: DN65, DN80 or DN100, dependent on pressure drop.

The parts supplied with the Head Pressure Control Valve Assembly include:

- Head Pressure Control Valve
- Manual Shut Off Valve
- Automatic Shut Off Valve (if selected)
- Bypass Valve (if selected)
- Temperature S

DN65 Head Pressure Control Valve Clamp

Differential Pressure Connections



IMPORTANT ⚠	The 1/4” BSP Male connection to the water pipework shall be connected through the bulkhead of the unit. Trace heating must be applied to protect against freezing.

Water System

Component Recommended Requirements

The recommended requirements to allow commissioning to be carried out correctly are:

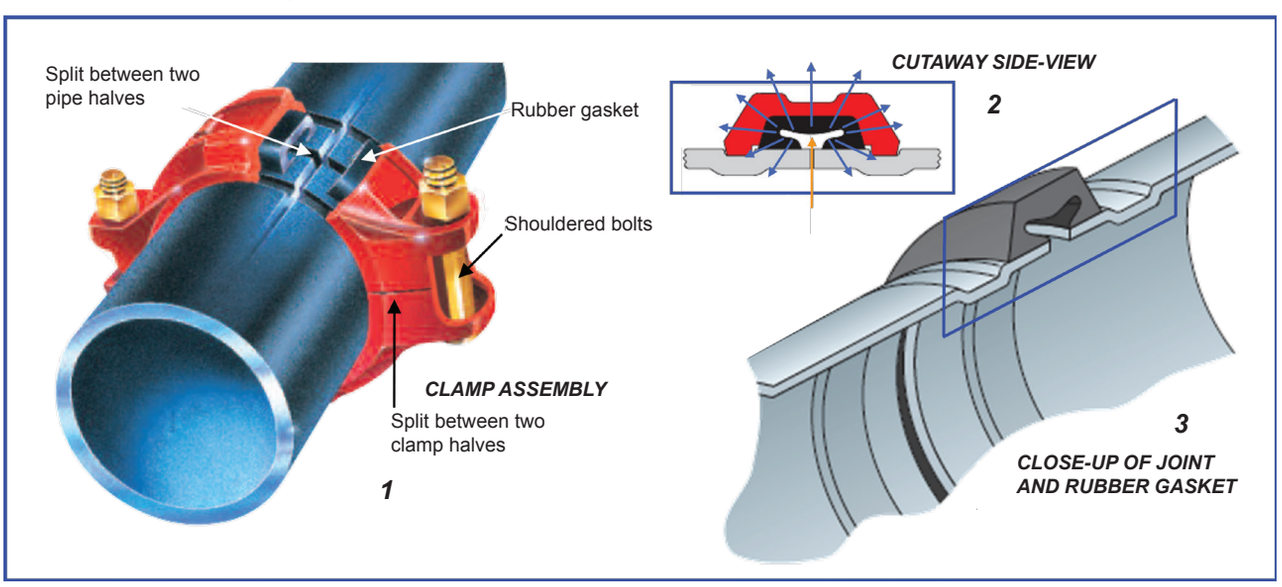
- The inclusion of binder points adjacent to the flow and return connections, to allow temperature and pressure readings
- A differential pressure sensor or equivalent, fitted adjacent to the water outlet side of the unit
- A 20 mesh strainer fitted prior to the evaporator inlet
- A water-flow commissioning valve set fitted to the system
- In multiple chiller installations, 1 commissioning valve set is required per chiller
- Isolating valves should be installed adjacent to all major items of equipment for ease of maintenance
- Balancing valves can be installed if required to aid correct system balancing
- All chilled water pipework must be insulated and vapour sealed to avoid condensation
- If several units are installed in parallel adjacent to each other, reverse return should be applied to avoid unnecessary balancing valves

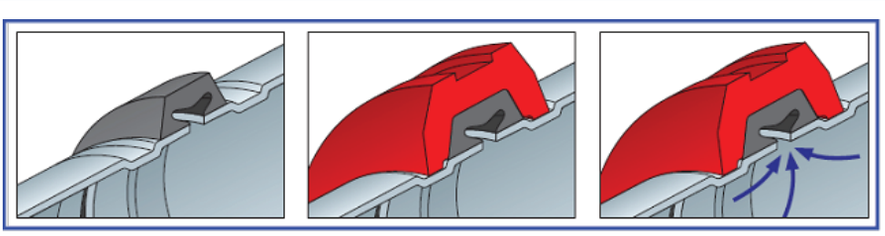
Chilled water pipework and ancillary components must be installed in accordance with:

- National and local water supply company standards
- The manufacturer's instructions are followed when fitting ancillary components
- The system liquid is treated to prevent corrosion and algae forming
- In ambients of 0°C and below, where static water can be expected, or when water supply temperatures of +5°C or below is required, the necessary concentration of Glycol or use of an electrical trace heater must be included
- The schematic is referred to as a guide to ancillary recommendations

CAUTION ⚠	The unit water connections are NOT designed to support external pipework, pipework MUST be supported separately. Pipes are fully isolated from supports helping to prevent electrolytic corrosion. Units may be moved periodically for maintenance requirements.

