RTWA 108-110
Screw compressor liquid chiller, water-cooled.
Single circuit

- Packaged unit.
- Nominal cooling capacity: 130 to 180 kW (R134a, 50 Hz).
- TRANE Helirotor screw compressor.
- Microprocessor based stepless capacity control.
- “Adaptive Control™” providing superior operation reliability.
- Easy integration in a Building Management System.
- Electronic expansion valve.
- Factory tested prior to shipment.
- Designed and manufactured in accordance with the TRANE Quality Management System, approved to ISO 9001.

R134a
ODP = 0

RLC-PRC008-E4
TRANE : Number 1 in rotary compressors applications.

By introducing the RTWA, TRANE is now able to offer a complete range of liquid chillers fitted with rotary compressors covering the cooling capacity range from 50 up to 4000 kW. For the largest cooling capacities, TRANE offers the centrifugal compressor liquid chillers. These machines have an excellent reputation for reliability. A survey published in the USA in 1988 revealed that more than 90% of the centrifugal chillers installed during the 50 last years were still in operation.

For the operating contractor:
- Condenser hydraulic connections possible from both sides allowing easier integration into the plant room.
- Fully factory tested reducing the commissioning cost and labour.

For the mechanical contractor:
- Reduced sound and vibrations levels.
- Higher application flexibility: ice storage, multiple operating conditions.
- Reduced sound and vibrations levels allowing installation in sensitive areas.

For the specifier:
- RTWA : Designed to offer more attractive benefits in all areas.
  - Sophisticated operator interface: the clear language display board allows for a quick and precise identification of the operating status of the machine or of an operating fault as soon as it is detected by the unit control module.
  - Serial link allows for a remote monitoring of the chiller.

For the owner:
- Superior energy efficiency reducing operating costs.
- Increase chiller life and drastically reduced maintenance costs: the compressors have been designed to operate for the whole life of the chiller without any major maintenance operations.
- Steady and safe operation: thanks to the stepless capacity control, the electronic expansion valve and the sophisticated control algorithms, the chiller can exactly match the required cooling capacity and maintain the chiller water outlet temperature within a range of +/- 0.5°C of the setpoint.
- Serial communication link facility to start and stop the chiller, modify the setpoints or to limit the current drawn from a remote location.

For the operating contractor:
- State of the art motor protection: the unit control module permanently senses the current of each phase of the motor power supply as well as the temperature of the motor windings, thus ensuring a complete and efficient protection of the motor.
- Adaptive Control, anticipates any operating problems: the control module consequently takes corrective actions to enable the chiller to stay within operating limits to guarantee trouble free operation even under critical conditions. The unit control module is programmed to react when faced with an emergency situation such as refrigerant loss, too low evaporator water flow rate, phase imbalance or even a stuck contactor. The chiller can continue to operate at a reduced load under these critical conditions until normal operation can be restored whereas a standard chiller would just stop as a fault.
- Sophisticated operator interface: the clear language display board allows for a quick and precise identification of the operating status of the machine or of an operating fault as soon as it is detected by the unit control module.
- Serial link allows for a remote monitoring of the chiller.

For the mechanical contractor:
- Reduced sound and vibrations levels.
- Higher application flexibility: ice storage, multiple operating conditions.
- Reduced sound and vibrations levels allowing installation in sensitive areas.

The RTWA offers in many areas a combination of the most advanced technologies available today:
- Screw compressor, with stepless capacity control and 5/7 lobes rotors profiles designed and patented by TRANE.
- Advanced microprocessor based "Adaptive Control" including PID leaving chilled water temperature control and a serial communication link for easy integration into a Building Management System.
- Electronic expansion valve: Gives steadier operation, optimized evaporator efficiency and improved energy efficiency with reduced condensing pressure.
- High efficiency heat exchange surfaces: energy efficiency combined with reduced surface area.

RTWA : A combination of the latest technological innovations in the field of liquid chillers.

