

TurboChill™ TCW
Water Cooled Compact Chiller
150-375kW
R134a
R1234ze



Technical Manual

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.

ChillerGuard™

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.

<p>CAUTION</p> 	<p>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.</p>
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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

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Environmental Considerations

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

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

⁽¹⁾ Refer to your glycol supplier for details.

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
Low Voltage Directive (LVD)	2014/35/EU
Machinery Directive (MD)	89/392/EEC version 2006/42/EC
Pressure Equipment Directive (PED)	97/23/EC
	Article 13 of 2014/68/EU

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

<p>IMPORTANT </p>	<p>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.</p>
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Occupancy Note - Plant Rooms

In line with EN378-1 2008+A2:2012 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 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.

<p>CAUTION </p>	<p>When working with any air conditioning units 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.</p>
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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 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
R134a = 1300

EN378-1 :2012 (100 year life)

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

Operating Temperature (TS),	TS =	Min -20°C to Max 120°C *
Maximum Operating Pressure (PS)	PS =	High Side 16.0 Barg Low Side 10.3 Barg


Global Warming Potential
R1234ze = <1

EN378-1 :2012 (100 year life)

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

Operating Temperature (TS),	TS =	Min -20°C to Max 120°C *
Maximum Operating Pressure (PS)	PS =	High Side 13.0 Barg Low Side 10.3 Barg

*Based upon the maximum machine running temperatures.

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.
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Protective Personal Equipment

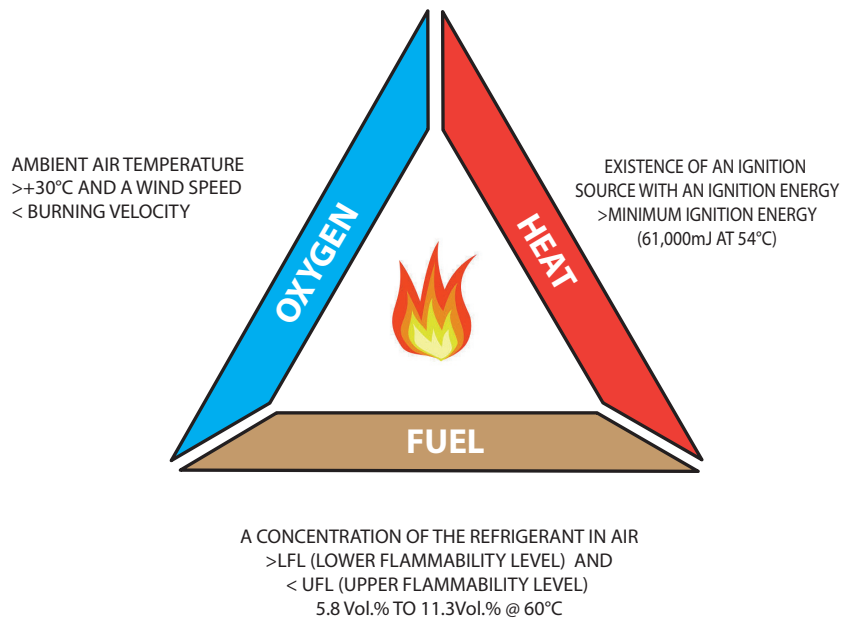
Airedale recommends that personal protective equipment is used whilst installing, maintaining and commissioning equipment.


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 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.
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NO SMOKING OR NAKED FLAME.



no access for people with active implanted cardiac devices

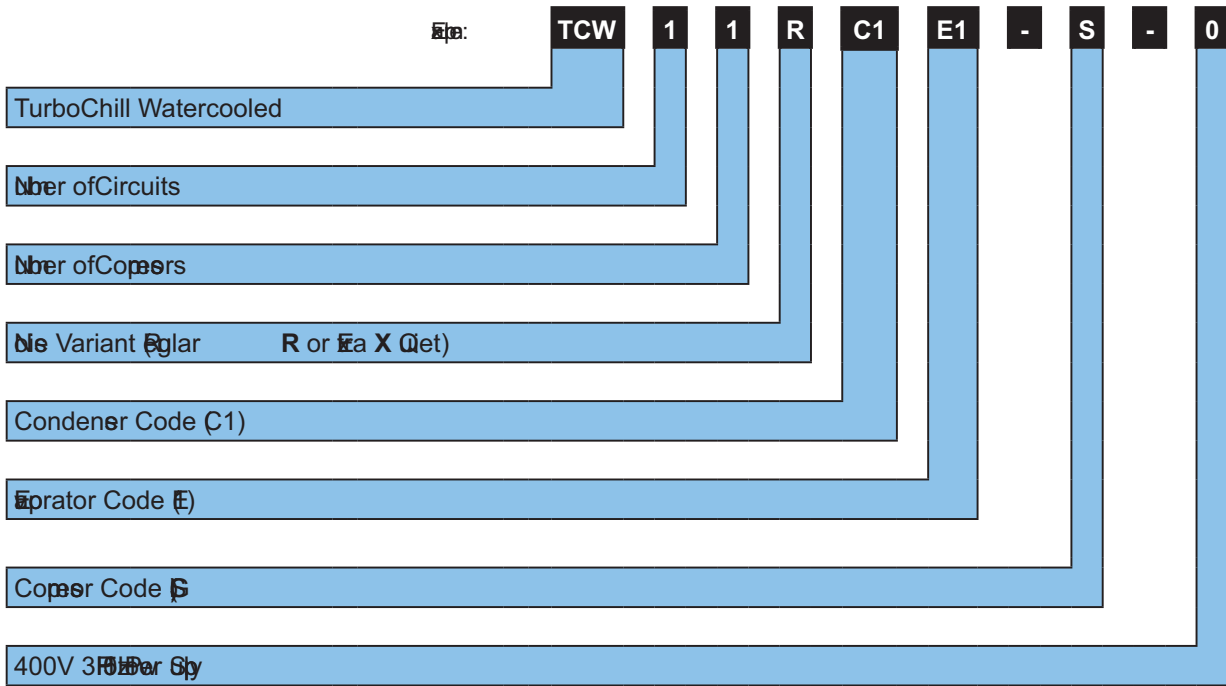
IMPORTANT 	To avoid any risk of injury, any work to be carried out on or around the compressor and magnetic check valve should be completed by personnel that do not have pacemakers fitted.
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Specifier's Guide

Nomenclature



Introduction

The Medala TurboChill Water Cooled chiller uses the technologically superior centrifugal TurboCor compressors designed for a cooling capacity of 16kW to 144kW; the normal operating conditions are based on ASHRAE rating conditions for water cooled chillers which are 12°C evaporator and 30°C Condenser water temperatures.

Refrigerant

The range has been designed and optimized for operation with ozone benign R32a refrigerant or R234a refrigerant.

Construction

The base shall be fabricated from galvanized steel to ensure a rigid, durable, weatherproof construction. All panels shall be manufactured from galvanized sheet steel coated with epoxy based 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 galvanized heavy duty base 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 models will be supplied with enclosed panels.

Unit Overview

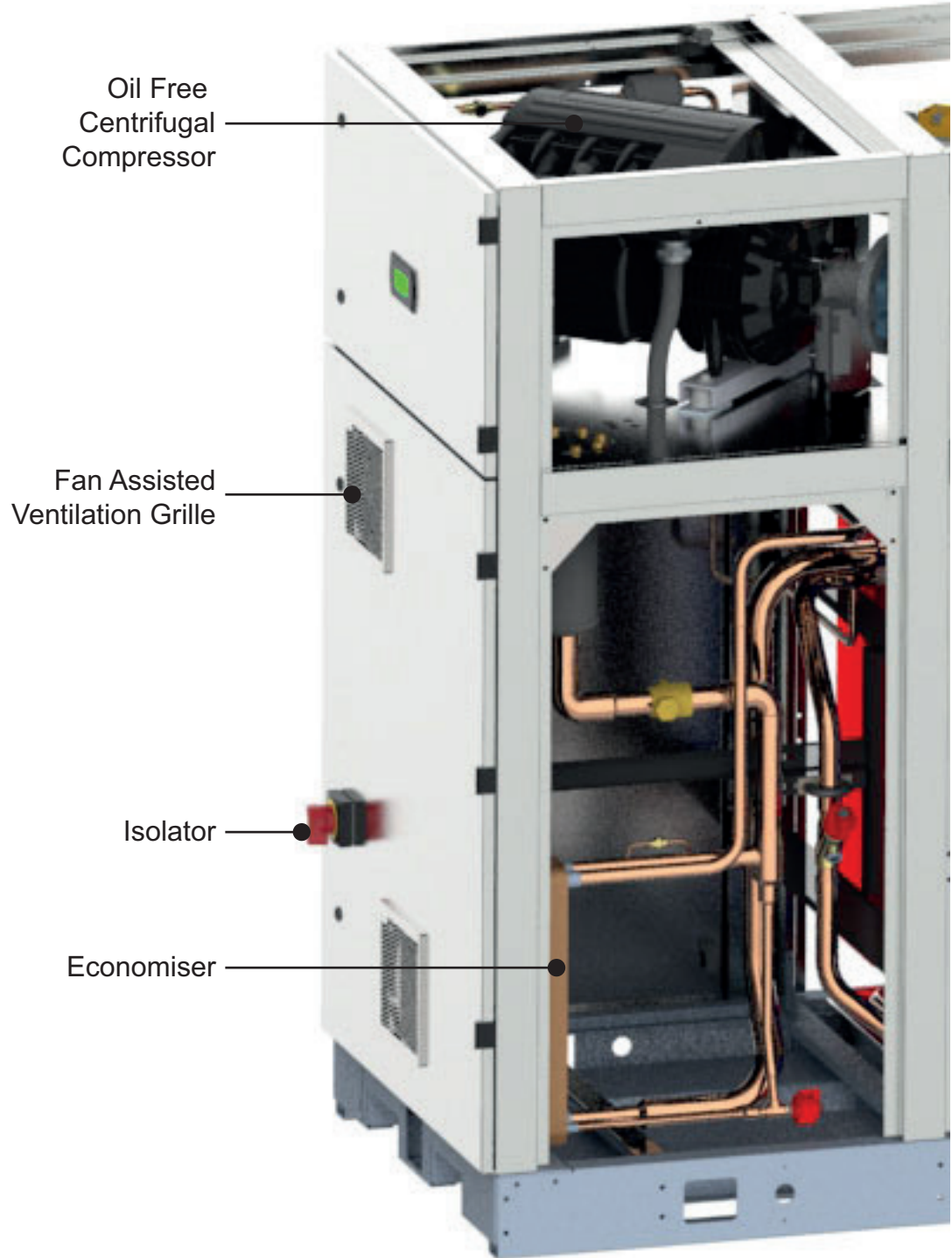


Fig 6 for illustration purposes only



Condenser

Evaporator

Features

The TurboChill Water Cooled Chiller shall be supplied complete with:

- TurboCor™ Free Compressor
- Microprocessor Control
- Copeland Compressor
- Copeland Condenser
- Dry Refrigeration Circuit
- Liquid Line Transmitters and Liquid Line Control Valves
- Maintainable Differential Pressure Relief Valves
- Electronic Expansion Valve
- Ground Water Connections Counterfeitably
- Differential Pressure Sensors across the evaporator and condenser for the protection against Water Flow Reversal.

