K SERIES CHILLERS

K12

STANDARD MODELS

INSTRUCTION MANUAL

Issue 1.0

ISO 9001
REGISTERED FIRM

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Contents

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1.0 Introduction

By selecting a K series chiller you have invested in many years experience in the design and manufacture of precision temperature control instrumentation.

ATC has built your K series chiller without compromise to meet the objectives of performance and reliability. Please read this manual carefully to ensure you understand the operation of the machine and how to use the unit safely and efficiently.

If you have any questions regarding installation or repair of this unit please contact ATC direct.

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For your information, all chillers comprise four functional elements:

1	Refrigeration	Provides cooling and heating to the **fluid**, also known as the **secondary refrigerant**. Repairs require specialist skills and tools.
2	Fluid handling	Includes the **pump**, but excludes the **pump motor**. Repairs require basic skills and a limited number of commonly available specialised parts
3	Electrical	Covers all electrical components, including **pump motor**, **compressor** and **alarms** or **interlocks**. Sound electromechanical skills are required.
4	Control	Comprises **controller**, **sensor** and **actuator**. Sound electromechanical skills are required.

Safety

For your safety we draw your attention to the following **Warning** and **Caution** statements throughout the manual, identified by the symbols…

 and 

respectively. The safe operation of a K series chiller remains the responsibility of the operator at all times.

Caution: *Failure to comply with a Caution will invalidate product warranty and absolve ATC from any liability, howsoever caused, and could result in permanent damage to equipment.*

Warning: *Failure to comply with a 'Warning' may result in personal injury or death. ATC does not accept any liability for injury caused through use of this equipment.*

Warning: No user serviceable parts.

Warning: Very hot surfaces, in excess of 100°C

Warning: Very cold surfaces and gases, lower than -40°C. Severe frostbite hazard.

Warning: Opening the refrigeration system may expose the operative to toxic and corrosive compounds (HFC's). Take protective measures including suitable eye protection.

Warning: Gases may exceed 300 psi (20 bar) during operation.

Warning: All refrigerants do not support combustion and are asphyxiating gases.

Warning: After switching off, the fan blades continue to rotate. Do not attempt service whilst the blades are rotating.

Warning: Always ensure the unit is isolated before service. Three phase represents increased danger from electric shock.

Warning: All chillers contain water and electricity in close proximity. Always ensure the unit is isolated before service. All K series chillers are protected from over current by the master circuit breaker. Never bypass this component.

Caution: Your K series chiller is fitted with a high pressure volumetric pump, capable of supplying fluids at 150psi. Ensure that your plumbing is compatible.

Caution: Filling/topping up of the tank should only be undertaken with the unit switched off, to prevent backflooding of the fluid.

Caution: All connections must be made with those supplied.

Caution: The high integrity refrigeration system contains no user-serviceable parts. Repair and service requires specialised knowledge and tools. Any unauthorised tampering with the refrigeration system automatically invalidates warranty.

Caution: THREE PHASE UNITS ARE NOT PHASE LOCKED, and whilst running the pump backwards will not damage the unit, the pump and compressor will not operate correctly if this is done.

1.1 Warranty registration

Caution: The warranty registration card must be completed and returned in order to activate cover. Failure to do so will limit warranty to three months from date of despatch from ATC.

1.2 Unpacking

Please check that both the packaging and the unit are undamaged. If there is any doubt, it is vital that you inform both ATC and the carrier before making a claim on the carrier. There are no hidden shipping bolts or other fixings. You should inspect the packaging for signs of transit damage before signing for the unit, and if possible unpack the unit before signing. Once you have signed for the goods, ATC cannot be held responsible for any transit damage subsequently found.

Remove the unit from its original packaging and ensure that there is no packaging left around the cooling ducts.

Please retain all packaging in the unlikely event that the chiller needs to be returned to our local representatives.

1.3 Site requirements

- **Hard, level surface.** Ideally smooth, to allow freewheeling of the castors, which are designed for indoor use.
- **Non-condensing ambient**, from +4°C to +40°C, ideally indoors. Cooling capacity is lost above 30°C.
- **Clean, dust free environment.** Air-cooled chillers move very large volumes of air. Large amounts of air-borne contamination will result in fouling of the condenser, reducing the capacity of the unit, and extreme cases may cause a system shut down.
- **Water supply (applies only to water cooled chillers).** Water cooled versions of these K series chillers all require clean process water at a flow rate of at least 10 litres per minute at a pressure of not less than 1 bar (15psi). The systems are designed for water to the chiller at 15°C. If the water available does not meet these requirements, please consult ATC for specific advice regarding your installation. Please have the following information available: **(i) cooling water flow, (ii) cooling water pressure, (iii) cooling water temperature and (iv) chiller serial number.**
- **Suitable power.** The supply requirements can be determined from the details printed on the rating plate. All ATC units are designed for a –15% to +10% fluctuation in supply voltage. Ensure that the house supply circuit breaker is suitably rated and is of the slow-blow type, since the chiller is capable of momentarily drawing ten times the current shown on the rating plate at startup.
- **Clearance** front and rear of the unit at least 500mm.