Grooved & Clamped Type Connection





Pump Statement

When installing circulating water pumps or equipment containing them, the following rules should be applied:

- Ensure the system is filled with liquid then vented and the pump primed with water before running the pump, this is required because the pumped liquid cools the pump bearings and mechanical seal faces
- To avoid cavitation the NPSH (Net Positive Suction Head) incorporating a safety margin of 0.5Barg must be available at the pump inlet during operation

Interlocks & Protection

Always electrically interlock the operation of the chiller with the pump controls and flow proving device for safety reasons.

CAUTION ⚠	Failure to install safety devices will invalidate the chiller warranty.

Maximum System Operating Pressure

The system can safely operate at a maximum of 10bar.

CAUTION ⚠	Although a pressure of 1.5 x working pressure is adequate for testing purposes, most local water authorities require 2 x working pressure.

Filling

CAUTION ⚠	The whole system MUST be flushed prior to filling to remove debris left in the water pipework, by using a flushing bypass as shown to avoid serious damage to the evaporator and condenser.

- During filling the system should be vented at all high points.
- Once the system has been completely vented all vents should be closed.
- To prevent air locking in the system it is advisable to fill the systems from the lowest point, ie drain point on pipework.
- If auto air vents are used then we strongly recommend an auto pressurisation unit be fitted to the system.
- Considerations must be made for glycol of the correct concentration to ensure the cooling medium is not diluted.

Electrical

IMPORTANT ⚠	• Please refer to the electrical wiring diagrams provided for installation. • ALL work MUST be carried out by technically trained competent personnel. • The equipment contains live electrical and moving parts, ISOLATE prior to maintenance or repair work. • The unit isolators DO NOT isolate the incoming mains supply, but isolate the individual electrical circuits. Isolate REMOTELY the mains incoming supply prior to maintenance or repair work. • Ensure electrical lock off procedures are conducted.

As standard the equipment is designed for 400V, 3 phase, 3 wire 50Hz and a separate permanent 230V, 1 phase, 50Hz supply, to all relevant IEE regulations, British standards and IEC requirements.
The control voltage to the interlocks is 24V, always size the low voltage interlock and protection cabling for a maximum voltage drop of 2 volts.
A fused and isolated electrical supply of the appropriate phase, frequency and voltage should be installed.
Wires should be capable of carrying the maximum load current under non-fault conditions at the stipulated voltage.
Ensure correct phase rotation.

CAUTION ⚠	A separately fused, locally isolated, permanent single phase and neutral supply is required for the evaporator trace heating and control circuit.