Refrigeration

The refrigeration circuit is supplied with the following:

- Full operating charge of R34a or R234a refrigerant
- Liquid injection cooling circuit fitted to each compressor as standard with Sight Glass, Filter Drier and Ball Valve
- Discharge Line Shut Valves
- Liquid Line Shut Valves
- Filter Drier with Replaceable Core
- Compressor and Liquid Line Isolators
- Low Pressure Switch with Auto Reset
- 2 High Pressure Switches with Manual Reset per compressor
- Liquid Pressure Transducer
- Discharge Check (non return) Valve

Refrigerant Leak Detection System

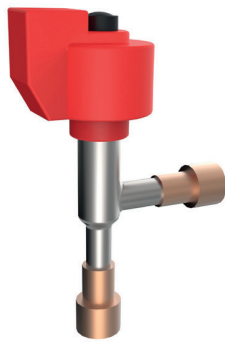
A factory calibrated leak detection system shall be fitted as standard.

Water/Glycol

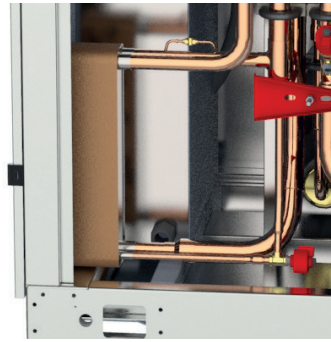
Each water/glycol circuit shall be supplied with the following:

- Differential Pressure Sensor across the evaporator and condenser for the protection against Flow Reversal
- Strategically placed Drain Valves

Refrigeration



Electronic Expansion Valve



Economiser

		System Configuration		
		S	G	L
Refrigeration	Compact Evaporator with Integrated Sub Cooler	●	●	●
	Compact Condenser	●	●	●
	TurboCor Copper	●	●	●
	R34a Refrigerant	●	—	●
	R234a Refrigerant	—	●	—
	Electronic Expansion Valves	●	●	●
	Discharge Line Ball Valves	●	●	●
	Liquid Line Ball Valves	●	●	●
	Transducers and Scales	●	●	●
	Suction Line Isolation Valve	○	○	○
	Liquid Line Injection Motor Cooling	●	●	●
	Filter Drier	●	●	●
	Evaporator Differential Pressure Relief Valve Assembly	●	●	●
	Condenser Differential Pressure Relief Valve Assembly	●	●	●
	Economiser	○	○	○
	Defrost Detection	●	●	●
	Refrigerant Detection	○	○	○
	Automatic Drain	○	●	○

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

Economiser

Via the economiser, a portion of the refrigerant is separated and used to further sub cool the bulk of the liquid refrigerant in a plate heat exchanger. This extra sub cooling over the liquid refrigerant enthalpy allows 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. In addition, superheat setpoint, head pressure setpoint and other features can be read and adjusted via the remote control display.

Whilst offering precise control at the full design duty of the unit, Thermostatic Expansion Valves (TEV) do not automatically provide the best to all operating conditions. Therefore, if the refrigeration system is operating at 40% or 60% full load, especially at a low ambient temperature than that for which the valve was designed, 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.

EEVs allow for good refrigeration control whilst operating at part load and low 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 turndown rate of a typical EEV is superior to that of thermostatic equipment, such that a reduced operating condensing pressure can be maintained at low capacity load.

EEVs can operate effectively between 10-100% of 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 achieved 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 manual reset for R32 units and automatic reset for R232 units.

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 package is available that monitors refrigeration parameters and determines if loss of refrigerant is occurring. This can detect which circuit is leaking for these parameters and give an intelligent decision of potential shutdown of the unit.

Evaporator and Condenser

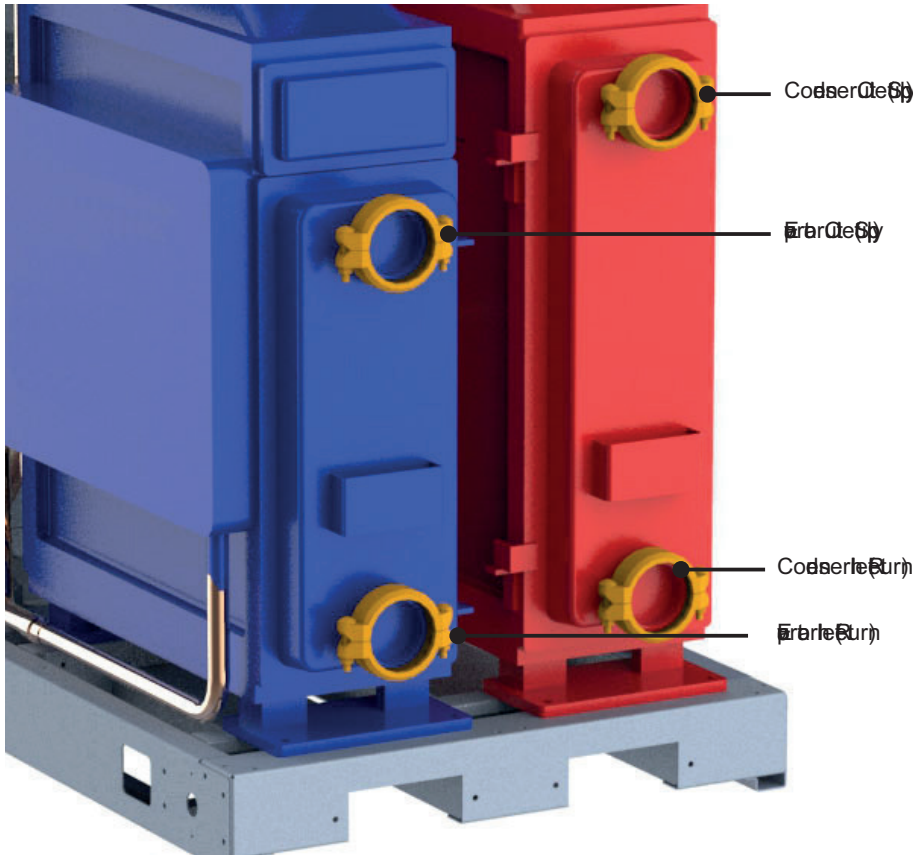


Fig for illustration purposes only

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

● Standard Feature ○ Optional Feature — Feature Not Available

Dual Pressure Relief Valve

A auto resetting pressure relief valve assembly shall be provided per evaporator circuit, opening on pressure rise above 10.3 barg. The dual auto reset valve assembly incorporates 2 pressure relief valves which can be individually set but offer a 3 way valve. This allows the maintenance of individual pressure relief valves without any requirement for refrigerant evacuation. Rupture discs are also fitted on systems with a refrigerant charge larger than 300kg in line with BS2002:2012 clause 6.2.6.5h accordance with EN13136:2013, pressure relief valves shall be sized to ensure that in the event of fire they can prevent excessive build-up of pressure within the evaporator. EN13136:2013 section 6.2.1 has been used to size valves accordingly.

It is a hazard that these units have not been designed to operate under fire, 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 external temperatures. This should allow the pressure relief valve to discharge effectively and not act as a choke (per any release) when discharging.

Compressor



TurboCor Compressor R34a Refrigerant



TurboCor Compressor R234ze Refrigerant

		System Configuration		
		S	G	L
Compressor	Vibration Isolating Rubber Mounts	●	●	●
	Section Sainer	●	●	●
	Discharge But Valves	●	●	●
	Section But Valves	●	●	●
	Inlet Reactor	●	●	●
	EMI/EMC filter	●	●	●

● Standard Feature ○ Optional Feature — Feature Not Available

TurboCor Compressor

TurboCor centrifugal compressors are standard:

- Section and discharge but valves
- Discharge nonreturn valve
- Inlet reactor for reducing additional impedance harmonics and voltage rise 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 sensor and incorporated surge protection
 - o Start module
 - o Magnetic bearing sensor
 - o Compressors are mounted on TurboCor specially designed vibration reducing isolating rubber mounts
 - o Inlet capacity modulation is provided by a variable frequency drive

<p>IMPORTANT </p>	<p>Ensure inlet gas pressure is disconnected permanently to ensure that the system is fully isolated and ventilate the compressor housing in the event of a leak being detected. A permanent sign is required.</p>
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Key benefits of TurboCor compressor technology:

- Oil free operation
- More efficient use of heat exchangers
- No oil entrainment issues or can be opted for performance not oil return
- Variable speed operation offering exact capacity match and optimal load performance
- Magnetic bearing design constantly lubricated / oil free operation
- 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 has a roller 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 Substantially less power at part load and very accurate setpoint control and exact capacity match
 - o The inbuilt electronic start produces a very low starting current of just 2A and eradicates the need to oversize electrical components on the

