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.

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) 113 239 7878 spares@airedale.com
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For information, visit us at our web site: www.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 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.

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 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.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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.

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.

- AMBIENT AIR TEMPERATURE >+30°C AND A WIND SPEED < BURNING VELOCITY
- EXISTENCE OF AN IGNITION SOURCE WITH AN IGNITION ENERGY > MINIMUM IGNITION ENERGY (61,000mJ AT 54°C)
- A CONCENTRATION OF THE REFRIGERANT IN AIR > LFL (LOWER FLAMMABILITY LEVEL) AND < UFL (UPPER FLAMMABILITY LEVEL) 5.8 Vol.% TO 11.3 Vol.% @ 60°C

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.

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.
Contents

Specifier's Guide 7
   Nomenclature 7
   Introduction 7

Unit Overview 8
   Refrigeration 11
   Evaporator and Condenser 13
   TurboCor Compressor 14
   Waterside 16
   Electrical 19
   Controls 20
   External 22

Performance Data 23
   Measurement of Sound Data 23

Design Data 24
   Glycol 24

Technical Data 26
   TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L 26
   TCW11XC1E1-S - TCW11XC1E1-G - TCW11XC1E1-L 28
   Waterside Pressure Drop 30
   Minimum System Water Volume Calculations 31

Installation Data 40
   Lifting 40
   Centre of Gravity 41
   Module Installation 42
   Standard Recommended Pipework Installation 44
   Water System 46
   Electrical 48
   Interconnecting Wiring 49
   pLAN Termination 50

Commissioning 51
   Pre Commissioning Checklist 51
   Commissioning Procedure 51

Maintenance 54

Troubleshooting 57

Storage Recommendations 58

After Sales 59
   Warranty 59
TurboChill™ Chillers

Specifier's Guide

Nomenclature

<table>
<thead>
<tr>
<th>TurboChill Watercooled</th>
<th>Circuits</th>
<th>Compressors</th>
<th>Noise Variant</th>
<th>Condenser Code</th>
<th>Evaporator Code</th>
<th>Compressor Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCW</td>
<td>1</td>
<td>1</td>
<td>R</td>
<td>C1</td>
<td>E1</td>
<td>S</td>
</tr>
</tbody>
</table>

400V 3PH 50Hz Power Supply

Introduction

The Airedale TurboChill Water Cooled chiller uses the technologically superior centrifugal TurboCor compressors designed for a cooling capacity of 150 kW to 1488 kW. 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 temperatures.

Refrigerant

The range has been designed and optimised for operation with ozone benign R34a refrigerant or R234a refrigerant.

Construction

The base shall be fabricated from galvanised steel to ensure a rigid, durable, weatherproof construction. The panels shall be manufactured from galvanised steel coated with baked powder paint to provide a durable and weatherproof finish. The standard unit colour shall be Light Grey (RAL 7035).

The compressor, condenser, and evaporator shall be mounted on a rigid galvanised heavy duty fan. Electrical panels shall be situated at one side of the unit.

Capacity data based on: nominal capacity at one to two periods

Enclosed panels should be used with enclosed units.
Unit Overview

- Oil Free Centrifugal Compressor
- Fan Assisted Ventilation Grille
- Isolator
- Economiser

Image for illustration purposes only
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 Seal Relief Valves
- Electronic Expansion Valve
- Grooved Water Connections & Counter Assembly
- Differential Pressure Sensors across the evaporator and condenser offer the same protection as Water Flow Switch.

Refrigeration
The refrigeration circuit is supplied with the following:
- Full operating charge of R134a or R1234ze 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 per compressor
- Liquid Refrigerant 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 Sensors across the evaporator and condenser offer the same protection as Switches
- Gate Operated Drain Valves
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 integrated subcooler as standard, further boosting its performance over other heat exchanger technologies.

Condenser
The starved condenser ad<br>ops a compact design, reducing footprint and refrigerant required for subcooling.

Economiser
Via the economiser, a portion of the refrigerant is evaporated and used to further subcool the bulk of the liquid refrigerant, allowing for higher enthalpy removal in the evaporator; the overall effect can increase in cooling capacity.

Should the option be selected, the 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 will 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 valve in their ability to maintain control of the suction superheat at reduced head pressures. This can lead to significant energy savings particularly at reduced loadings and low ambient temperatures. The superheat at the entry point, head pressure, and other features can be viewed and adjusted in the microprocessor display.

While offering versatile control at the full design duty of the unit, Thermostatic Expansion Valves (TEV) do not automatically optimize themselves for all operating conditions. Therefore, if the refrigeration system is operating at 40% or 50% 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 normal in conventional use.