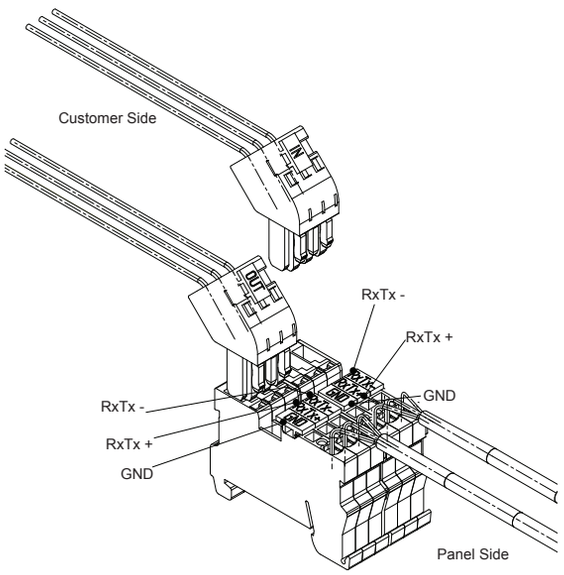
Interconnecting Wiring

	L1	○	←	Mains Incoming Supply 400V / 3~ / 50Hz
	L2	○	←	
	L3	○	←	
	PE	○	←	
	L4	○	←	Separate Permanent Supply 230V / 1~ / 50Hz
	N	○	←	
	PE	○	←	
	502	○	→	(1) Evaporator Flow Switch
	506	○	←	
	502	○	→	(1) Condenser Flow Switch
	513	○	←	
	502	○	→	Unit Remote On/Off
	507	○	←	
	502	○	→	(1) Remote Pump Interlock
	508	○	←	
	502	○	→	Setback Setpoint Temperature Switch
	510	○	←	
	808	○	←	Remote Setpoint Adjust
	500	○	→	
	560	○	→	Volt Free Alarm N/O
	561	○	←	Volt Free Common Alarm
	562	○	→	Volt Free Alarm N/C
	580	○	→	Volt Free Alarm N/O
	581	○	←	Volt Free Common Alarm
	582	○	→	Volt Free Alarm N/C
	Rx/Tx+	○	←	pLAN Network Connection (In)
	Rx/Tx-	○	←	
	GND	○	←	
	Rx/Tx+	○	→	pLAN Network Connection (Out)
	Rx/Tx-	○	→	
	GND	○	→	
	891	○	↔	Wired BMS connection (ModBUS, BACNet, LON, RS485)
	892	○	↔	
	893	○	↔	
	N/A	○	↔	BMS Network Connections (pCOWEB Ethernet)

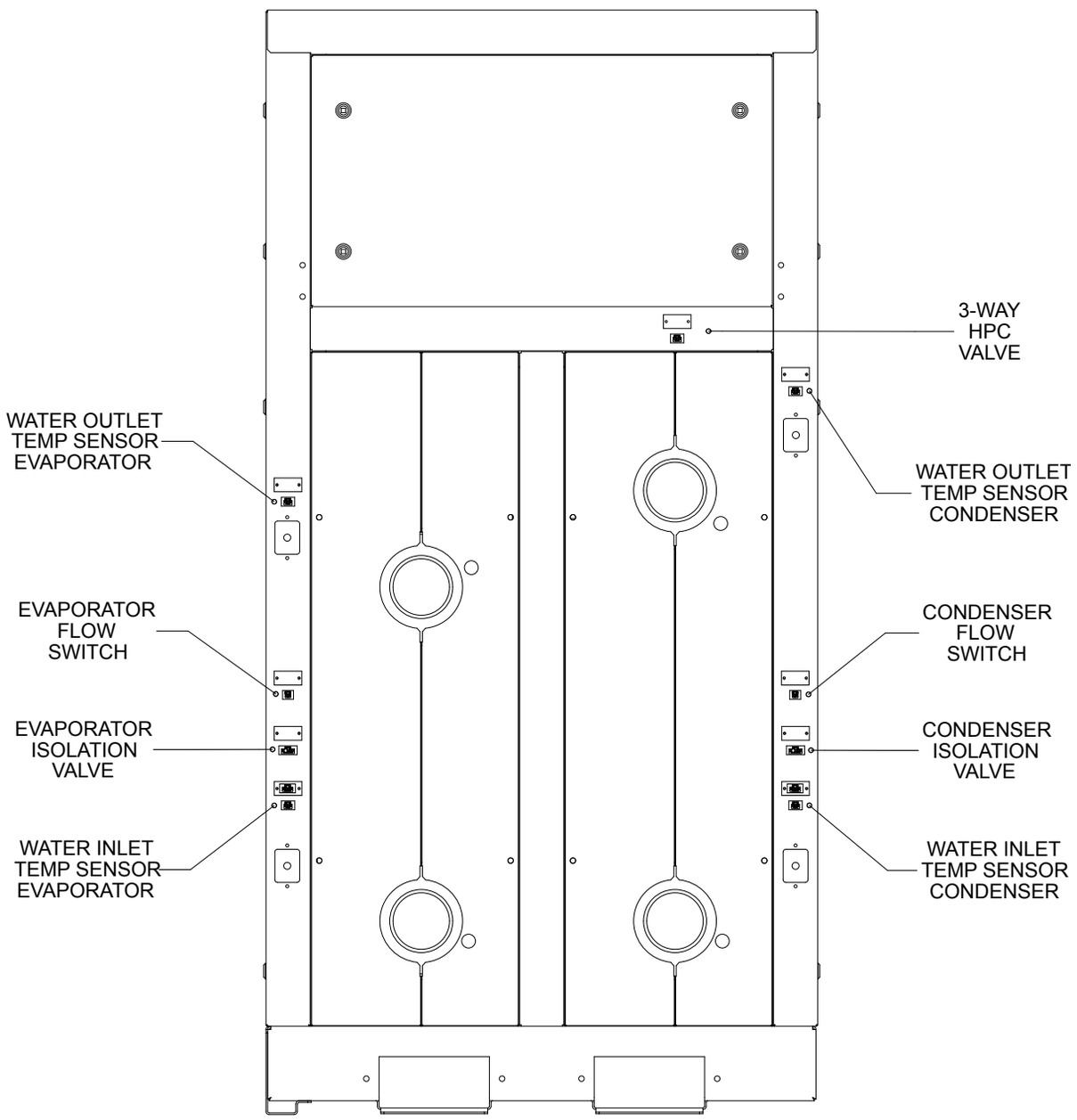
CAUTION ⚠	(1) MUST be directly wired to the chiller to validate warranty.

pLAN Termination

⚠ The plugged termination ensures that the connections are made simultaniously. Failure to attached the cables this this way may cause damage to the controller.