Waterside

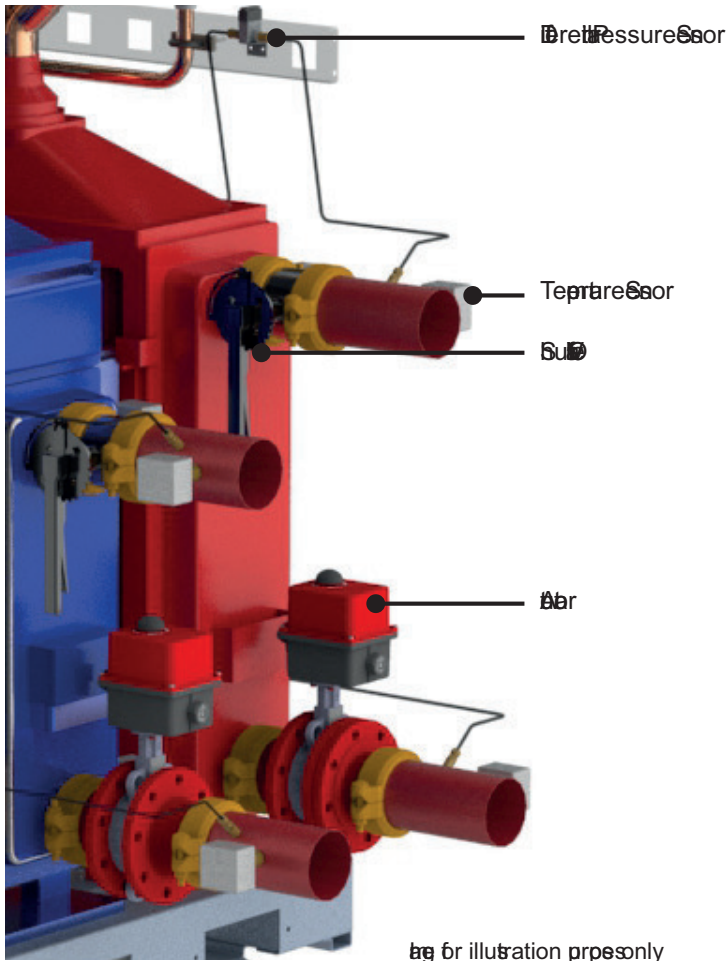


Fig for illustration purposes only

		System Configuration		
		S	G	L
Waterside	Differential Water Pressure Transducers	●	●	●
	Good and Clamped Termination	●	●	●
	Flanged Connections	●	●	●
	Manual and Actuated Isolation Valves	●	●	●
	Interlock	●	●	●
	Water Flow Switch*	○	○	○

● Standard Feature ○ Optional Feature — Feature Not Available

<p>CAUTION </p>	<p>*Each feature is a flow proving device and 2 out of the 3 should be fitted to any unit to validate warranty</p>
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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*

Option 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 good and clamp type construction, enabling easy termination. The unit is supplied with a counter flange and coupling assembly for quick installation. Optional flanged connections available on request, please consult the dealer. Water inlet and outlet are located at the end of the unit.



Electrical Panel View

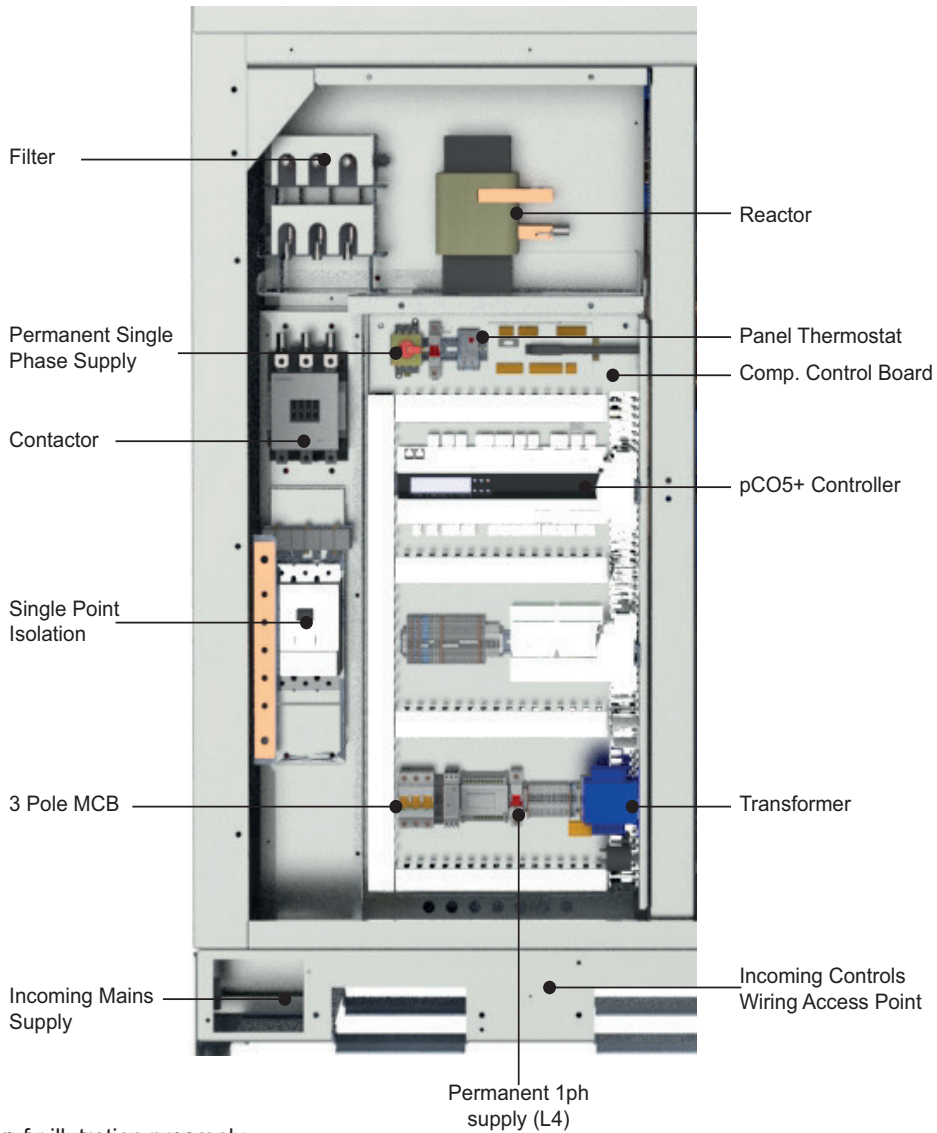


Fig for illustration purposes only

		System Configuration		
		S	G	L
Electrical	Electronic Start	●	●	●
	Single Point Isolation	●	●	●
	Ultracap Power Backup	●	●	●
	Control Panel Ventilation	●	●	●
	Ventilated Control Enclosure	—	●	—
	Phase Rotation Relay	●	●	●
	Energy Management Meter	○	○	○

● Standard Feature ○ Optional Feature — Feature Not Available

Electrical

A electrical panel and control panel is situated at the front of the unit and contains

- Individual main power isolator for the compressor
- Emergency interlock isolator handle
- Easily accessible control 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 panel and control panel is fitted to the latest European standards and codes of practice. Mains supply is 3 phase, a neutral is only required for permanent supply. Separate 230V permanent supply is required for the controls and safety features.

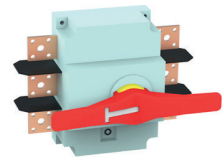
<p>IMPORTANT </p>	<p>TurboChill units are designed for indoor use only and are not to be installed outside.</p>
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Electronic Soft Start

The electronic soft start enables the chiller compressor motor to be ramped to speed with the minimum load current. Further benefits include removal of nuisance tripping, supply voltage dips and motor overheating.

Single Point Isolation

Single point isolation shall be fitted as a standard feature. The feature is now available to be reconnected upon request subject to your own 3 phase unit main isolator.



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 through time to change power supplies.



The Ultra Capacitors are used to maintain the controller's main function to close the electronic valves in the event of a power failure. Power will be maintained until the power is reinstated for a period of 10 minutes.

The module uses ultracapacitor capacitors. Electric Double Layer Capacitors 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

Real time energy consumption can be monitored via a dedicated display. Unit parameters can be adjusted via the unit microprocessor control to affect energy usage in line with the demand.



Controls



		System Configuration		
		S	G	L
Controls	Microprocessor with built-in display	●	●	●
	Door Mounted Display	○	○	○
	7" 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 Directive 2002/95 compliant microprocessor controller connected to an 822 backlit LCD display. Backlit displays 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.

The boards feature a 16 bit microprocessor, and consequently the calculation power and operation processing 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 keypad features an array of soft keys to navigate through the inbuilt menus.

With an 822 character (132 x 64 pixels) screen size, backlit in white for improved contrast, the large screen allows for user friendly viewing and easy status recognition by displaying a combination of text and icons.

The default screen shows 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 shall be visually displaying alarm whenever, as an optional extra, a display with audible alarm is available.

BMS Interface Cards

BMS Interface Card controlled units shall be interfaced with most BMS, factory fitted, please contact Airedale.

A wide range of protocols shall be accommodated through the use of interface devices available as a standard option are: ModBus/Jbus, and Carel. For interfaces such as SNMP, LonWorks, Metasys and BACnet, please contact Airedale.

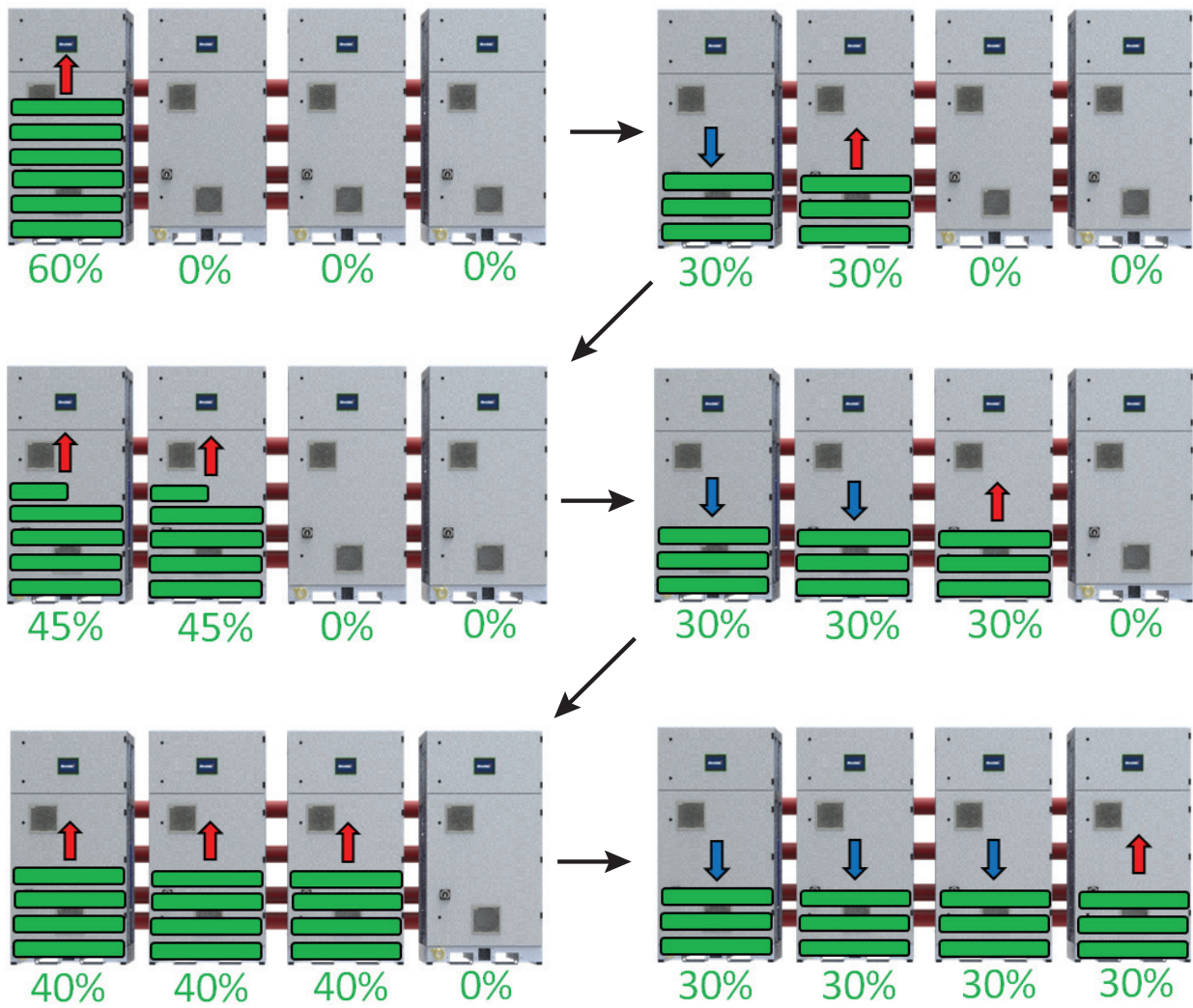
Also available shall be Airedale's own supervisory plug-in BMS card pCOWEB, based on Ethernet TCP/IP secure technology. All features shall require no proprietary cabling or monitoring software and be supplied pre-programmed with an IP address for ease of set up. Cables to the BMS to be supplied by others.