Using an EEV allows for good refrigeration control while 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 ratio of a typical EEV is superior to that of its thermostatic equivalent, such that a reduced condensing pressure can be maintained at lower compressor load. An EEV can operate effectively between 10% and 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 unit. This can be replaced with changeable inner cores.

HP/LP Transducers and Switches

High/Low pressure switches are fitted at the unit to protect against high or low pressures. These switches are available for R34a units and automatic reset for R234a 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.

An alarm is available that monitors refrigeration pressures and determines if refrigerant is occurring. This can detect which circuit has the leak and determine an intelligent decision on potential shut down of the unit.
Evaporator and Condenser

<table>
<thead>
<tr>
<th>Evaporator/Condenser</th>
<th>System Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporator Differential Pressure Switch</td>
<td>S</td>
</tr>
<tr>
<td>Condenser Differential Pressure Switch</td>
<td>●</td>
</tr>
<tr>
<td>Evaporator Water Temperature Sensors</td>
<td>●</td>
</tr>
<tr>
<td>Evaporator Water Temperature Sensors</td>
<td>●</td>
</tr>
<tr>
<td>Dual Pressure Relief Valves</td>
<td>●</td>
</tr>
</tbody>
</table>

● Standard Feature ○ Optional Feature – Feature Not Available

Dual Pressure Relief Valve

An auto resetting pressure relief assembly shall be provided per evaporator circuit, opening at a pressure above 10.3 barg. The dual relief assembly incorporates two relief valves, one with a differential pressure relief valve, which can be individually shut off via a 3-way valve. This allows maintenance of individual 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 EN 2008-2012 clause 6.2.6.5. In accordance with EN 13136:2013, 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. EN 13136:2013 section 6.2.1 has been used to size accordingly.

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 assembly from external temperatures. This may allow the pressure relief valve to discharge efficiently and not act as a choke for any discharge.

Introduction
Compressor

TurboCor Compressor - R134a Refrigerant

Compressor
- Vibration isolating rubber mounts
- Action isolator
- Discharge non-return valve
- Line reactor (for removing additional impedance harmonics and voltage spikes in the ac waveform)
- EMI/EMC filter

TurboCor centrifugal compressor supplied 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:
  - AC-DC rectifier
  - DC capacitors
  - DC-AC (IGBT) converter
  - Motor bearing management and incorporated surge protection
  - Suction isolator
  - Magnetic bearing management
  - Compressors mounted on TurboCor vibration reducing isolating rubber mounts

Linear capacity modulation is provided by a variable frequency drive.

IMPORTANT
- Ensure input power supply is connected permanently to ensure that the refrigerant and lubricant circulating within the motor housing is not affected by unbalanced power. A dedicated power source is required.
Key benefits of TurboCor compressor technology:

- Free operation
- More efficient use of heat exchangers
- No oil entrainment issues - pipes 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
- All and light, only 32 kg
- No mechanical contact, very quiet operation
- Very low 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 are levitated 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:
  - Substantially lower at part load and inaccurate setpoint control and exact capacity match
  - The inbuilt electronic start produces a very low starting current of just 2A and eradicates the need for oversized electrical components
## Waterside

<table>
<thead>
<tr>
<th>Feature</th>
<th>S</th>
<th>G</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Water Pressure Transducers*</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Grooved and Clamped Unit Terminations</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Flanged Connections</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Manual and Actuated Isolation Valves</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Pump Interlock</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Water Flow Switch*</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

* Standard Feature  ○ Optional Feature  – Feature Not Available

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**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*
Option for a pump interlock 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.

*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 construction, enabling pipework termination. The unit is supplied with a counter pipe and coupling assembly for quick installation. Optional flanged connections available on request, please consult Airedale. Water inlet and outlet are located at the end of the unit.
Electrical Panel View

**System Configuration**

<table>
<thead>
<tr>
<th>Feature</th>
<th>S</th>
<th>G</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Soft Start</td>
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<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Slip Ring Isolation</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ultracap Power Backup</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Control Cabinet Ventilation</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ventilated Control Cabinet</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Remote Station Box</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Energy Manager Meter</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

- Standard Feature
- Optional Feature
- Feature Not Available

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Image for illustration purposes only
TurboChill™

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

- Individual mains power isolator for the compressor
- Emergency interlock isolator handle
- Bllyaccessible control components, allowing adjustment of controls at pivot point of the unit
- Circuit breaker for protection of all unit components
- Phase rotation relay incorporating phase loss protection (not fitted if energy manager selected)

The electrical power and control panel is designed 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 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 to be ramped to speed at the minimum full 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 shown available to be removed upon request subject to your own 3 phase unit isolator.