Sensor Connections



Power Quality & Harmonics

Variable speed drives are now common place due to their efficiency and versatility. Not ignoring these facts, care must be taken when installing VSD technology into new and existing installations. This is due to the effect the introduction of such technology may have on line harmonics of a buildings electrical system. VSDs by their nature cause distortion of the AC line by drawing current in pulses, rather than continuously from the supply resulting in harmonic generation. The useful power to a motor is that obtained from the fundamental frequency of 50Hz. The additional currents at the higher frequencies are not useful to the appliance and are therefore transmitted back onto the line.

Examples of other non-linear loads that cause harmonics are:-

Single phase loads, e.g.

- Switched mode power supplies
- Personal computers
- HF fluorescent ballasts
- Compact fluorescent lamps

Three phase loads, e.g.

- Variable frequency drives
- Inverters
- Large UPS systems

The distortion of the line caused by harmonics can cause the following associated issues:-

- Erroneous operation of control systems
- Nuisance tripping of circuit breakers
- Overloading of transformers
- Overloading of capacitors
- Overvoltage problems
- Excessive currents in neutral conductor

The 3rd, 5th, 7th and 9th harmonics are considered to be the predominant frequencies produced by non-linear loads. To minimize the harmonic effect, each Turbocor compressor is fitted with a 5% line reactor to help reduce the harmonics and improve the displacement power factor above 0.95(1). However, to further reduce the effects and to help meet limits for engineering recommendation (ER) G5/4, the following guidelines can be followed.

Current Harmonics

Harmonic currents contribute to system losses. Mitigation measures can be implemented in the following ways:

a) Install passive/active harmonic filters.
b) Install the unit as far from the source transformer as possible.

Voltage Harmonics

Harmonic voltage distortion causes disturbance to other loads and increases losses in them. Methods for harmonic voltage reduction can be achieved in the following ways:

a) Increase the size of the supply transformer.
b) Connect the unit to a point with a high fault level (low impedance).
c) Keep the unit as far from the point of common coupling (PCC) as possible.

Engineering Recommendation G5/4

It is important to understand that G5/4 is effectively an “Installation Standard” and applies to the total harmonic generating equipment installed by a consumer. G5/4 identifies consumers by their PCC to the supply and applies limits at that point. G5/4 is not a product or equipment standard and therefore no single item of equipment can be said to comply.

Note: (1) Based at full load conditions.

Commissioning

To be read in conjunction with the commissioning sheets provided.

CAUTION ⚠	Please ensure all documents have been completed correctly and return to Airedale Technical Support immediately to validate warranty.

Pre Commissioning Checklist

CAUTION ⚠	ALL work MUST be carried out by technically trained competent personnel.

The equipment contains live electrical and moving parts, ISOLATE prior to maintenance or repair work.
The door interlocking MCCB should be in the OFF position and the auxiliary alarm contact from the MCCB should be linked out.
Check all pipework is complete and insulated where necessary.

IMPORTANT ⚠	Check phase rotation of electrical supply prior to running compressor as compressor is direction sensitive.

Refrigerant Standing Pressure

The refrigerant charge is to be checked to ensure correct charge. This is done by measuring the liquid line standing pressure and temperature. This can then be compared to refrigerant data tables or Refrigerant Comparator.
Standing pressures can only be measured in the liquid state.

Commissioning Procedure

Ensure that the water filter is fitted and clean.

Water Flow Rate

Check that the design water flowrate is available to the unit.

Waterside Pressure Drop

Measure the waterside pressure drop of the unit ensuring that the pump (if fitted) is operating.

Glycol Strength

Check and record the glycol type and strength. Low levels of glycol can cause freeze up problems when operating at low temperatures or during the unit off state during cold ambient conditions.
Glycol concentration is measured by use of a Refractometer.

Differential Pressure Sensor

Ensure that the differential pressure sensor operates satisfactorily; the best way to do this is to:

- Reduce the flow to the chiller.
- From pressure curves determine the design Flowrate/ pressure drop.
- Make sure that any effects of glycol in the system are taken into account (flowrate and pressure drop).
- Input into the controller the reduced pressure drop (kPa) value (normally 80% of design flowrate).
- Once this value is programmed into the controller the water Flowrate can be reduced to verify that the low flow alarm is activated.
- Ensure that the tubes connected to the sensor are insulated.

Low Supply Water Trip

To check operation of the low temperature trip the following procedure can be carried out:

- With the unit running increase the low temperature limit to the actual supply water temperature - this will trip the unit in a safe manner without risk of freezing the evaporator.
- Return the low temperature limit to correct value after test (this will allow the unit to operate correctly).