RTWA : Designed to offer more attractive benefits in all areas.

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TRANE Helirotor Screw compressors:
Superior energy efficiency and reliability.

- **Less critical components**: only two rotating parts, reduced number of components and particularly of critical parts (the total number of critical components is on average 30 times lower compared to a standard reciprocating chiller)
- **Rugged design**: all potentially fragile components (suction and discharge valves, springs) have been eliminated; the compressors are fitted with class 5 bearings designed not to be replaced during compressor life time. This performance cannot be compared with reciprocating compressors and even existing screw compressors which are fitted with journal bearings which require periodical overhauling to check or replace the bearings.
- **Unique rotor 5/7 lobes profiles**: patented by TRANE: only TRANE provide this specific compressor design. This specific design guarantees a superior rotor rigidity. The latest evolutions allow in particular an extended capacity control range capability.
- **High precision machining**: the very precise rotor tip tolerance (10 micrometers) is achieved due to the most advanced machine tools available today. TRANE is able to build screw compressors with a reduced amount of leakage between the high and low pressure cavities. As a result, the energy efficiency of the compressor is considerably improved compared to the first generation of screw compressors which were in some cases derived from air compression technology.
- **Rotary compressor**: reduced sound and vibration level compared to reciprocating equipments. The overall sound level is lower and furthermore the shape of the sound spectrum is different: the sound level is inferior in the low frequencies bands. The noise generated is not only less troublesome but also easier to attenuate.

**HFC 134a**

**A new non-flammable, non-toxic, chlorine-free refrigerant with zero ozone depletion potential.**

**HFC 134a** is very well suited to replace CFC 12 but also HCFC 22 in most liquid chiller applications, in particular for screw compressor comfort cooling and process chillers.

**HFC 134a** is listed in the European EINECS-inventory of approved chemical compounds for which no further toxicity testing is required by the regulation.

The voluntary toxicity testing programme which includes **HFC 134a** (PAFT 1), a cooperative research effort of the 15 leading chemicals companies in the world, was undertaken to facilitate and accelerate the phase out of CFC’s.

The PAFT programme on **HFC 134a** is now complete.

All results show that **HFC 134a** will be at least as safe as CFC 12 which has an excellent record, including in medical applications.

All PAFT members have set the recommended occupational exposure limit for **HFC 134a** at 1000 ppm, the highest level that is ever assigned to any industrial chemical. This OEL-level confirms the extremely low toxicity of this refrigerant (the OEL of HCFC 22 is 500 ppm).

Extensive research and development efforts in TRANE’s corporate R+D laboratories were necessary to adapt the proven RTWA chiller design to the environmentally acceptable refrigerant **HFC 134a**.

Suitable lubricants and sealing materials had to be identified, screened and extensively tested and their compatibility established.

The result of this R+D programme is an advanced chiller design which combines a proven mechanical concept, unmatched reliability and a safe, environmentally-acceptable refrigerant.

**Electronic expansion valve**

When coupled with Trane Adaptive Control microprocessor, the electronic expansion valve significantly improves part load performance of the RTWA chiller by minimizing superheat in the evaporator and allowing the chiller to run at reduced condensing pressures.

Chillers which use conventional TXV must run at higher head pressures and consume more power at part load than necessary. Additionally the electronic expansion valve and its control allow much better control over dynamic load and head changes. Under these conditions a conventional TXV may never achieve control stability and “huntings” and liquid slugging are common.

**Precise refrigerant flow metering**

The electronic expansion valve is actuated by a stepper motor. The exact valve position is permanently known by the Unit Control Module.

**Quick response**

To operate the valve from fully closed to fully open position requires less than 30 seconds.

This is to compare with thermo-electric devices which have no stable position and require up to several minutes to fully close.