Integrated Optimised Loading and Offloading Sequence

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

As the load ramps up to 60% and the second module becomes active and ramps to 30%. 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 equally as the period 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 demand for each module and then as one module is switched off the remaining modules ramp to take up the difference to maintain a set point reduction in cooling capacity. This strategy is continued until the set point is at its minimum cooling capacity represented by one module at its minimum demand.



TurboChill optimised loading sequence

External



		System Configuration		
		S	G	L
External	Dedicated Compressor Enclosure	●	●	●
	Ventilated Compressor Enclosure (L.A.T.)	○	●	○
	Lifting Eye Bolts	●	●	●
	Pallet Truck Mobility	●	●	●
	Acoustic Enclosure	○	○	○
	Anti-Vibration Mounts (optional)	○	○	○

● Standard Feature ○ Optional Feature — Feature Not Available

Dedicated Compressor Enclosure

Units will be shipped with dedicated compressor enclosure as standard.

Ventilated Compressor Enclosure

R234a units shall have ventilation in accordance with ASHRAE standards, 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 shipped with additional L.A.T. corner protection and cross-braces to absorb extra transit protection. Sterling board heat treated and treated material shall be used (including pallet) to comply with port regulations. (Please contact the dealer for this option)

Performance Data

Measurement of Sound Data

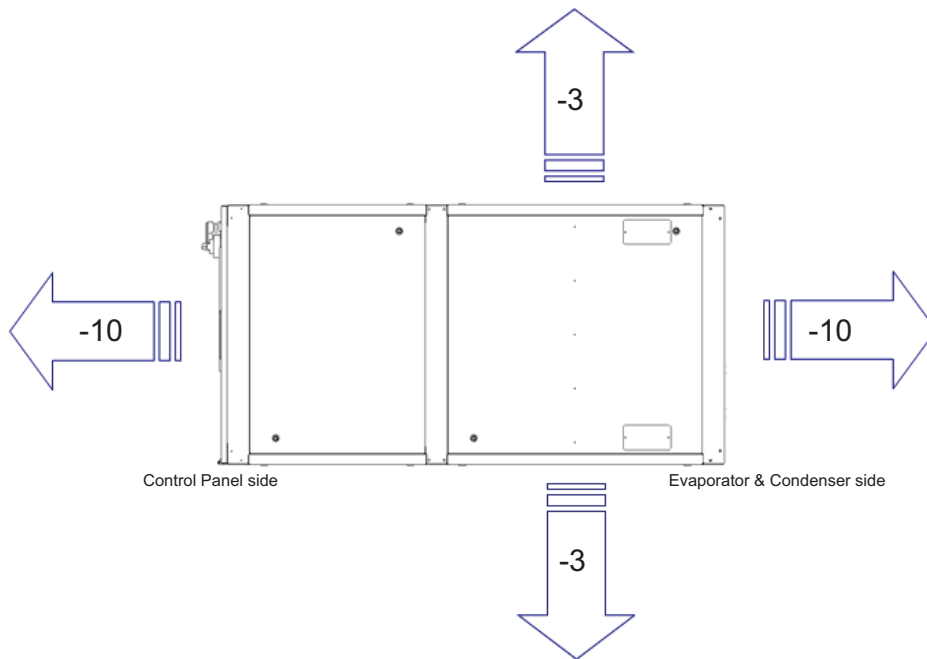
Sound data quoted has been measured in the third octave band limited using a Brüel & Kjær calibrated sound intensity meter in accordance with BS EN ISO 9614 Part 1:2009. The Global sound data quoted is valid for noise emitted in the horizontal plane in all directions

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 parallel method according to BS EN ISO 11203: 2009.

Sound Directivity

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

$$Q = \rho \times \dot{m} \times C_p \times \Delta t$$

Where

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

Ethylene Glycol Specific Heat

Temperature °C	Glycol Percentage / Freezing Point					
	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

Temperature °C	Glycol Percentage / Freezing Point					
	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

	Catalogue Data x by:	Glycol in System / Freezing Point °C			
		10% / -3.2°C	20% / -7.8°C	30% / -14.1°C	40% / -22.3°C
Cooling Duty		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.

$$Q = \rho \times \dot{m} \times C_p \times \Delta t$$

Where

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

Propylene Glycol Specific Heat

Temperature °C	Glycol Percentage / Freezing Point					
	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

Temperature °C	Glycol Percentage / Freezing Point					
	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 °C			
		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)	W	300	300	300
	(2)	W	82	60.2	71
	(3)		516	4.99	4.8
	(4)		814	78	716
	(5)		807	78	718
Capacity Steps	(1)	%	30/100%	30/100%	30/100%
	(2)	m	2000 x1000 x196	2000 x1000 x196	2000 x1000 x196
	(3)	kg	225	2265	2265
	(4)	kg	246	2467	2467
Construction Material/Colour			Base: Plain Galvanised Steel, Panels: Galvanised Sheet Steel Epoxy Baked Powder Paint, Light Grey (RAL 7035)		
Evaporator - Type	Coil - Shell and Tube				
	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	Coil - Shell and Tube				
	Class N				
	Total Max. Water Flow	l/s	277	277	277
Total Min. Water Flow	l/s	1.6	1.6	1.6	
Compressor - Type	TurboCor - Free Compressor				
	Quantity		1	1	1
Capacity Control			Variable Frequency Drive / Inverter Linear Capacity Modulation		
Refrigeration	R234a Circuit				
	Refrigerant Recharge	kg	R34a	R234a	R34a
	Charge (Total)	kg	8	8	8
Refrigerant Control			Electronic Expansion Valve (E) (5)		
Water System - Evaporator	Fixed Top Coupling and Accessibility				
	Water Inlet/Outlet		DN00	DN00	DN00
	Water Volume	l	1085	1085	1085
	Min. Start Water Volume	l	180	180	180
	Max. Pressure	Bar(g)	10	10	10
	Flow Rate	l/s	14.2	14.2	177
Pressure Drop	Bar	29.6	29.6	48	
Water System - Condenser	Fixed Top Coupling and Accessibility				
	Water Inlet/Outlet		DN00	DN00	DN00
	Water Volume	l	93.5	93.5	93.5
	Min. Start Water Volume	l	180	180	2306
	Max. Pressure	Bar(g)	10	10	10
	Flow Rate	l/s	16.9	16.9	21.3
Pressure Drop	Bar	38	38	8	

(1) Based on unit performance at 12/7°C evaporator, 100% water and 30/35°C condenser return/supply temperatures

(2) Cooling duty/compressor input per

(3) ESEER/SEER based upon operating conditions as defined by the Eurovent Certification Company for water cooled chillers

(4) Nominal dimensions do not include water side isolation valves external to unit

(5) Charge specified is without economiser option

Technical

Technical Data

TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L

Electrical

			TCW11RC1E1-S	TCW11RC1E1-G	TCW11RC1E1-L
Unit Data					
Rated Power	(1)	A	135	18	210
Rated Current	(2)	A	2	2	2
Main Supply		V ϕ		400V \pm 0%R \pm 1%	
Rated Main Supply		A	160	160	28
Max Main Incoming Cable		m	0	0	18
Rated Supply		V ϕ		230V \pm 0%R \pm 1%	
Rated Current		A	16	16	16
Max Incoming Cable		m	6	6	6
Control Circuit		V ϕ		24V \pm 30V \pm 0%	
Evaporator					
Evaporator Rating		W	20	20	20
Condenser					
Condenser Rating		W	20	20	20
Compressor					
Quantity			1	1	1
Motor Rating		W	8	92	130
Rated Power	(1)	A	135	16	210
Rated Current	(2)	A	2	2	2
Type				Electronic Start	

(1) Based on full load conditions.

(2) Rating 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	7	3.0	3.3	6.1	8	8.2	8	6.6	8
	Pressure @0m	48	41.3	41.6	44.3	5.6	5.4	46.5	44.8	50
TCW11RC1E1-G	Power	61.3	61.3	66.2	80	8.9	8.6	8.0	9.3	9.5
	Pressure @0m	29.5	29.5	34.4	46.2	52	49.9	48	47.5	50
TCW11RC1E1-L	Power	61.3	61.3	66.2	80	8.9	8.6	8.0	9.3	9.5
	Pressure @0m	29.5	29.5	34.4	46.2	52	49.9	48	47.5	50

1) dB(A) is the overall sound level, measured on the A scale.

2) Sound data based at normal conditions Water inlet 12°C at 30°C ambient.