Pump Interlock

The pump interlock is fitted and functioning correctly.

Controls

Controller

Record on the commissioning sheet the controller serial numbers details.

- Controller type
- Address
- Serial number
- Bios
- Boot

Also record any expansion valve driver serial numbers.

Controller Settings

The following controller settings are to be recorded on the commissioning sheet.

- Head pressure differential (Barg)
- Minimum suction pressure (Barg)
- Supply water set point (summer/day) (°C)
- Supply water set point (winter/night) (°C)
- Minimum supply water temperature (°C)

Refrigeration

Compressor

Record on the commissioning sheet compressor details

- Type
- Serial numbers
- Overload settings

Operating Conditions

Record the following operating conditions of the unit at stable conditions:

- Suction pressure (Bar)
- Liquid pressure (Bar)
- Discharge pressure (Bar)
- Suction temperature (°C)
- Liquid temperature (°C)
- Discharge temperature (°C)
- Superheat (K)
- Sub cooling (K)
- Evaporator water return temperature (°C)
- Evaporator water supply temperature (°C)
- Condenser water return temperature (°C)
- Condenser water supply temperature (°C)

The supply and return water temperatures should be taken and recorded in both full and part load conditions approximately 1m away from the unit.

Liquid Line Sight Glass

Record the status of the liquid line sight glass

- Clear/flashing
- Wet/dry (yellow or green)

HP/LP Trips

Check operating of HP/LP cut-out, settings
LP cut-out – (Auto reset for 3 times when the low pressure is detected for 6 minutes)
Low pressure cut-out – R134a 0.5 bar (7 psig)
R1234ze(E) 1.0 bar (14.5 psig) Differential 2.0bar (29 psig)
HP switch – (auto reset): High pressure switch – 12.5 bar (181 psig)
Differential 2.0 bar (29 psig)
HP limiting function 13.6 bar

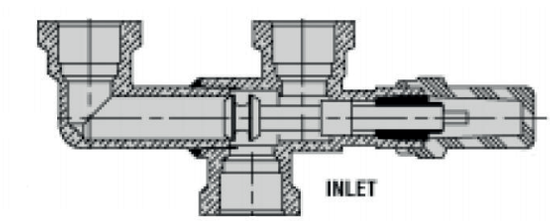
Maintenance

CAUTION ⚠	The equipment contains live electrical and moving parts, ISOLATE prior to maintenance or repair work. ALL work MUST be carried out by technically trained competent personnel. Ensure electrical lock off procedures are conducted.

Pressure Relief Valve

In line with EN 378, Airedale recommends that the valve be replaced at least every 5 years. These intervals may have to be reduced if other regulations apply. The pressure relief is fitted to the unit by a three way dual shut off valve.
This valve enables the pressure relief to be changed without the need for refrigerant recovery.

To change a pressure relief valve, back seat or forward seat the valve to seal the required port that is being changed.
Do not forget to set the valve into the centre to check that the valve does not leak refrigerant.
Then select one of the pressure relief valves and open that port.
Take extreme care that the correct port is selected.



CAUTION ⚠	Put the cap on the three way valve. Perform an F-Gas inspection.

Shut Down Periods

For periods of winter shut down the following precautions are recommended:

- Close the liquid and discharge ball valve
- Cap service ports
- Drain the water from the unit

Maintenance

Check the following against commissioning records. Investigate and adjust as necessary.

	Task	Frequency		
		3 months	12 months	60 months
System	Check the following against commissioning records:			
	Alarm log for unusual occurrences	●		
	Chilled water control maintains design termperatures	●		
	Chilled water flow is within design limits of zero plus 10%	●		
	Concurrently ensure chilled water pump and flow switch operate efficiently, and that interlocks function correctly	●		
	Operation of water flow switch and pump interlock	●		
	Check pressure drop of evaporator/condenser. Clean where appropriate.	●		
	Check glycol concentration if appropriate. Adjust as necessary.		●	
	Clean evaporator water strainer.		●	
	Leak test all refrigerant joints and visually inspect pipe and pipework insulation.	●		
	Inspect all water connections for any leaks.		●	
	Pipe work clamps are secure.		●	
Refrigeration	System pressure readings, suction, liquid and discharge	●		
	System temperature readings, suction, liquid and discharge	●		
	Head pressure control is maintained	●		
	Liquid level control	●		
	Check each circuit sight glass for dryness and bubbles for indication of leaks	●		
	Pressure relief valves	●		
	F-Gas inspection	●		

Maintenance

Check the following against commissioning records. Investigate and adjust as necessary.