- **Outside installation.** The unit is compatible with outdoor installation, provided that shelter from direct rainfall and sunlight is provided. It is strongly recommended that Hexid A4 is used to provide baseline frost protection.
- **Plumbing** to be clean and compatible with the fluid to be used. It is advisable that the minimum of right angle bends and compression fittings are used. See also section 2.0

2.0 Installation

Having ensured that your installation meets all of the site requirements identified in section 1.3, it is best practice that the fluid lines between your application and the chiller have the following characteristics:

- *Short*
- *Large diameter* (ideally at least 12mm internal diameter)
- *Free from right angle bends*, to suppress water hammer
- *Opaque*, ideally black, to inhibit growth of algae. Alternatively, use solid copper or welded ABS. **Caution**: Never use transparent tubing.
- *Clean*. If your installation is to existing pipe work, it is good practice to flush the system with either a commercially available central heating cleaner or 5% acetic acid solution. The system should be flushed clean with tap water to remove all traces of cleaner prior to filling with Hexid.

All connections should be made using either the ATC ‘easy clamp’ or a jubilee type clip. Where threaded or compression type fluid joints are to be made, always use a suitable jointing compound such as PTFE tape.

Voltage selection

Caution: If your K series chiller is rated for multi-tap and dual frequency operation, it is essential that the voltage selector switch on the K series chiller is set to match the voltage and frequency available at your site.

Having ensured that the system is correctly connected, with the inlets and outlets having the correct orientation relative to your application, all joints tight and leak free, and with the unit isolated from the electrical supply, prepare to fill the unit with Hexid fluid.

Hexid fluids are the preferred coolant choice as they provide excellent corrosion protection, freeze protection, algae inhibition and good heat transfer properties.

Caution: Always use ATC recommended fluids in your K series chiller. Never use other anti-freeze mixtures, as they may corrode your application and will damage the K series pump seals.

Filling procedure

1. Check all valves are open, including solenoid valves located in your application.
2. Remove outer cover from the chiller, then remove cover from the tank
3. Fill with Hexid to 10mm below the rim of the tank neck.
4. Switch the unit on.
5. Wait while the fluid level drops in the tank.
6. Switch the unit off.
7. Repeat steps 3 to 5 until all of the air has been purged from the system.
8. Top up to 30mm below the rim of the tank neck to ensure the level switch is made.
9. Check the system carefully for leaks, including the inside of your application. The system is now ready to be run.

Warning: Always isolate the chiller from the electrical supply when filling the tank.

There are two on-board circuit breakers protecting the chiller. The main three phase MCB is located on the front panel. This also acts as the emergency off (EMO) and requires continuity via the terminal strip located at the rear of the unit. Should a remote EMO be required, a separate EMO may be fitted in series. The other MCB, protecting the single phase components (fans, controller and solenoid), is located to the rear of the electrical box inside the unit. See Figure 1, page 11.

Setting the maximum permissible fluid pressure

If your chiller is fitted with a rotary vane pump, it will be fitted with a pressure control valve as standard. This type of pump is ideal for small capacity chillers as it is very efficient and capable of very high pressures with little or no loss of fluid flow at higher pressures. ATC fit a pressure control valve as standard, to protect your application from damaging over pressure. **Pump types affected by the pressure control system are P5, P10 and P17**. The valve simultaneously limits the maximum permissible system pressure and the operation flow and pressure characteristics. It is important to understand that the pressure displayed during normal operation is lower than the peak pressure in a deadhead situation. In the event of blockage of a return line from the application, the pressure may exceed 10 bar (150 psi). The pressure control valve is factory set to 50 psi (1.5 bar). If your application is incapable of sustaining this pressure, the following adjustment must be made:

1. Connect a short length of flexible hose between the inlet and outlet of the chiller.
2. Following the 'filling procedure' (see earlier this section) carefully fill the tank with fluid and switch on.
3. *With the chiller running*, fold the flexible tubing back on itself, and secure with a cable tie to block the fluid outlet.
4. Read the pressure displayed on the front panel.
5. Adjust the pressure using the pressure control valve ('A' in Figure 2, page 11) until your known maximum system pressure shows on the front panel. NOTE - in optional low temperature chillers, this is metallic and covered in insulating material

The maximum system pressure attainable has now been adjusted. Please be aware that the actual running pressure will be lower than this value. If the maximum system pressure is close to the actual pressure achieved during normal operation, only a proportion of the pump's output will be supplied to your application.