Ultracap UPS
Bit controllers are maintained by an Ultracap. The Ultracap module is an external backup device for the controller. The module guarantees power to the controller in the event of power failures and allows enough time to keep the controller running with time to change power supplies.

The Ultracap 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 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 damage by running the compressor in the wrong direction.

Energy Manager
All energy consumption can be monitored in a dedicated Energy Manager. Parameters can be adjusted in the unit processor control to affect energy usage in line with the need.
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 analog and digital control to meet a wide range of monitoring and control features including a real-time clock and industry standard communication ports and network connections.

The board features a 16-bit microprocessor, and consequently the calculation performance has 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 features an array of keys for navigation through the built-in menu.

With an 822 character (32 x 64 pixel) screen, backlit in black or white contrast, the larger screen will provide user-friendly and easy status recognition by displaying a combination of text and icons.

The default screen will show the unit status without the need for interrogation and an easy-to-navigate menu structure for further interrogation and adjustment will be provided.

**Alarm Log**

The controller will log and display, not less than the last 200 conditions recorded in descending chronological order through the keypad display.

The standard display will always display alarm messages, as an optional extra, a display with an audible alarm 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 standard options 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, features shall require no proprietary cabling or monitoring software and be 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 to allow operation of up to 4 modules (circa 1.5 MW). The loading sequence has been optimized to max for a given load, here utilize TCW modules as bare the load evenly on plate.

A single module ramps up to 60% demand, the second module becomes active and ramps up 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. All modules are active, the load is equally shared. The 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 a single module is turned off, and the remaining modules ramp 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

![Image of a TurboChill™ Chiller]

#### System Configuration

<table>
<thead>
<tr>
<th>Feature</th>
<th>S</th>
<th>G</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated Compressor Enclosure</td>
<td>●</td>
<td>○</td>
<td>●</td>
</tr>
<tr>
<td>Ventilated Compressor Enclosure Fans</td>
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<td>○</td>
</tr>
<tr>
<td>Lifting Eye Bolts</td>
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<td>●</td>
<td>●</td>
</tr>
<tr>
<td>pallet Truck Mobility</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Acoustic Enclosure</td>
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<td>○</td>
<td>○</td>
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<tr>
<td>Anti-Vibration Mounts (pad type)</td>
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</tbody>
</table>

- ● Standard Feature
- ○ Optional Feature
- $ Feature Not Available

**Dedicated Compressor Enclosure**

Units shall be supplied with dedicated compressor enclosure as standard.

**Ventilated Compressor Enclosure**

R234 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 with additional L.A.T. corner protection and cross bracing for extra transport protection. Sterling board heat treated pine material shall be used (including pallets) to comply with transport regulations (please contact Medale for this option).
Performance Data

Measurement of Sound Data

Sound data quoted have been measured in the third-octave band limited using a Real Time Analyzer 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 Directivity

The Global sound measurements 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 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.

\[ Q = p \times m \times C_p \times \Delta t \]

Where

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

### Ethylene Glycol Specific Heat

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>0% / 0°C</th>
<th>20% / -7.8°C</th>
<th>25% / -10.7°C</th>
<th>30% / -14.1°C</th>
<th>35% / -17.9°C</th>
<th>40% / -22.3°C</th>
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### Ethylene Glycol Density

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<thead>
<tr>
<th>Temperature °C</th>
<th>0% / 0°C</th>
<th>20% / -7.8°C</th>
<th>25% / -10.7°C</th>
<th>30% / -14.1°C</th>
<th>35% / -17.9°C</th>
<th>40% / -22.3°C</th>
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### Correction Factors

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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 = ρ x m x Cp x ∆t

Where

Q = Cooling Performance (kW)
ρ = Density of cooling medium (kg/m³)
m = mass flow of cooling media (kg/s)
Cp = Specific heat Capacity (kJ/kg K)
∆t = Temperature difference between Inlet and Outlet (K)

Propylene Glycol Specific Heat

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>0% / 0°C</th>
<th>20% / -7.1°C</th>
<th>25% / -9.6°C</th>
<th>30% / -12.7°C</th>
<th>35% / -16.4°C</th>
<th>40% / -21.1°C</th>
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Propylene Glycol Density

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<tr>
<th>Temperature °C</th>
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<th>20% / -7.1°C</th>
<th>25% / -9.6°C</th>
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Correction Factors

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<th>10% / -3.3°C</th>
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## Technical Data

### Mechanical

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(1) Based on unit performance at 127°C evaporator, 100% water and 30/35°C condenser return/supply temperatures
(2) Cooling Input = W / E
(3) ESEEER/SEEER based on operating conditions as defined by the Eurovent Certification Company for water cooled chillers
(4) Nominal dimensions do not include acoustical isolations external to unit
(5) Charge specified is without economiser option
## Technical Data