**Superior tightness**

Because of the superior tightness of the electronic expansion valve when full closed the liquid line solenoid valve is no more required. It enables to further improve the reliability of the chiller by reducing the total number of moving parts.
**“Adaptive control™” : Trouble-free installation, start-up and operation.**

**Trouble-free operation**
The water cooled series RTWA utilizes the most advanced microprocessor control issued from the latest development in micro-electronics. Control and protection of chiller were the two functions of previous chiller control design. “Adaptive Control™” keeps the chiller on line, makes the control “intelligent”.
The “Adaptive Control™” means the system takes corrective action when any of the control variables approaches a limit condition at which the protection function of previous control schemes would normally shut down the chiller. Corrective action is achieved through combined actions of compressor unloader mechanism, electronic expansion valve modulation. Only when the control system has exhausted the corrective actions it can take and the unit is still violating an operating limit, the unit will be shut down.
The control logic of the P.I.D. type based on the leaving chilled water temperature integrates the control of variables (current draw by the motor, evaporating and condensing temperature) maintains accurate control, minimizes the drift from the setpoint and provides better building comfort.

**Improved chiller and motor protection**
The control system integrates all the functions necessary to ensure safe operation of the chiller in all applications and duty conditions:
- System safeties, such as oil, water, refrigerant pressure and temperature faults.
- Motor safeties. By monitoring the motor current on each of the 3 phases, the control system ensures protection against:
  - Overload at start-up and in operation.
  - Phase loss/Power loss.
  - Phase unbalance or reversal.
  - Over/Under voltage.
  - Welded contactors.

If a fault occurs, one of over 90 individual diagnostic and operating codes will displayed directly on the control module.

**“Adaptive Control™”, features summary**
- Ensures safe operation of the chiller.
- Keeps chiller on line.
- Optimizes total chiller power consumption.
- Ensures total chiller reliability.
- Allows easy interface.
- Minimizes service expense.

**Operator interface**
Easier than ever to use. The microprocessor is equipped with a two lines, forty character Clear Language Display. It shows over 90 operating and status points, the control panel will display the most current diagnostic message and store the last 10 for more accurate diagnosis by service personnel. Having the ability to diagnosis a problem via the control display will lower the service expense, as well as the downtime of the chiller.

**Readability**
Local operator interface with the system is accomplished using the 16 keys on the front of the Clear Language Display panel. The backlight allows the operator to read the display in low light conditions. The depression of any key will active the backlight.

**Application flexibility**
The UCM CLD is available with the output in six languages and either English or metric units.

**Communication**
The Unit Control Module (UCM) of the RTWA offers several communication levels which considerably simplify the implementation of a telemonitoring of the chiller or its integration in a Building Management System (BMS).

**Telemonitoring through a parallel link**
Analog input and output ports allow chiller operation optimization or easy chiller monitoring when the machine is not integrated in a BMS.

**Remote running and alarm contacts**
The unit provides three single pole/double-throw contact closures to indicate whether:
- a failure has occurred,
- the compressor is running,
- the compressor is running at maximum capacity. This information may be used to authorize the start of an additional chiller.

**External chilled water setpoint and current limit setpoint (option):**
The UCM allows the external setting independent of the front panel setpoint by one of the following means:
- a remote resistor (fixed or adjustable)
- a 2-10 VDC input
- a 4-20 mA input
In the same way, the motor control can be limited to optimize the total energy efficiency of the installation.

**Integration in the Building Management System through the Serial link**
The unit can be equipped upon request with a serial link communication card. All the data and functions available at the UCM front panel can be transmitted or accessed through the serial link. The integration in a Building Management or the chiller operation optimization in order to reduce the overall energy consumption are thus considerably simplified.

**Data which can be read**
Following parameters can be read by the BMS through the serial link:
- Entering leaving evaporator water temperature.
- Entering leaving condenser water temperature.
- Motor current.
- Operating status : compressor stopped or running, compressor running at full load or auto-limitation.

More than 100 data can be accessed or transmitted.