<p>IMPORTANT </p>	<p>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.</p>
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Technical Data

TCW11XC1E1-S - TCW11XC1E1-G - TCW11XC1E1-L

Mechanical

			TCW11XC1E1-S	TCW11XC1E1-G	TCW11XC1E1-L
Cooling Duty	(1)	W	300	300	300
		W	82	60.2	71
	(2)		516	4.99	4.8
	(3)		844	78	746
	(4)		807	78	718
Capacity Steps	(5)	%	30/400%	30/400%	30/400%
		m	2000 x1000 x196	2000 x1000 x196	2000 x1000 x196
		kg	238	230	230
		kg	29	27	27
	Construction Material/Colour			Base: Plain Galvanised Steel, Panels: Galvanised Sheet Steel Epoxy Baked Powder Paint, Light Grey (RAL 7035)	
Evaporator - Type			Coil - 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			Coil - Shell and Tube		
Insulation			N		
Total Max Water Flow		l/s	277	277	277
Total Min. Water Flow		l/s	1.6	1.6	1.6
Compressor - Type			TurboCor - Free Compressor		
Quantity			1	1	1
Capacity Control			Variable Frequency Drive / Inverter Linear Capacity Modulation		
Refrigeration			R234a Circuit		
Refrigerant Recharge		kg	R34a	R234a	R34a
Charge (Total)		kg	8	8	8
Refrigerant Control			Electronic Expansion Valve (E)		
Water System - Evaporator			Coiled Tube Coupling and Flange		
Water Inlet/Outlet			DN00	DN00	DN00
Water Volume		l	1085	1085	1085
Min. Water Volume		l	150	150	187
Max. Pressure		Barg	10	10	10
Flow Rate		l/s	14.2	14.2	177
Pressure Drop		Bar	29.6	29.6	45
Water System - Condenser			Coiled Tube Coupling and Flange		
Water Inlet/Outlet			DN00	DN00	DN00
Water Volume		l	93.5	93.5	93.5
Min. Water Volume		l	183	180	2306
Max. Pressure		Barg	10	10	10
Flow Rate		l/s	16.9	16.9	21.3
Pressure Drop		Bar	38	38	8

(1) Based on unit performance at 12/7°C evaporator, 100% water and 30/35°C condenser return/supply temperatures

(2) Cooling duty per input power

(3) ESEER/SEER based upon operating conditions as defined by the Eurovent Certification Company for water cooled chillers

(4) Nominal dimension does not include water side insulation 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					
Rated Power	(1)	A	135	18	210
Max. Rated Power	(2)	A	2	2	2
Main Supply		V ϕ		400V \pm 0%R \pm 1%	
Max. Main Supply		A	160	160	28
Max. Main Incoming Cable		mm	0	0	18
Rated Supply		V ϕ		230V \pm 0%R \pm 1%	
Max. Rated Supply		A	16	16	16
Max. Rated Incoming Cable		mm	6	6	6
Control Circuit		V ϕ		24V \pm 30V \pm 0%	
Evaporator					
Evaporator Rating		W	20	20	20
Condenser					
Condenser Rating		W	20	20	20
Compressor					
Quantity			1	1	1
Motor Rating		W	8	92	130
Rated Power	(1)	A	135	16	210
Rated Power	(2)	A	2	2	2
Type				Electronic Start	

(1) Based on full load conditions.

(2) Rating 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	0.4	60	60	57	3.8	63.1	82	88
	Pressure @0m	37.3	3.7	36.2	36.3	44.0	42.1	31.4	26.4	47
TCW11XC1E1-G	Power	5.1	7	61.0	0.2	8	7.0	62	60.9	9.5
	Pressure @0m	22.4	27	29.3	35	46.2	39.3	33.5	29.1	47
TCW11XC1E1-L	Power	5.1	7	61.0	0.2	8	7.0	62	60.9	9.5
	Pressure @0m	22.4	27	29.3	35	46.2	39.3	33.5	29.1	47

1) dB(A) is the overall sound level, measured on the A scale.

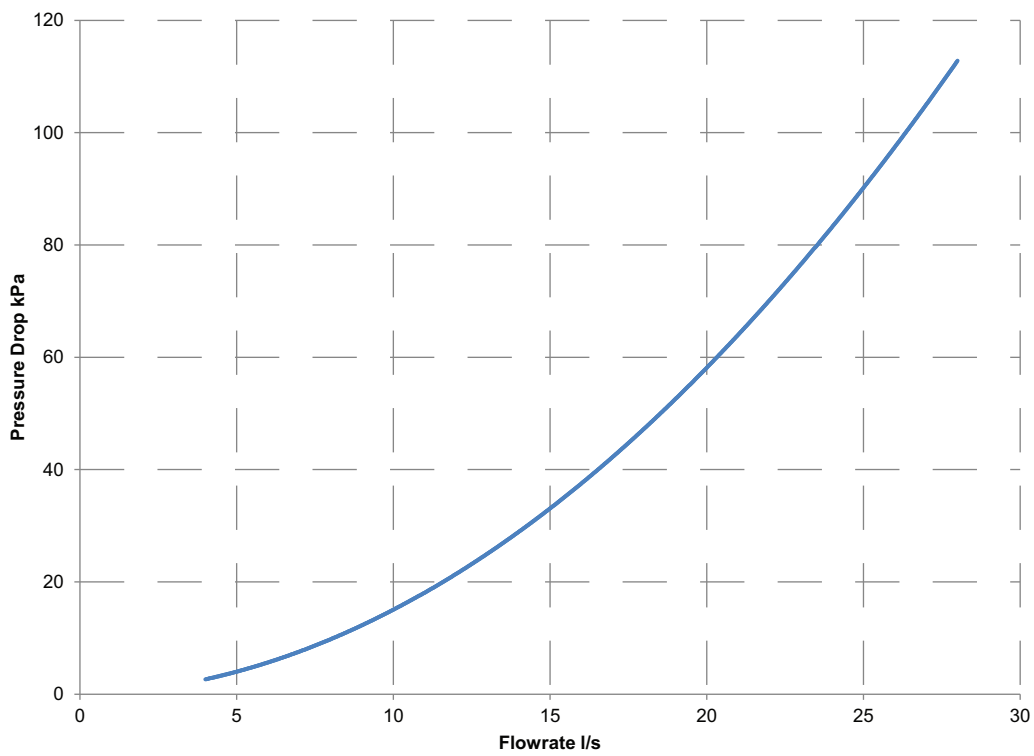
2) Sound data measured at normal conditions Water inlet 12°C at 30°C ambient.

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.

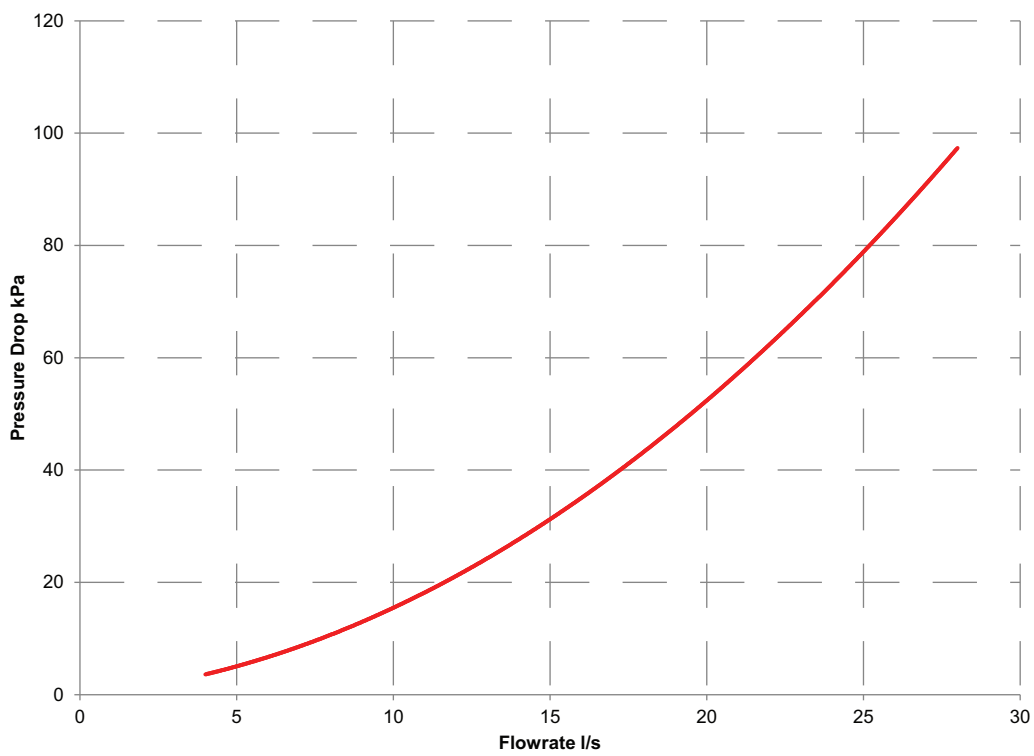


Waterside Pressure Drop

Evaporator



Condenser



Represented performance at 100% water.

Technical

Minimum System Water Volume Calculations

**METHOD 1
(Preferred Method)**

Where the permanent heat load is known, the minimum water volume in litres

V_{min} is

$$V_m = \text{Water Flow Rate (litres/hr)} \times \text{Minimum COP on Turndown} \times \text{Chiller loading factor CF}$$

$$\text{Water Flow Rate} = \frac{KW \times 60}{CP \times \Delta t} \times \text{minutes} \times \text{CLF} = \frac{\text{Minimum Turndown (KW)} \times 1.2}{KW}$$

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

Permanent Heat Load = 300kW

Minimum Turndown = 3 Modules

$$V_m = \frac{300 \times 60}{3.9 \times 5} \times 6.75 = 2163 \text{ litres}$$



METHOD 2

Where the permanent heat load is unknown.

$$V_m = \text{Water Flow Rate (litres/hr)} \times \text{Min. Turndown} \times 1.2 \times \text{Min. COP on Turndown} + \text{Internal water vol. (24)}$$

$$\text{Water Flow Rate} = \frac{KW \times 60}{CP \times \Delta t} \times 0.07 \times 1.2 \times \frac{5}{60} + 24$$

Minimum Turndown

- 1 Module - 30%
- 2 Modules - 15%
- 3 Modules - 10%
- 4 Modules - 7%

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

Minimum Turndown = 0.07 (1 Module)

$$V_m = \frac{300 \times 60}{3.9 \times 5} \times 0.07 \times 1.2 \times \frac{5}{60} + 24 = 1312 \text{ litres}$$