### Electrical

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<th>TCW11RC1E1-S</th>
<th>TCW11RC1E1-G</th>
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<td><strong>Immerison heater rating / W</strong></td>
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<td><strong>Immerison heater rating / W</strong></td>
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<td>270</td>
<td>270</td>
</tr>
<tr>
<td><strong>Quantity</strong></td>
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<td>1</td>
</tr>
<tr>
<td><strong>Motor rating / kW</strong></td>
<td>8</td>
<td>72</td>
<td>130</td>
</tr>
<tr>
<td><strong>Nominal run amps / A</strong></td>
<td>135</td>
<td>16</td>
<td>210</td>
</tr>
<tr>
<td><strong>Start amps / A</strong></td>
<td>(2) A</td>
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### Sound Data

<table>
<thead>
<tr>
<th></th>
<th>63 Hz</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
<th>8000 Hz</th>
<th>Overall [dBA]</th>
</tr>
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<tbody>
<tr>
<td>TCW11RC1E1-S</td>
<td>72</td>
<td>3.0</td>
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<td>8.1</td>
<td>5.6</td>
<td>8.2</td>
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<td>8.6</td>
<td>dB(A)</td>
</tr>
<tr>
<td>ReAr @ 0m</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>41.3</td>
<td>dB(A)</td>
</tr>
<tr>
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<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
<td>dB(A)</td>
</tr>
<tr>
<td>ReAr @ 0m</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>29.3</td>
<td>dB(A)</td>
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<td>29.3</td>
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<td>dB(A)</td>
</tr>
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<td>29.3</td>
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<td>dB(A)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**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.

---

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

---

TCW11RC1E1-S - TCW11RC1E1-G - TCW11RC1E1-L

---

### Technical Data

**Mechanical**

<table>
<thead>
<tr>
<th>TCW11XC1E1-S</th>
<th>TCW11XC1E1-G</th>
<th>TCW11XC1E1-L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Duty</strong></td>
<td>kW</td>
<td>300</td>
</tr>
<tr>
<td><strong>Nominal Input</strong></td>
<td>kW</td>
<td>516</td>
</tr>
<tr>
<td><strong>E E R</strong></td>
<td>1</td>
<td>8.4</td>
</tr>
<tr>
<td><strong>Construction Material/Colour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rating Weight</strong></td>
<td>kg</td>
<td>28</td>
</tr>
<tr>
<td><strong>Dimensions (H x W x L)</strong></td>
<td>mm</td>
<td>2000 x 1000 x 1956</td>
</tr>
<tr>
<td><strong>Machine Weight</strong></td>
<td>kg</td>
<td>238</td>
</tr>
<tr>
<td><strong>Operating Weight</strong></td>
<td>kg</td>
<td>2572</td>
</tr>
<tr>
<td><strong>Total Min. Water Flow</strong></td>
<td>l/s</td>
<td>23.6</td>
</tr>
<tr>
<td><strong>Total Max. Water Flow</strong></td>
<td>l/s</td>
<td>27</td>
</tr>
<tr>
<td><strong>Condenser - Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Min. Water Flow</strong></td>
<td>l/s</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Evaporator - Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Max. Water Flow</strong></td>
<td>l/s</td>
<td>23.6</td>
</tr>
<tr>
<td><strong>Refrigeration Capacity</strong></td>
<td>kW</td>
<td>8</td>
</tr>
<tr>
<td><strong>Refrigeration Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Refrigeration Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Min. System Water Volume</strong></td>
<td>l</td>
<td>18</td>
</tr>
<tr>
<td><strong>Max. Flow Rate</strong></td>
<td>l/s</td>
<td>16.9</td>
</tr>
<tr>
<td><strong>Min. Flow Rate</strong></td>
<td>l/s</td>
<td>14.2</td>
</tr>
<tr>
<td><strong>Max. Pressure Drop</strong></td>
<td>kPa</td>
<td>38.6</td>
</tr>
<tr>
<td><strong>Min. Pressure Drop</strong></td>
<td>kPa</td>
<td>29.6</td>
</tr>
</tbody>
</table>

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

(2) Cooling input per kW per minute

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

(4) Nominal dimensions do not include absorber isolation or external insulation to unit