**Orders which can be sent to the chiller**
The BMS can send following orders:
- Compressor start and stop.
- Motor current limit.
- Chilled water setpoint reset.
Superior control

TRANE RTWA chiller is available with twisted pair connection to a remote control panel. Chiller operation can be controlled similarly to the control interface on the chiller itself. All through a twisted pair of wire unit can be turned on or off, change the chilled water set-point, and display over 90 diagnostics conditions.

Remote control panel can be mounted so access to chiller information is just step away and no need to go into the chilled water plant.
## Performance data

<table>
<thead>
<tr>
<th>Unit size</th>
<th>Leaving chilled water temperature (°C)</th>
<th>Leaving condenser water temperature (°C)</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTWA</td>
<td></td>
<td>Cooling Capacity (kW)</td>
<td>Power Input (kW)</td>
<td>Cooling Capacity (kW)</td>
<td>Power Input (kW)</td>
</tr>
<tr>
<td>108</td>
<td>5</td>
<td>134</td>
<td>32</td>
<td>118</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>144</td>
<td>32</td>
<td>127</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>154</td>
<td>33</td>
<td>136</td>
<td>37</td>
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<tr>
<td>109</td>
<td>5</td>
<td>148</td>
<td>35</td>
<td>131</td>
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<tr>
<td></td>
<td>7</td>
<td>159</td>
<td>36</td>
<td>142</td>
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<tr>
<td></td>
<td>9</td>
<td>171</td>
<td>37</td>
<td>153</td>
<td>42</td>
</tr>
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<td>180</td>
<td>43</td>
<td>158</td>
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<td></td>
<td>7</td>
<td>193</td>
<td>44</td>
<td>170</td>
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<tr>
<td></td>
<td>9</td>
<td>207</td>
<td>46</td>
<td>183</td>
<td>49</td>
</tr>
</tbody>
</table>

(1) With °T evaporator : 5°C, °T condenser 5°C, fouling factor : 0.044 m² K/kW, standard heat exchangers, electrical power supply 50Hz, refrigerant R134a.

## General data

<table>
<thead>
<tr>
<th>Unit size</th>
<th>RTWA</th>
<th>108</th>
<th>109</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal motor rating (kW)</td>
<td>45</td>
<td>52</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Compressor type</td>
<td>CHHB</td>
<td>70</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Capacity modulation capability</td>
<td>Continuous 100 - 20%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starting amps (1)(2) (A)</td>
<td>295</td>
<td>350</td>
<td>458</td>
<td></td>
</tr>
<tr>
<td>Maximum amps (1)(3) (A)</td>
<td>108</td>
<td>119</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>Oil heater (W)</td>
<td>150</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control circuit (VA)</td>
<td>1600</td>
<td>1600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat exchanger type</td>
<td>ES71</td>
<td>ES81</td>
<td>ES101</td>
<td></td>
</tr>
<tr>
<td>Condenser</td>
<td>CS61</td>
<td>CS81</td>
<td>CS101</td>
<td></td>
</tr>
<tr>
<td>Water content (l)</td>
<td>145</td>
<td>134</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Evaporator</td>
<td>22</td>
<td>27</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Condenser</td>
<td>14</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating charges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerant (kg)</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Oil (litres)</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating weight (4) (kg)</td>
<td>1945</td>
<td>2050</td>
<td>2080</td>
<td></td>
</tr>
</tbody>
</table>

(1) 400V/50Hz/3Ph power supply.
(2) With part winding start.
(3) To be taken in account for the sizing of power cables.
(4) With compressor sound enclosure, refrigerant and oil operating charge and heat exchanger water content.
### Dimensions

#### Unit size

<table>
<thead>
<tr>
<th>Unit size</th>
<th>RTWA</th>
<th>108</th>
<th>109</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>A</td>
<td>2630</td>
<td>2630</td>
<td>2630</td>
</tr>
<tr>
<td>Width</td>
<td>B (1)</td>
<td>865</td>
<td>865</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>B' (2)</td>
<td>1020</td>
<td>1020</td>
<td>1020</td>
</tr>
<tr>
<td>Height</td>
<td>C (2)</td>
<td>1815</td>
<td>1815</td>
<td>1815</td>
</tr>
<tr>
<td>Clearance</td>
<td>E (3)</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>F (4)</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
</tbody>
</table>