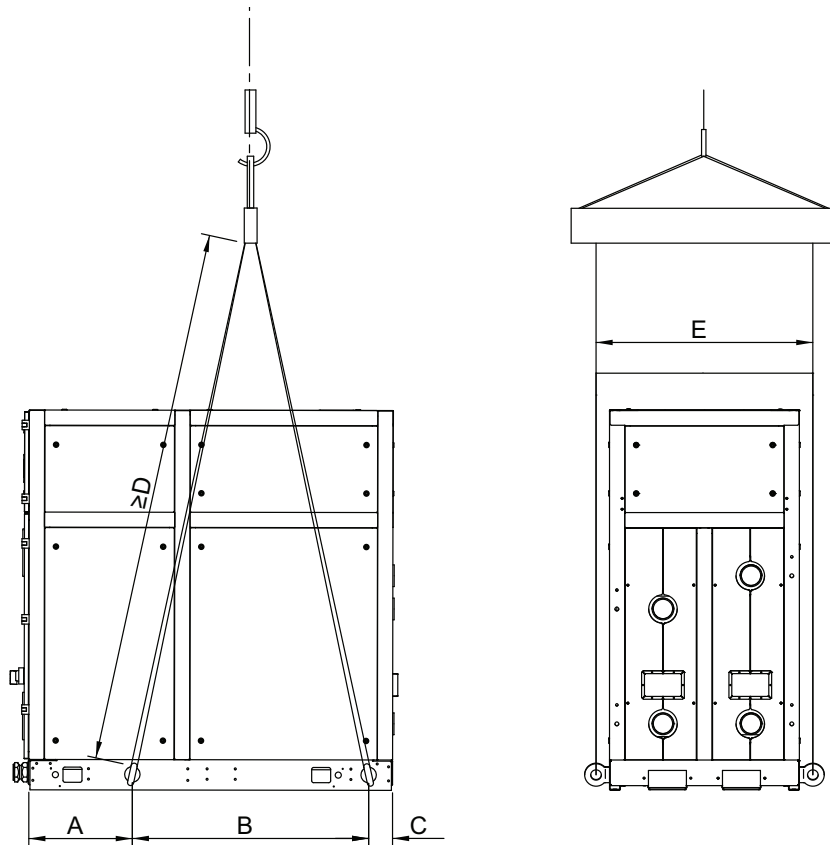
Installation Data

Lifting

- Only lifting points
- local codes and regulations relating to the lifting of this type of equipment should be observed
- the lifting points should be
- the appropriate leader bars should be used
- Each 4 lifting points should be used on the 4 lifting points each chain and eye bolt should be capable of lifting the whole chiller
- If the unit is to be lifted
- If the unit is dropped, it should immediately be checked for damage and reported to the dealer

CAUTION ⚠ Always use lifting points.

The unit should be lifted from the base and where possible, with all packaging and protection in position. In any other case of lifting, due care should be taken to ensure that the lifting gear does not crush the casing.

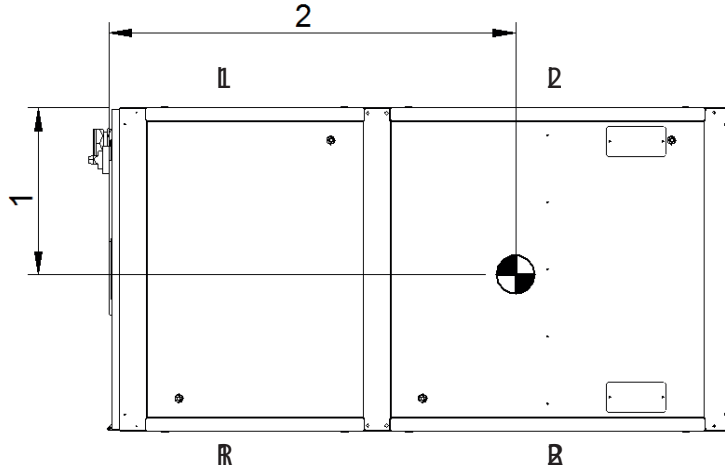


		A	B	C	D	E
ALL MODELS	m	6	1245	126	3000	1142

CAUTION ⚠ Work should 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



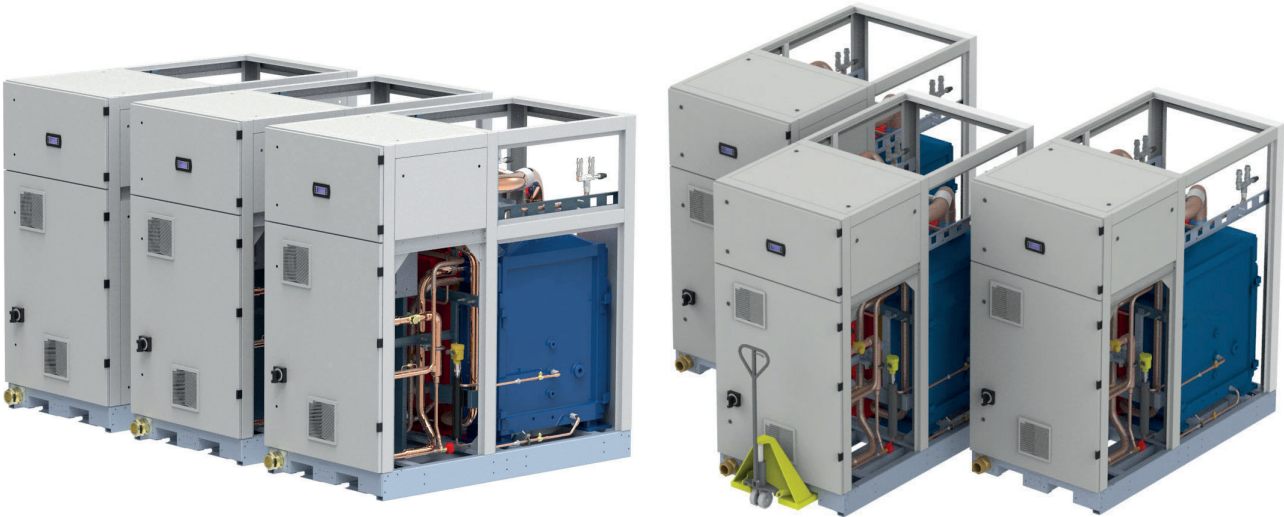
Installation

	lifting	rating	L	D	R	R	CoG	CoG	liftingCoG	
	Mas	Mas	P	P	P	P	m	m	x	y
TCW11R1ES	225	2465	405	85	410	80	65	1225	60	1220
TCW11R1EG	2265	247	410	80	420	80	65	1220	60	1220
TCW11R1EL	2265	247	410	80	420	80	65	1220	60	1220
TCW11R1ES	236	28	435	80	440	8	65	1215	60	1220
TCW11R1EG	237	28	440	85	445	8	65	1215	60	1220
TCW11R1EL	237	28	440	85	445	8	65	1215	60	1220

Module Installation

The compact evaporator and condenser shall be designed for a single refrigeration circuit with a nominal cooling capacity of circa 292kW (1200 Btu/h Cond). The evaporator and condenser shall be suitable for use with the TurboCor compressor, which in addition to the compact design lends itself to a modular application as can be seen below

Installation



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 in a common water side 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 all space claim requirements each module can be disconnected from the common water side and withdrawn for maintenance and or replacement with extra long 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 8'x4'0" (not high cube) container shall accommodate 10 of modules circa 3.1MW total nominal cooling capacity

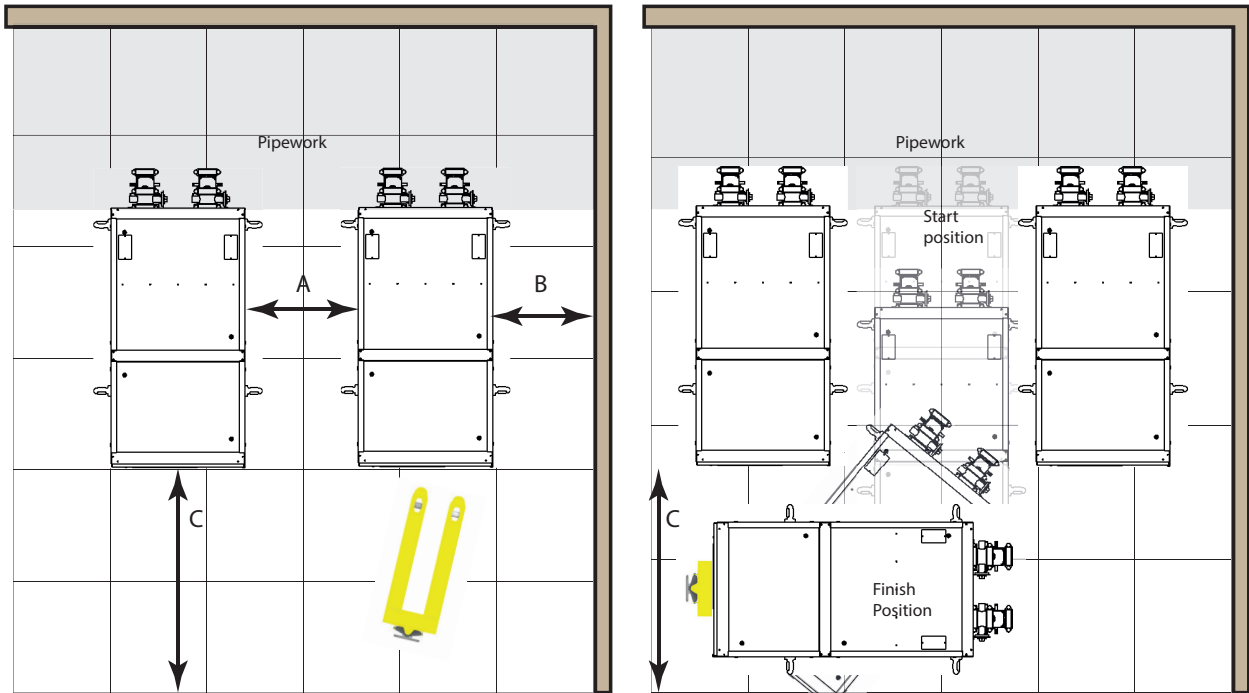
Positioning

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
- Leveling should be to 1/1000
- Adequate maintenance clearances
- Piping and electrical connections are readily accessible
- Increased maintenance clearances for enclosed or multiple unit applications
- Increased space for maintenance with pallet truck wheels in the base suitable for truck movement.