(5) Charge specified is without economiser option
## Technical Data

### Electrical

<table>
<thead>
<tr>
<th>Unit Data</th>
<th>TCW11XC1E1-S</th>
<th>TCW11XC1E1-G</th>
<th>TCW11XC1E1-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nom. Eq.</td>
<td>A 135</td>
<td>16</td>
<td>210</td>
</tr>
<tr>
<td>Main A</td>
<td>A 2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Main Sp.</td>
<td>V% 400V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lc.Mains</td>
<td>A 160</td>
<td>160</td>
<td>2B</td>
</tr>
<tr>
<td>Max.Mains cable</td>
<td>m 0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Fr. Mains</td>
<td>V% 230V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lc.Fr. Mains</td>
<td>A 16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Max. Mains cable</td>
<td>m 6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Control Circuit</td>
<td>V% 24V</td>
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</tbody>
</table>

### Sound Data

<table>
<thead>
<tr>
<th>Unit Data</th>
<th>63 Hz</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
<th>8000 Hz</th>
<th>Overall [dBA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power @0m</td>
<td>69.1</td>
<td>9.4</td>
<td>6.6</td>
<td>6.8</td>
<td>3.8</td>
<td>6.1</td>
<td>31.4</td>
<td>26.4</td>
<td>42.0</td>
</tr>
<tr>
<td>Press @0m</td>
<td>35</td>
<td>39</td>
<td>36.2</td>
<td>36.3</td>
<td>44</td>
<td>42.1</td>
<td>31.4</td>
<td>26.4</td>
<td>42.0</td>
</tr>
<tr>
<td>Power @0m</td>
<td>54.1</td>
<td>58.7</td>
<td>61</td>
<td>70.2</td>
<td>78</td>
<td>71</td>
<td>65.2</td>
<td>60.9</td>
<td>79.5</td>
</tr>
<tr>
<td>Press @0m</td>
<td>54.1</td>
<td>58.7</td>
<td>61</td>
<td>70.2</td>
<td>78</td>
<td>71</td>
<td>65.2</td>
<td>60.9</td>
<td>79.5</td>
</tr>
<tr>
<td>Power @0m</td>
<td>22.4</td>
<td>29</td>
<td>29.3</td>
<td>33.6</td>
<td>46.2</td>
<td>39.3</td>
<td>32.3</td>
<td>29.5</td>
<td>42.5</td>
</tr>
<tr>
<td>Press @0m</td>
<td>22.4</td>
<td>29</td>
<td>29.3</td>
<td>33.6</td>
<td>46.2</td>
<td>39.3</td>
<td>32.3</td>
<td>29.5</td>
<td>42.5</td>
</tr>
</tbody>
</table>

1) [dB(A)] is the overall sound level, measured on the A scale.
2) Sound data measured at nominal conditions: Water In/Out 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

Graphs represent performance at 100% water.
Minimum System Water Volume Calculations

**METHOD 1**
*(Preferred Method)*

Where the permanent heat load is known, the minimum volume in litres $V_{\text{min}}$ is

$$V_{\text{min}} = \frac{\text{Water Flow Rate (litres/minute)}}{\text{Minimum Compressor Run Time (minute)}} \times \text{Chiller Loading Factor (CLF)}$$

**Water Flow Rate**

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

---

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

Permanent Heat Load = 300kW

Minimum Turndown = 75% (4 modules)

$$V_{\text{min}} = \frac{0 \times 60 \times 6.75}{3.9 \times 5 \times 300} = 2163 \text{ litres}$$

---

**METHOD 2**

Where the permanent heat load is unknown

$$V_{\text{min}} = \frac{\text{Water Flow Rate (litres/hour)}}{\text{Min. Turndown (kW) \times Min. Compressor Run Time (hour) + Internal Water Volume (litres)}}$$

**Water Flow Rate**

$$\text{Water Flow Rate} = \frac{W \times 60}{CP \times \Delta t} \times \text{0.08\%} \times \text{1.2} \times \frac{5}{60} + 274$$

---

**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 = 0.08\% (4 modules)

$$V_{\text{min}} = \frac{0 \times 600 \times 0.08\% \times 1.2 \times 5}{3.9 \times 60} = 1312 \text{ litres}$$
Installation Data

Lifting

- By lifting specialists
- Local codes and regulations relating to the lifting of this equipment should be observed
- Use the lifting eye bolts provided
- Use the appropriate spider 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

Owe liftpointspised.

The unit should be lifted from the base and made level with all packing and protection in position. Any other type of lifting used, due care should be taken to ensure that the lifting does not crush the case work.