	Task	Frequency 3 months	12 months	36 months	60 months
Compressor Maintenance	Visually check the following:				
	Secure/tighten as necessary		●		
	Tightness and condition of compressor mounts		●		
	Anti-vibration mounts fixings (if fitted)		●		
	Check operation of discharge non return valve		●		
	For further information refer to compressor manual which is available from Airedale on request or the TurboCor website.				
Controls	Change the compressor capacitor				●
	Change the controller battery (may be more frequent dependant on usage)			●	
Electrical	Check mains power supply voltage		●		
	Check that electrical terminals are tight (tighten as needed)		●		
	Check for signs of discolouration on power cables		●		
	Check amperage are as per design		●		
	Record on maintenance records.				

Troubleshooting

FAULT	POSSIBLE CAUSE	REMEDY/ACTION
Unit will not start	No power.	Check power supply to the controller.
	Wired incorrectly.	Check wire connections in accordance with wiring diagram.
	Loose wires.	Check all wires, connections, terminals etc.
	Remote on/off.	Check that the remote on/off is at the on position.
Compressor not operating	No power to compressor.	Check isolator, fuses, MCBs, contactor and control circuit wiring.
	Low pressure cut-out operated (large or complete loss of refrigerant charge).	Recover refrigerant, repair, pressure test, evacuate and recharge system.
	Compressor showing fault on controller.	Determine fault, refer to alarm codes for further information.
Head Pressure too high/HP cut-out operated	Condenser clogged or dirty.	Clean condenser.
	Overcharge of refrigerant. Normally troublesome in warm weather.	Remove excess refrigerant from system using correct refrigerant handling techniques.
	Air or other non-condensable gas in system.	Evacuate system and re-charge with new refrigerant.
	Head pressure controller faulty.	Check EC fan control module - if faulty - replace.
Head pressure too low	Water temperature too low.	Check condenser temperature setpoint
Suction Pressure too low	Flash gas (bubbles in sight glass) at liquid line.	Investigate for refrigerant leaks, repair, pressure test, evacuate and re-charge system.
	Clogged filter drier (pressure/ temperature drop across it).	Replace drier cores.
No water flow	Strainer blocked.	Clean strainer
Unit not operating due to water pressure sensor low limit alarm.	Low flow alarm operating.	Check that the low flow pressure variable is set correctly. If too high the unit may have nuisance trips.
Low temp limit alarm	Partial blockage in evaporator causing low flow. The water flow is reduced however the differential pressure switch still remains healthy as the pressure would increase.	
Water/Glycol freezing up (crystallizes)	Insufficient glycol/water concentration for operating temperatures.	Check glycol concentration and add accordingly.

Troubleshooting

Storage Recommendations

Airedale recommends that equipment should be stored in an ambient protected warehouse facility. The unit should be stored within a heated warehouse ensuring that the temperature does not fall below 0°C. All water should be drained from the evaporator and condenser. Ensure refrigerant line shut off valves are closed.

Before turning the unit on after extended periods of storage the following checks/procedures must be carried out over and above any commissioning checks:

Any low temperature protection devices must be turned on for a minimum of 8 hour.

These include:

- Panel heaters
- Electric trace heating

Checks must be carried out for the operation of unit components

Waterside

- Check 3 way valve operates correctly
- Check that flow switches operate correctly
- Check that differential pressure sensor operates

Electrical

- Check electrical seals and glands are satisfactory and have not cracked
- Check all electrical terminal boxes are free from moisture
- Check all cable insulation is satisfactory and does not have any signs of damage

Refrigeration

- Ensure all valves are open
- Carry out an F-gas inspection ensuring no refrigerant leaks

After Sales

Warranty

All Airedale products or parts (non consumable) supplied for installation within the UK mainland and commissioned by an Airedale engineer, carry a full Parts & Labour warranty for a period of 12 months from the date of commissioning or 18 months from the date of despatch, whichever is the sooner.

Parts or Equipment supplied by Airedale for installation within the UK or for Export that are properly commissioned in accordance with Airedale standards and specification, not commissioned by an Airedale engineer; carry a 12 month warranty on non consumable Parts only from the date of commissioning or 18 months from the date of despatch, whichever is the sooner.

Parts or equipment installed or commissioned not to acceptable Airedale standards or specification invalidate all warranty.

Warranty is only valid in the event that

In the period between delivery and commissioning the equipment:

- is properly protected & serviced as per the Airedale installation & maintenance manual provided
- where applicable the glycol content is maintained to the correct level.

In the event of a problem being reported and once warranty is confirmed* as valid under the given installation and operating conditions, the Company will provide the appropriate warranty coverage (as detailed above) attributable to the rectification of any affected Airedale equipment supplied (excluding costs for any specialist access or lifting equipment that must be ordered by the customer).

*Once warranty is confirmed, maintenance must be continued to validate the warranty period.

Any spare part supplied by Airedale under warranty shall be warranted for the unexpired period of the warranty or 3 months from delivery, whichever period is the longer. To be read in conjunction with the Airedale Conditions of Sale - Warranty and Warranty Procedure, available upon request.