#### Hydraulic connections

- **Evaporator**: Flanges 5" / DN125 / PN16
- **Condenser 2 Passes**: Flanges 3" / DN 80 / PN16

#### Electrical connection G

- **Electrical connection G**: 130 x 300

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1. Minimum clearance for usual maintenance.
2. Minimum clearance for retubing of the heat exchangers (to be provided at either one end of the unit).

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(1) With compressor sound enclosure and disconnect switch handle removed.
(2) With compressor sound enclosure and disconnect switch handle mounted.
(3) Clearance for retubing: can be on either end of the chiller.
(4) Clearance all around the unit in order to achieved usual maintenance operations.
Water side pressure drop

Evaporator

Condenser

Water side pressure drop (kPa) vs. Water flow rate (1/sec)
GCI: Integration in a Building Management System

More and more often, the liquid chillers have to be integrated into the Building Management System and are monitored by an upper system as well as the safety and heating equipments. All the information and commands available through the serial link are directly transmitted to the BMS. To achieve this task TRANE offers the GCI (Generic Communication Interface) which provides numerous benefits.

Integration with most existing BMS systems
The GCI enables the conversion of the serial link and communication protocols used by TRANE products into a protocol which can be read by BMS. It can be either a MODBUS type protocol or a proprietary protocol from a BMS manufacturer.

Consult your local TRANE Sales Office to obtain more details about the compatibility of the GCI with the BMS installed on site.

Up to 16 chillers can be connected
One GCI can thus supervise the chillers installed on most sites.

Integration of different type of chillers
The GCI enables connection of chillers having different capacity control principles (for example reciprocating and screw compressors) and/or using different communication protocols.

Reduced commissioning expenses
The installation of the GCI lowers the first cost of the BMS equipment (compared to a traditional hard wired link connection method in particular). The number of hours of labour required by a computer specialist to write the software protocol is also reduced. In the event of additional chillers being added to the system, the cost of including them in the BMS system will be lower too.

Flexibility of use
All of the information available have been sorted in order to be processed more easily. All the set points of the chillers can be modified through the GCI by the BMS system without fitting additional equipment. This can be done on a punctual basis or on a scheduled base as a function of external parameters (time, day of the week, outside temperature, etc.).

CPM: Chiller Plant Manager

For all chilled water plant of 2 to 6 chillers, TRANE has developed the CPM which can control the operation of the complete installation: chillers, pumps, cooling towers, isolating valves, etc. CPM is a programmable module, factory configured according to the requirements of the end user. With the CPM module, TRANE can undertake full responsibility for an optimized automation and energy management for the entire chiller plant. The main functions of the CPM are:

- **Chiller sequencing:** CPM basically equalizes the number of running hours of the chillers. Different control strategies are available depending on the configuration of the installation.
- **Control of the auxiliaries:** CPM includes input/output modules to control the operation of the various auxiliary equipments (water pumps, valves, cooling towers, etc.).
- **Time of day scheduling:** CPM allows the end user to define the occupancy period, i.e. time of the day, holiday periods and exception schedules.
- **Optimization of the start/stop time of the installation:** based on the programmed schedule of occupancy and on the historical record of the behaviour of the temperatures, CPM calculates the optimal time of start and stop of the installation to get the best compromise between energy savings and comfort of the occupants.
- **Soft loading:** the soft loading function minimizes the number of chillers that are operated to satisfy the building morning pull down, thus preventing an overshoot of the actual capacity required. Unnecessary starts are avoided and the peak current demand is lowered.
- **Communication capabilities:** several communication levels are provided:
  - local, through a CRT terminal keyboard.
  - remote, through a modem. In this case, the remote station must be equipped with a PC computer.
  The CPM module can be programmed to send messages to the remote station in the following cases:
  - Analog parameter exceeding a programmed value.
  - Maintenance warning.
  - Component failure alarm.
  - Critical alarm messages. In this latter case, the message is displayed until the operator acknowledges the receipt of the information.
  From the remote station it is also possible to access and modify the chiller plant's control parameters.
- **Integration into a Building Management System:** The CPM provides a single point connection between the BMS and the entire chilled water plant equipment. The only necessary additional equipment is a GCI module.
Mechanical specifications