<table>
<thead>
<tr>
<th>ABCD E</th>
<th>ALL MODELS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>6</td>
<td>1245</td>
<td>126</td>
<td>3000</td>
<td>1142</td>
</tr>
</tbody>
</table>

CAUTION

Work must be carried out by technically trained competent personnel. Prior to connecting services ensure that the equipment is installed and completely.
Installation Data

Centre of Gravity

<table>
<thead>
<tr>
<th>Model</th>
<th>luggage Mass</th>
<th>operating Mass</th>
<th>L</th>
<th>P</th>
<th>R</th>
<th>CoG</th>
<th>CoG</th>
<th>lengthCoG</th>
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</thead>
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<tr>
<td>TCW118X1ES</td>
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<td>2465</td>
<td>405</td>
<td>85</td>
<td>410</td>
<td>80</td>
<td>85</td>
<td>1225</td>
</tr>
<tr>
<td>TCW118X1ES</td>
<td>2265</td>
<td>247</td>
<td>410</td>
<td>80</td>
<td>420</td>
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<td>85</td>
<td>1220</td>
</tr>
<tr>
<td>TCW118X1ES</td>
<td>230</td>
<td>247</td>
<td>410</td>
<td>80</td>
<td>420</td>
<td>80</td>
<td>85</td>
<td>1215</td>
</tr>
<tr>
<td>TCW118X1ES</td>
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<td>247</td>
<td>410</td>
<td>80</td>
<td>420</td>
<td>80</td>
<td>85</td>
<td>1215</td>
</tr>
</tbody>
</table>

Note: The values are in millimeters (mm) and kilograms (kg).
Module Installation

The compact evaporator and condenser will be designed for a single refrigeration circuit with a nominal cooling capacity of circa 292kW (12.7°C Evap 30/35°C Cond). The evaporator and condenser will 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.

Each module will be a complete packaged water-cooled chiller independent of adjacent modules. Multiple modules can be linked together via 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 is required to access components.

In the event that multiple modules are installed directly next to each other, due to small space 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 container or even an ISO 1A0 (40 foot high cube) container. A container will 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 table and even base, levelled to ensure that the compressor operates correctly.
- Bellow should be to the
- Care maintenance clearances.
- All electrical connections are readily accessible.
- Increase maintenance clearances for side enclosed or multiple unit applications.
- Increase space for maintenance with pallet truck and the base suitable for truck movement.
Clearance

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

A - Clearance between units 800mm
B - Clearance between unit and external walls 800mm
C - Clearance for chiller maneuverability 2000mm

Anti Vibration Mounting Pad Type

<table>
<thead>
<tr>
<th>Pad Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. M16 bolt (not supplied)</td>
</tr>
<tr>
<td>2. Waber N38 (not supplied)</td>
</tr>
<tr>
<td>3. Fixing 613231</td>
</tr>
<tr>
<td>4. Anti Vibration Bd 613223</td>
</tr>
<tr>
<td>5. 2 M16 bolts (not supplied)</td>
</tr>
<tr>
<td>6. Bolt tie</td>
</tr>
<tr>
<td>7. Bolt Mounting plate</td>
</tr>
</tbody>
</table>

IMPORTANT: If the unit is mounted on a plinth, suitable fixings must be used.
Standard Recommended Pipework Installation

**CAUTION**

The below installation recommendations should be adhered to. Failure to do so may invalidate the chiller warranty. Spare parts are not supplied by the manufacturer of the three-way head pressure control valve.

---

**Condenser Head Pressure Control**

To ensure correct operation of the chiller a 3-way valve shall be installed on the condenser supply leg. The aim is to maintain the design head pressure point throughout the operation of the chiller at various loading stages 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 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 warranty. The correct operation of the flow control is critical as the chiller warranty to be valid.

---

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

- Temperature sensors
- Drain point
- Auto air vent
The head pressure control valve will be available in three sizes: DN65, DN80, or DN100, depending on pressure drop.
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.
- A single chiller installation is commissioning required per chiller.
- Balancing valves should be installed adjacent to all major items for ease of maintenance.
- Blanking caps can be installed if required to aid correct system balancing.
- A chilled water pump should be insulated and spurt sealed to avoid condensation.
- Feural unitaire installed in parallel adjacent to each other, reverse return should be added to avoid unnecessary balancing.

In multiple chillers 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.

Chilled water pump 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 system is treated to prevent corrosion and algae forming.
- Ambient below 0°C and below, where static water can be expected, or when water temperatures of 0°C or below are 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 designed to support external pipework be spurt separately for the prevention of electrolytic corrosion. Units may be moved periodically for maintenance requirements.

Grooved & Clamped Type Connection

[Diagram of Grooved & Clamped Type Connection]

1. Rubber gasket
2. Shouldered bolts
3. Clamping assembly

Split between two pipe halves

CUTAWAY SIDE-VIEW

CLOSE-UP OF JOINT AND RUBBER GASKET
Pump Statement
When installing circulating water pump equipment, the following rules should be applied:

- Ensure the system is filled with liquid and the pump primed with water before running the pump, this is required because the liquid cools the pump bearings and mechanical seal faces.
- To avoid cavitation, the NPSH (Net Positive Suction Head) incorporating a safety margin of 0.5 bar 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.