Procedure

When a component part fails, a replacement part should be obtained through our Spares department. If the part is considered to be under warranty, the following details are required to process this requirement. Full description of part required, including Airedale's part number, if known. The original equipment serial number. An appropriate purchase order number.

A spares order will be raised under our warranty system and the replacement part will be despatched, usually within 24 hours should they be in stock. When replaced, the faulty part must be returned to Airedale with a suitably completed and securely attached "Faulty Component Return" (FCR) tag. FCR tags are available from Airedale and supplied with each Warranty order.

On receipt of the faulty part, suitably tagged, Airedale will pass to its Warranty department, where it will be fully inspected and tested in order to identify the reason for failure, identifying at the same time whether warranty is justified or not.

On completion of the investigation of the returned part, a full "Report on Goods Returned" will be issued. On occasion the release of this complete report may be delayed as component manufacturers become involved in the investigation. When warranty is allowed, a credit against the Warranty invoice will be raised. Should warranty be refused the Warranty invoice becomes payable on normal terms.

Exclusions

Warranty may be refused for the following reasons.

- Misapplication of product or component
- Incorrect site installation
- Incomplete commissioning documentation
- Inadequate site installation
- Inadequate site maintenance
- Damage caused by mishandling
- Replaced part being returned damaged without explanation
- Unnecessary delays incurred in return of defective component

Returns analysis

All faulty components returned under warranty are analysed on a monthly basis as a means of verifying component and product reliability as well as supplier performance. It is important that all component failures are reported correctly.

Appendix - Ecodesign

The following tables of Ecodesign data is based on the following common information:

SEPR (Seasonal Energy Performance Ratio)

- Type of Condensing - Water Cooled.
- Refrigerant Fluid - R134a / R1234ze.
- Operating Temperature - +7°C (Outlet water).
- Operating Control - Variable.
- Outdoor Side Heat Exchanger - Water
- Indoor Heat Exchanger - Water.
- Type Driven - Vapour Compression.
- Driver of Compressor - Electric Motor.
- Degradation Coefficient - 0.9

Part load conditions for SEPR calculation for air cooled high temperature process chillers

Rating Point	Part load ratio (%)	Outdoor side heat exchanger	Indoor side heat exchanger
		Inlet air temperature (°C)	Evaporator inlet/ outlet water temperatures (°C)
			Fixed outlet
A	100	35	12/7
B	93	25	(*)/7
C	87	15	(*)/7
D	80	5	(*)/7

EU 2016/2281 Table 22.

(*) With the water flow rate determined during “A” test for units with a fixed water flow rate or with a variable flow rate.

SSCEE (Seasonal Space Cooling Energy Efficiency)

- Capacity Control - Variable.
- Standard Rating Condition - Low Temperature Operation.

Air to water comfort chillers

Rating Point	T_1 (°C)	Part load ratio (%)	Outdoor air dry bulb temperature (°C)	Fan coil application inlet/ outlet water temperature (°C)		Cooling floor application inlet/ outlet water temperatures (°C)
				Fixed outlet	Variable outlet (*)(*)	
A	35	100 %	35	12/7	12/7	23/18
B	30	74 %	30	(*)/7	(*)/8.5	(*)/18
C	25	47 %	25	(*)/7	(*)/10	(*)/18
D	20	21 %	20	(*)/7	(*)/11.5	(*)/18

EU 2016/2281 Table 21.