Packaged liquid chiller, series RTWA, fitted with one semi-hermetic direct drive screw compressor, shell and tube evaporator and condenser, microprocessor based “Adaptive control™” module, factory mounted starter panel. Units are factory run tested prior to shipment and delivered ready to operate.

General construction
Welded evaporator, condenser assembly fitted on a structural steel profiles frame. Compressor supporting plate designed to allow installation of the compressor sound enclosure on site.

Compressor and lubrication oil system
Semi-hermetic, accessible direct drive, 2050 rpm dual screw compressor with:
- Capacity control slide valve down to 20% nominal load, oil pressure actuated.
- Pressure lubricated, class 5 rolling element bearing groups support the rotor assembly.
- Squirrel cage induction motor, refrigerant suction gas cooled and hermetically sealed. Oil separator, oil cooler, oil heater and filtration devices are provided separate from the compressor. Check valves in the compressor discharge and lube oil system and a solenoid valve in the lube system are provided.

Heat exchangers
Shell and tube heat exchangers. Carbon steel shell plates and tube sheets. Tubesheets are drilled reamed and grooved to accomodate tubes. Individually replaceable tubes, mechanically expanded into tube sheets and fastened into intermediate tube supports made of carbon steel (condenser) or plastic (evaporator). Headers of high strength cast steel bolted to the tube sheets. Self energizing type gaskets requiring low bolt torque.


Refrigerant circuit
Includes: electronic expansion valve minimizing evaporator superheat, removable core filter drier, liquid line shut off valve.

Control panel
All unit controls are housed in a watertight enclosure. Removable plate on the top of the enclosure to allow customer connection of power wiring and remote interlocks. Microcomputer control provides all control functions including start-up and shut down, leaving chilled water temperature control, compressor and expansion valve modulation, anti-recycle logic and load limiting. “Adaptive Control™” microprocessor prevents unit shutdown due to abnormal operating conditions associated with low refrigerant temperature, high condensing temperature and motor overload.

Unit protective functions include loss of chilled water flow, evaporator freeze protection, low or high refrigerant pressure, reverse rotation, compressor starting and running over current, phase loss, phase imbalance, phase reversal. The Clear Language Display (CLD) eliminates coded information. Information available with the “Adaptive Control™” microprocessor includes: entering and leaving water temperatures, evaporator and condenser refrigerant temperatures and pressures, compressor suction temperature, compressor star and running hours, chilled water setpoint, over 90 diagnostic and operating conditions.

Starte panel
Part winding starter. Typically TRANE heliotor screw compressor are up to full speed in less than one second.

Rigging
4 liftings lugs are provided on the unit base frame.

Option and accessories
- Ice making module
- Communication interface/Remote control display board
- Ammeter-voltmeter
- Compressor sound enclosure
- Disconnect switch
- Pressure gauges.

Factory run tests
Pressure test on each individual component (before assembly) and on the refrigeration circuit (when fully assembled). All RTWA units are fully run tested prior to shipment, Unit operation and all controls are thoroughly checked.

Shipment
All units are ship with the refrigerant and operating charge, fully assembled and wired, ready for immediate starting. Commissioning work is limited to electrical and hydraulic connections.

Quality assurance
The Quality Management System applied by TRANE has been subject to independent third party assessment and approval to ISO 9001. The products described in this catalogue are designed, manufactured and tested in accordance with the approved system requirements as described in the Trane Quality Manual.

Trane reserves the right to alter any information without prior notice.

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