Failure to install safety devices will invalidate the chiller warranty.

Maximum System Operating Pressure
The system can safely operate at a maximum of 10 bar.

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

Filling

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.
- Ensure 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, i.e., drain point on the pump.
- If auto air vents are used then we strongly recommend an auto pressurisation unit be fitted to the system.
- Considerations must be made for the correct concentration to ensure the cooling medium is not diluted.
Installation

**Electrical**

- 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.
- Ensure correct phase rotation.
- All work must be carried out by technically trained competent personnel.
- The equipment is designed for 400V, 3 phase, 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 current under non-fault conditions at the stipulated voltage.
- Bare electrical lockoff procedures are conducted.

**CAUTION**

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

---

**IMPORTANT**

- The unit isolators do not isolate the incoming mains supply, but isolate the individual electrical circuits to facilitate the mains incoming prior to maintenance or repair work.
- Ensure electrical lockoff procedures are conducted.

---

**NOTE**

- The equipment is designed for 400V, 3 phase, 50Hz, and a separate permanent 230V, 1 phase, 50Hz supply, to all relevant IEE regulations, British standards and IEC requirements.
### Interconnecting Wiring

<table>
<thead>
<tr>
<th>L1</th>
<th>➔</th>
<th>Mains Incoming Supply 400V / 3~ / 50Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>➔</td>
<td>Sprate Equipment 230V / 1~ / 50Hz</td>
</tr>
<tr>
<td>L3</td>
<td>➔</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>➔</td>
<td></td>
</tr>
</tbody>
</table>

- 82  ➔  Operator Switch
- 86  ➔  |
- 82  ➔  Condenser Switch
- 83  ➔  |
- 82  ➔  Cell Rate ID
- 87  ➔  |
- 82  ➔  Rate Counter
- 50  ➔  Back Spint Temperature Sch
- 88  ➔  Rate Spint Sch
- 60  ➔  |
- 60  ➔  Volt Free Alarm N/O
- 61  ➔  Volt Free Common Alarm
- 62  ➔  Volt Free Alarm N/C

- 5x  ➔  Modbus Connection (1)
- 5x  ➔  |
- 5x  ➔  Modbus Connection (2)
- 5x  ➔  |
- 81  ➔  Wired Modbus Connection
- 82  ➔  Modbus Connection
- 83  ➔  |

**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.
Commissioning

To be read in conjunction with the commissioning sheets provided.

**CAUTION**

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 for 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 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 during operation at low temperatures or during the unit off state during cold ambient conditions.

Glycol concentration is measured by a refractometer.
Differential Pressure Sensor
Ensure that the differential pressure sensor operates satisfactorily, by doing this:
- Reduce the flow to the chiller
- Compare the sensor reading with the design flow rate
- 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 risking 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 number details:
- Controller type
- Address
- Serial number
- BS
- Boot
- Record any expansion valve serial numbers

Controller Settings
The below controller settings are to be recorded on the commissioning sheet:
- Head pressure differential (Bar)
- Minimum suction pressure (Bar)
- Supply set point (summer/day) (°C)
- Supply set point (winter/night) (°C)
- Minimum supply temperature (°C)
Refrigeration

Compressor
Record the commissioning details
- Type
- Serial numbers
- Overload settings

Operating Conditions
Record the following operating conditions of the unit at steady conditions:
- Suction pressure (bar)
- Liquid pressure (bar)
- Discharge pressure (bar)
- Suction temperature (°C)
- Liquid temperature (°C)
- Discharge temperature (°C)
- Superheat (K)
- Subcooling (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 1 meter 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 the status of the trip settings:
- LP cutout - Auto reset for 3 times when the low pressure is detected for 6 minutes
- LP cutout - 0.5 bar
- Differential 2.0 bar
- LP cutout - 14.6 bar
- HP switch - Manual reset
- HP switch - 13.6 bar
- HP limit function - 13.6 bar
Maintenance

The equipment contains electrical and moving parts. To ensure safe work, all electrical and mechanical 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. The 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 enables the pressure relief to be changed without the need for refrigerant recovery.

To change a pressure relief valve, back out or brand eat 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 Gas Inspection.