Technical Data

TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L

Ecodesign

	Notes:	Units	TCW11RC1E1-S	TCW11RC1E1-G	TCW11RC1E1-L
SEPR	1,3,5		9.23	9.31	8.72
SEPR Tier			Tier 2 (2021)	Tier 2 (2021)	Tier 2 (2021)
Annual Electricity Consumption		kWh/a	240181	218317	296247
Rated Refrigerant Capacity P_A	1,3,5	kW	299.1	274.3	348.8
Rated Power Input D_A		kW	60.2	50.5	70.3
Rated $EER_{DC,A}$			4.97	5.43	4.96
Declared Refrigerant Capacity P_B	1,3,5	kW	279.1	256.0	325.5
Declared Power Input D_B		kW	41.8	36.4	49.6
Declared $EER_{DC,B}$			6.67	7.03	6.56
Declared Refrigerant Capacity P_C	1,3,5	kW	259.1	237.6	302.1
Declared Power Input D_C		kW	25.3	24.9	34.4
Declared $EER_{DC,C}$			10.23	9.55	8.78
Declared Refrigerant Capacity P_D	1,3,5	kW	239.1	219.3	278.8
Declared Power Input D_D		kW	24.7	21.4	28.4
Declared $EER_{DC,D}$			9.67	10.27	9.82
SSCEE	2,3,5	%	265%	289%	224%
SSCEE Tier			Tier 2 (2021)	Tier 2 (2021)	Tier 2 (2021)
Rated Cooling Capacity $P_{rated,c}$	2,4,5	kW	299.1	274.3	348.8
Declared Cooling Capacity 35°C Pdc	2,3,5	kW	299.1	274.3	348.8
Declared EER_d 35°C			4.97	5.43	4.96
Declared Cooling Capacity 30°C Pdc	2,3,5	kW	221.1	202.8	257.8
Declared EER_d 30°C			6.16	6.67	5.68
Declared Cooling Capacity 25°C Pdc	2,3,5	kW	140.1	128.5	163.3
Declared EER_d 25°C			7.49	8.26	5.65
Declared Cooling Capacity 20°C Pdc	2,3,5	kW	85.1	76.2	108.0
Declared EER_d 20°C			8.64	9.30	7.59
Sound Power Level		dB(A)	89	90	90
Water flow rate		m^3/h	61.5	55.6	71.6
Off mode P_{OFF}		kW	0.183	0.185	0.185
Thermostat-off mode P_{TO}		kW	2.054	1.667	2.913
Standby Mode P_{SB}		kW	0.188	0.190	0.190
Crankcase heater mode P_{CK}		kW	0.000	0.000	0.000

(1) Nominal conditions as stated in EU 2016/2281 Table 22.
(2) Nominal conditions as stated in EU 2016/2281 Table 21.
(3) Performance data (Nett) is supplied in accordance with EN14511-1:2013.
(4) Performance data (Gross) is supplied excluding absorbed pump power as per EN14511-1:2013.
(5) All performance data based upon standard waterside configuration.

Technical Data

TCW11XC1E1-S -TCW11XC1E1-G -TCW11XC1E1-L

Ecodesign

	Notes:	Units	TCW11XC1E1-S	TCW11XC1E1-G	TCW11XC1E1-L
SEPR	1,3,5		9.23	9.31	8.72
SEPR Tier			Tier 2 (2021)	Tier 2 (2021)	Tier 2 (2021)
Annual Electricity Consumption		kWh/a	240181	218317	296247
Rated Refrigerant Capacity P_A	1,3,5	kW	299.1	274.3	348.8
Rated Power Input D_A		kW	60.2	50.5	70.3
Rated $EER_{DC,A}$			4.97	5.43	4.96
Declared Refrigerant Capacity P_B	1,3,5	kW	279.1	256.0	325.5
Declared Power Input D_B		kW	41.8	36.4	49.6
Declared $EER_{DC,B}$			6.67	7.03	6.56
Declared Refrigerant Capacity P_C	1,3,5	kW	259.1	237.6	302.1
Declared Power Input D_C		kW	25.3	24.9	34.4
Declared $EER_{DC,C}$			10.23	9.55	8.78
Declared Refrigerant Capacity P_D	1,3,5	kW	239.1	219.3	278.8
Declared Power Input D_D		kW	24.7	21.4	28.4
Declared $EER_{DC,D}$			9.67	10.27	9.82
SSCEE	2,3,5	%	265%	289%	224%
SSCEE Tier			Tier 2 (2021)	Tier 2 (2021)	Tier 2 (2021)
Rated Cooling Capacity $P_{rated,c}$	2,4,5	kW	299.1	274.3	348.8
Declared Cooling Capacity 35°C Pdc	2,3,5	kW	299.1	274.3	348.8
Declared EER_d 35°C			4.97	5.43	4.96
Declared Cooling Capacity 30°C Pdc	2,3,5	kW	221.1	202.8	257.8
Declared EER_d 30°C			6.16	6.67	5.68
Declared Cooling Capacity 25°C Pdc	2,3,5	kW	140.1	128.5	163.3
Declared EER_d 25°C			7.49	8.26	5.65
Declared Cooling Capacity 20°C Pdc	2,3,5	kW	85.1	76.2	108.0
Declared EER_d 20°C			8.64	9.30	7.59
Sound Power Level		dB(A)	79	80	80
Water flow rate		m^3/h	61.5	55.6	71.6
Off mode P_{OFF}		kW	0.183	0.185	0.185
Thermostat-off mode P_{TO}		kW	2.054	1.667	2.913
Standby Mode P_{SB}		kW	0.188	0.190	0.190
Crankcase heater mode P_{CK}		kW	0.000	0.000	0.000

(1) Nominal conditions as stated in EU 2016/2281 Table 22.
(2) Nominal conditions as stated in EU 2016/2281 Table 21.
(3) Performance data (Nett) is supplied in accordance with EN14511-1:2013.
(4) Performance data (Gross) is supplied excluding absorbed pump power as per EN14511-1:2013.
(5) All performance data based upon standard waterside configuration.

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