Clearance

Could the chiller be installed standalone/unable to see the unit, position to be able for maintenance around the chiller. The following minimum clearance is required:



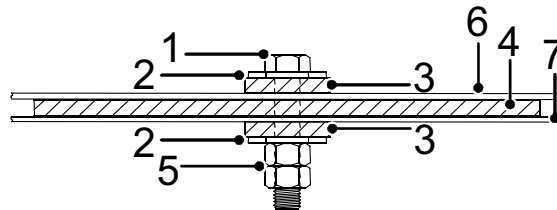
- A - Clearance between units - 80mm
- B - Clearance between unit and external walls - 80mm
- C - Clearance for chiller maneuverability - 2000mm

Anti Vibration Mounting Pad Type

Pad Type

Component Installation

1. M16 Bolt (Not Supplied)
2. Washer (Not Supplied)
3. Pad 613231
4. Anti Vibration Pad 613223
5. 2 x M16 Bolt (Not Supplied)
6. Bolt
7. Bolt Mounting Path



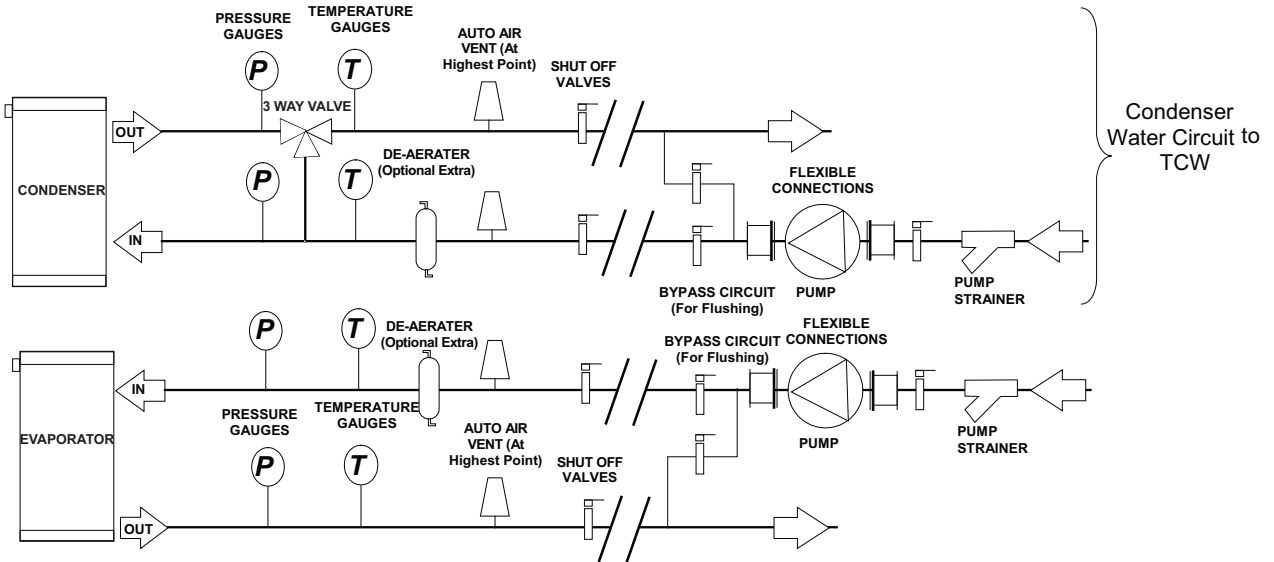
<p>IMPORTANT </p>	<p>If the unit is mounted on a plinth, suitable fixings must be used.</p>
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Installation

Standard Recommended Pipework Installation

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

Installation



Condenser Head Pressure Control

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

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

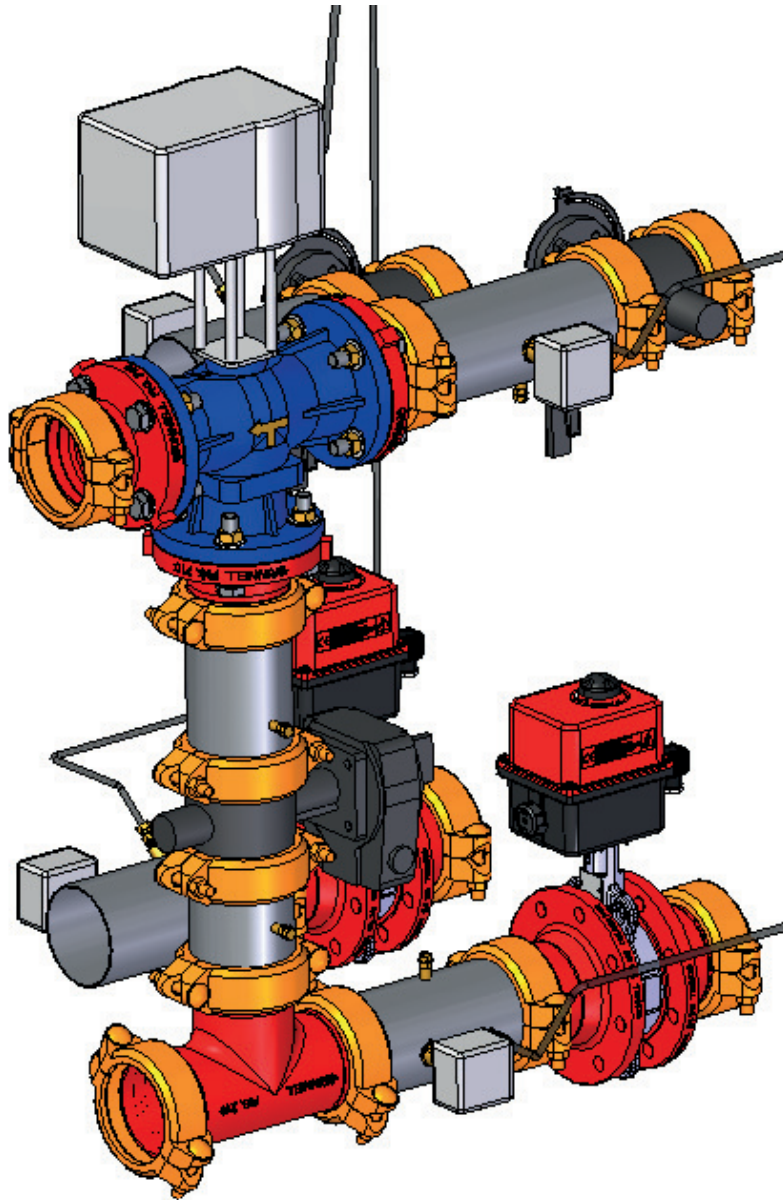
The 3-way valve should be closed at part load initially to ensure correct operation.

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

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

- Temperature sensors
- Main point
- Auto air vent

The head pressure control valve shall be available with three sizes or 100, dependent on pressure drop



DN65 Head Pressure Control Valve Clamp

Installation

Water System

Component Recommended Requirements

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

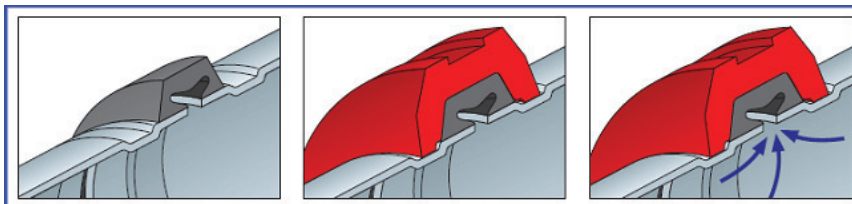
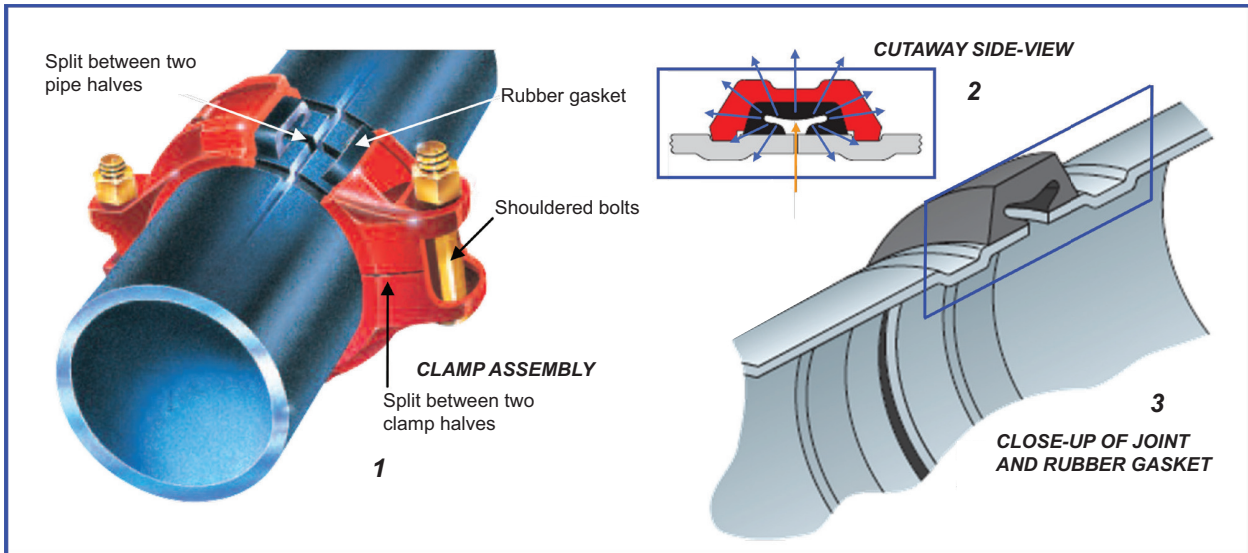
- The inclusion of binder points adjacent to the flow and return connections, to allow temperature and pressure reading
- A differential pressure sensor or equivalent, fitted adjacent to the water outlet side of the unit
- A 20 mesh strainer fitted prior to the evaporator inlet
- A water-flow commissioning valve set fitted to the system
- In multiple chiller installations, commissioning set is required per chiller
- Balancing valves should be installed adjacent to all appropriate equipment for ease of maintenance
- Balancing valves can be installed if required to aid correct system balancing
- A chilled water pipework to 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 should be installed in accordance with:

- National and local water supply standards
- The manufacturer's instructions are followed when fitting ancillary components
- The liquid is treated to prevent corrosion and algae forming
- In ambient of 0°C and below, where static water can be expected, or when water temperatures of 6°C or below are required, the necessary concentration of biocide or use of an electrical trace heater should be included
- The sheet is referred to as a guide to ancillary recommendations

<p>CAUTION </p>	<p>The unit water connections are not designed to support external pipework. External pipework should be supported separately. Connections are fully isolated for supporting pipework to prevent electrolytic corrosion. Connections should be checked periodically for maintenance requirements.</p>
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Grooved & Clamped Type Connection



Pump Statement

When installing circulating water pump equipment containing 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 pump liquid cools the pump bearings and mechanical seal faces
- To avoid cavitation the pump should be incorporated into a system of 0.5m or more head 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
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Maximum System Operating Pressure

The system should operate at a maximum of 10 bar.