Shut Down Periods

For periods of winter but during the blooming season, the following precautions are recommended:

- Close the liquid and discharge ball valve.
- Cap service ports.
- Drain the water for the unit.
## Maintenance

<table>
<thead>
<tr>
<th>Task</th>
<th>3 months</th>
<th>Frequency</th>
<th>12 months</th>
<th>60 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the blower circuit connections against commissioning records.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm for unusual occurrences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilled water control maintains design temperatures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilled water flow is within design limits of zero plus 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concurrently ensure chilled water pump and flow switch operate efficiently, and that interlocks function correctly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation of water flow switch and pump interlock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check pressure drop evaporator/condenser. Clean where appropriate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check glycol concentration if appropriate. Adjust as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean evaporator water trainer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check all water connections for any leak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipework clamps are secure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration System pressure readings, suction, liquid and discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration System temperature readings, suction, liquid and discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head pressure control is maintained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid level control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check each circuit sight glass for dryness and bubbles for indication of leak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recharge relieving</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Maintenance

Check the following against commissioning records and adjust as necessary.

<table>
<thead>
<tr>
<th>Task</th>
<th>3 months</th>
<th>12 months</th>
<th>36 months</th>
<th>60 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually check the bilowg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure/tight as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tights and condition of compressor mounts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-vibration mounts fixings (if fitted)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check operation of discharge non return valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For further information refer to compressor manual which is available from Airedale on request or the TurboCor website.

<table>
<thead>
<tr>
<th>Controls</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change the compressor capacitor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change the controller battery (may be frequent dependent on usage)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for signs of discolouration on power cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for signs of discolouration on power cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for signs of discolouration on power cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record on maintenance records</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Troubleshooting

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible Cause</th>
<th>Remedy/Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit will not start</td>
<td>No power. Check power supply to the controller.</td>
<td>Check power to the controller.</td>
</tr>
<tr>
<td></td>
<td>Wired incorrectly</td>
<td>Check power connections in accordance with wiring diagram.</td>
</tr>
<tr>
<td></td>
<td>Bores</td>
<td>Check all connections and terminals etc.</td>
</tr>
<tr>
<td></td>
<td>Remote on/off</td>
<td>Check that the remote on/off is at the on position.</td>
</tr>
<tr>
<td>Compressor not operating</td>
<td>No power to compressor. Check isolator, fuses, MCBs, contactor and control circuit wiring.</td>
<td>Check isolator, fuses, MCBs, contactor and control circuit wiring.</td>
</tr>
<tr>
<td></td>
<td>Low pressure cut-out operated (large or complete loss of refrigerant charge)</td>
<td>Recover refrigerant, repair, test, evacuate and recharge system.</td>
</tr>
<tr>
<td></td>
<td>Condenser clogged or dirty</td>
<td>Recover refrigerant, perform correct refrigerant handling techniques.</td>
</tr>
<tr>
<td></td>
<td>Condenser being fault on controller</td>
<td>Evacuate and recharge with new refrigerant.</td>
</tr>
<tr>
<td></td>
<td>Condenser clogged or dirty</td>
<td>Check control module — if faulty — replace.</td>
</tr>
<tr>
<td>Head pressure too high/HP cut-out operated</td>
<td>Head pressure controller faulty</td>
<td>Check control module — if faulty — replace.</td>
</tr>
<tr>
<td>Head pressure too low</td>
<td>Water temperature too low</td>
<td>Check condenser temperature setpoint.</td>
</tr>
<tr>
<td>Suction pressure too low</td>
<td>Water temperature too low</td>
<td>Evacuate and recharge new refrigerant.</td>
</tr>
<tr>
<td></td>
<td>Liquid line</td>
<td>Evacuate and recharge new refrigerant.</td>
</tr>
<tr>
<td></td>
<td>Clogged filter drier (pressure/temperature drop across)</td>
<td>Evacuate and recharge new refrigerant.</td>
</tr>
<tr>
<td>No water flow</td>
<td>Sainere blocked.</td>
<td>Replace drier cores.</td>
</tr>
<tr>
<td>Unit not operating due to water pressure sensor low limit alarm.</td>
<td>Low flow alarm operating.</td>
<td>Check that the low flow pressure variable is set correctly.</td>
</tr>
<tr>
<td>Low temp limit alarm</td>
<td>Initial blocking in evaporator causing low flow. The water flow is reduced how the differential pressure is high till remaining healthy</td>
<td>Check that the low flow pressure variable is set correctly.</td>
</tr>
<tr>
<td></td>
<td>Insufficient glycol/water concentration or operating temperatures</td>
<td>Insufficient glycol/water concentration and add accordingly.</td>
</tr>
</tbody>
</table>
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. Water should be drained from the evaporator and condenser. Be sure refrigerant line but connections are closed.

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

1. Any low temperature protection devices must be turned on for a minimum of 8 hours. These include:
   - Panel heaters
   - Electric trace heating

2. Checks must 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: Be sure all valves are open, Carry out an inspection ensuring no refrigerant leak
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.