CAUTION	Although a pressure of 1.5 bar is adequate for testing purposes local water authorities require 2 bar test pressure.
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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.
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- 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 should be made for control of the correct concentration to ensure the cooling medium is not diluted

Electrical


<p>IMPORTANT </p>	<ul style="list-style-type: none"> • Please refer to the electrical wiring diagram provided for installation • All work to be carried out by technically trained competent personnel • The equipment contains live electrical and moving parts. Do not touch or attempt to adjust or repair the equipment before the power is disconnected and the equipment is isolated. • The unit isolators isolate the incoming supply but do not isolate the individual electrical circuits. Isolate the incoming supply before carrying out maintenance or repair work. • Ensure electrical lock-off procedures are conducted.
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Standard the equipment is designed for 400V, 3 phase, 3 wire 60Hz and a separate permanent 230V, 1 phase, 60Hz supply to all relevant Regulations, Standards and Requirements.

The control voltage to the interlocks is 24V, always use the low voltage interlock and protection cabling for a minimum voltage drop of 2 volts.

Isolated 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 specified voltage. Ensure correct phase rotation.

<p>CAUTION </p>	<p>Separately fused, locally isolated, permanent line phase and neutral supply is required for the evaporator trace heating and control circuit.</p>
--	--

Interconnecting Wiring

	L1	○	←	Main Incoming 400V /3-φ
	L2	○	←	
	B	○	←	
	E	○	←	
	L	○	←	Separate Branch 230V /1-φ
	N	○	←	
	E	○	←	
	62	○	→	(1) Compressor Fan
	66	○	←	
	62	○	→	(1) Condenser Fan
	53	○	←	
	62	○	→	Fan Fan
	67	○	←	
	62	○	→	(1) Fan Interlock
	68	○	←	
	62	○	→	Backstop Temperature
	50	○	←	
	88	○	←	Fan Stop
	60	○	→	
	60	○	→	Volt Free Alarm
	61	○	←	Volt Free Alarm
	62	○	→	Volt Free Alarm
	8	○	→	Volt Free Alarm
	8	○	←	Volt Free Alarm
	8	○	→	Volt Free Alarm
	Rx	○	←	Network Connection (f)
	Rx	○	←	
	G	○	←	
	Rx	○	→	Network Connection (g)
	Rx	○	→	
	G	○	→	
	81	○	↔	Wired Network Connection (Modbus, BACnet)
	82	○	↔	
	83	○	↔	
	N	○	↔	Network Connections (Ethernet)

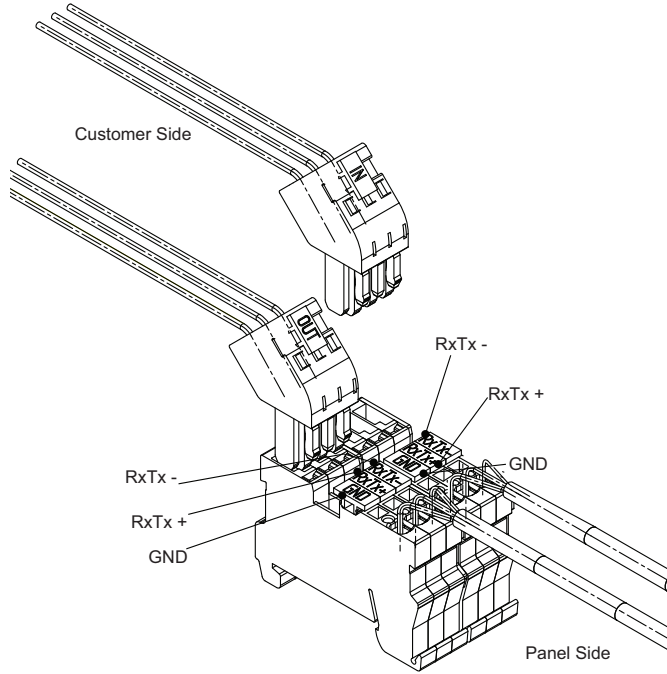
CAUTION

(1) Must be directly wired to the chiller to validate warranty

pLAN Termination

The plugged termination ensures that the connections are made simultaneously. Failure to attach the cables this way may cause damage to the controller.

Installation



Commissioning

To be read in conjunction with the commissioning sheets provided.

CAUTION	<p>Please ensure all documents have been completed correctly and return to the dealer Technical Support immediately to validate warranty.</p>
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Pre Commissioning Checklist

CAUTION	<p>Work must be carried out by technically trained competent personnel.</p>
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The equipment contains live electrical and refrigerant. Prior to maintenance or repair work the door interlocking MCCB should be in the open position and the auxiliary alarm contact for the MCCB should be linked out.
Check all work is completed and insulated where necessary.

IMPORTANT	<p>Check the rotation of electrical supply prior to running compressor as compressor is direction sensitive.</p>
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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 Compressor.
Standing pressure 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. Levels of glycol can cause freeze up problems when operating at low temperatures or during the unit start up during cold ambient conditions.
Glycol concentration is measured by use of a refractometer.

Differential Pressure Sensor

Ensure that the differential pressure sensor operates satisfactorily by doing the following:

- Reduce the flow to the chiller
- For 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 water temperature trip the following procedure can be carried out:

- With the unit running increase the low water temperature limit to the actual supply water temperature - this will trip the unit in a safe manner without affecting the evaporator
- Return the low water temperature limit to correct value after tests (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
- ID
- Port

Record any expansion valve or drier serial numbers

Controller Settings

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

- Head pressure differential (Bar)
- Minimum pressure (Bar)
- Supply set point (sat) (°C)
- Supply set point (intermitt) (°C)
- Minimum water temperature (°C)

Refrigeration

Compressor

Record on the commissioning sheet compressor details

- Type
- Serial numbers
- Load setting

Operating Conditions

Record the following operating conditions of the unit at table 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 sub temperature (°C)
- Condenser water return temperature (°C)
- Condenser water sub temperature (°C)

The supply and return water temperatures should be taken and recorded in both full and part load conditions appropriately for the unit.

Liquid Line Sight Glass

Record the status of the liquid line sight glass

- Clear/flashing
- Wet/dry (allow green)

HP/LP Trips

Check operating pressure cutout setting

Pressure cutout - At rest for 3 times when the low pressure is detected for 6 minutes

Pressure cutout -0.5 bar (29 inHg)


Differential 2.0 bar (29 inHg)

Rich (annual rest) high pressure switch -4.6 bar (212 inHg)

Differential 2.0 bar (29 inHg)

High function 13.6 bar

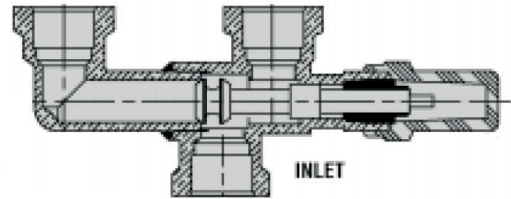
Maintenance


<p>CAUTION </p>	<p>The equipment contains electrical and moving parts. Prior to maintenance or repair work, all electrical lockout procedures are conducted.</p>
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Pressure Relief Valve

In line with BS 5442, it is recommended that the valve be replaced at least every 5 years. This interval 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, backseat 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.



<p>CAUTION </p>	<p>Set the cap on the three way valve. Do not run in suction.</p>
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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 points concerning records, settings and adjustments as necessary

	Task	Frequency		
		3 months	12 months	60 months
System	Check the following points concerning records			
	Check for unusual occurrences	●		
	Chilled water control maintains design temperatures	●		
	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 of evaporator/condenser. Clean where appropriate.	●		
	Check glycol concentration if appropriate. Adjust as necessary		●	
	Clean evaporator water trainer.		●	
	Inspect all refrigerant joints and insulation for leaks and work insulation.	●		
	Inspect all water connections for any leaks		●	
	Pressure relief valves secure.		●	
Refrigeration	Check pressure readings on suction, liquid and discharge	●		
	Check temperature readings on suction, liquid and discharge	●		
	Check high pressure control is maintained	●		
	Check liquid level control	●		
	Check each circuit for dry gas or bubbles and indication of leaks	●		
	Check pressure relief valves	●		
	Check suction	●		

Maintenance

Check the following against commissioning records, tighten and adjust as necessary

	Task	Frequency			
		3 months	12 months	36 months	60 months
Compressor Maintenance	Visually check the following				
	Securely 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 (to be more frequent dependant on usage)			●	
Electrical	Check main supply voltage		●		
	Check that electrical terminals are tight (tighten as needed)		●		
	Check for signs of discolouration on power cables		●		
	Check that fuses are as per design		●		
	Record on maintenance records				

Troubleshooting

FAULT	POSSIBLE CAUSE	REMEDY/ACTION
Unit will not start	Wired incorrectly	Check wiring connections in accordance with wiring diagram
	Wired incorrectly	Check all wiring connection terminals etc.
	Wired incorrectly	Check that the remote control is in the on position.
	Wired incorrectly	Check relay, fuses, MCB, contactor and control circuit wiring
Compressor not operating	High pressure cut-out operated (arg or complete loss of refrigerant charge)	Recover refrigerant, repair, re-charge and re-charge system
	Compressor 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. Dirty or other non-condensable gas in system	Recover excess refrigerant for re-use using correct refrigerant handling techniques. Evacuate and re-charge with new refrigerant.
Head pressure too low	Head pressure controller faulty	Check fan control module - if faulty replace.
Suction Pressure too low	Gas bubbles in gas liquid line.	Investigate for refrigerant leak, repair, re-charge, evacuate and re-charge system
	Clogged filter drier (pressure/temperature drop across)	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 which 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

Recommend 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. Water should be drained from the evaporator and condenser. Ensure refrigerant line but off valves are closed.

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

All low temperature protection devices should be turned on for a minimum of 8 hours.

These include:

- Panel heaters
- Electric trace heating

Checks should be carried out for the operation of unit components:

Water side

- 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 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.



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