Adjusting fluid flow and pressure

It is possible to change the operating pressure of the chiller, also using the pressure control valve, as follows:

1. With the chiller running, release the locking nut on the pressure control valve.
2. Turn the valve knob ('A' in Figure 2, page 11) anticlockwise to reduce the flow/pressure, clockwise to increase the flow/pressure. NOTE - in optional low temperature chillers this is metallic and covered in insulating material
3. The pressure can be observed on the gauge on the front panel.

Caution:

Changing the flow/pressure with the pressure control valve will also change the preset pressure safety setpoint. This will move to a lower pressure than the factory setting when decreasing the flow/pressure, and to a higher pressure when increasing the flow/pressure.

Caution:

When the flow/pressure is manually increased with the pressure control valve, the safety provided by the valve will be effected at higher pressures than standard. For this reason, please ensure that it is safe for your application to operate at pressures in excess of 50 psi, even if the pressure setting on the chiller reads lower than this. A blockage in your application could result in the pressure exceeding the raised safety pressure, and while the K series chiller is tested to 120 psi, your application may not be safe at this pressure.

We recommend that *pressures exceeding 100psi must never be used.*

Figure 1: MCB locations, looking from rear of chiller

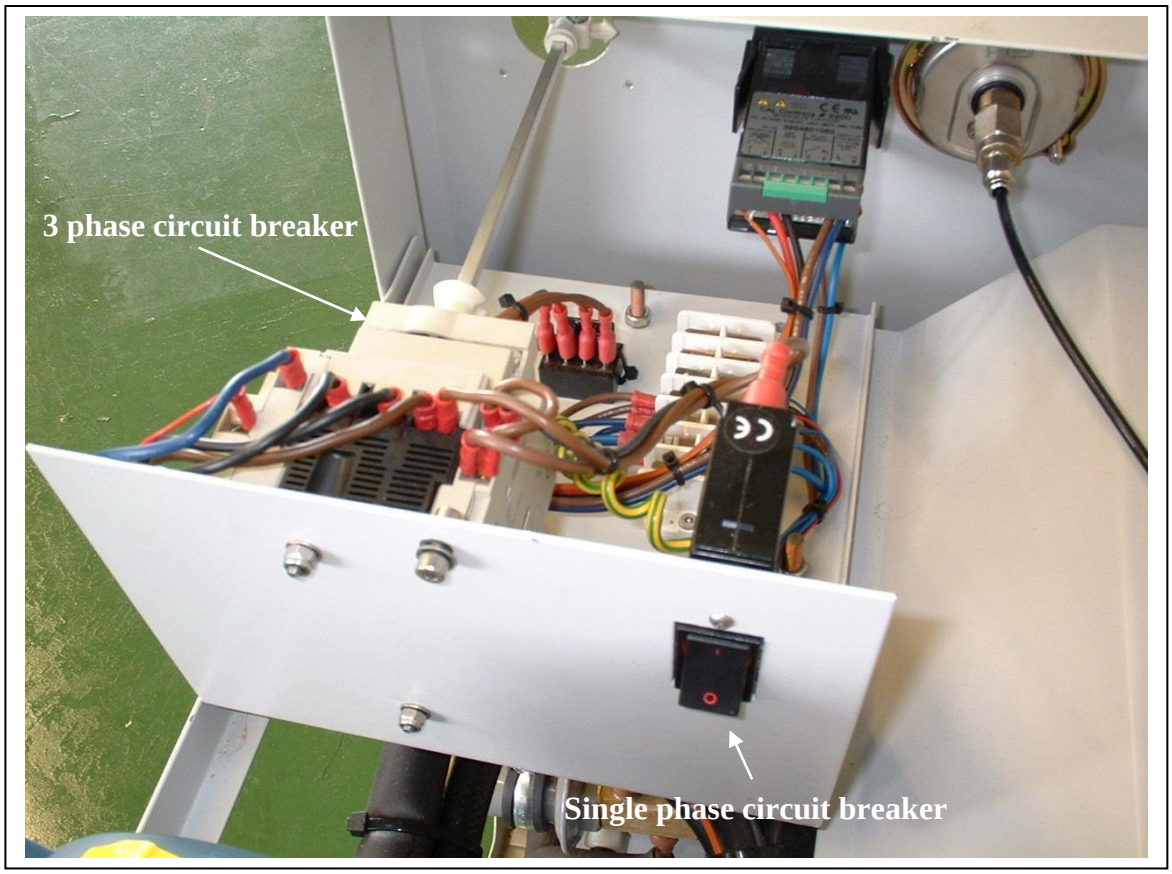
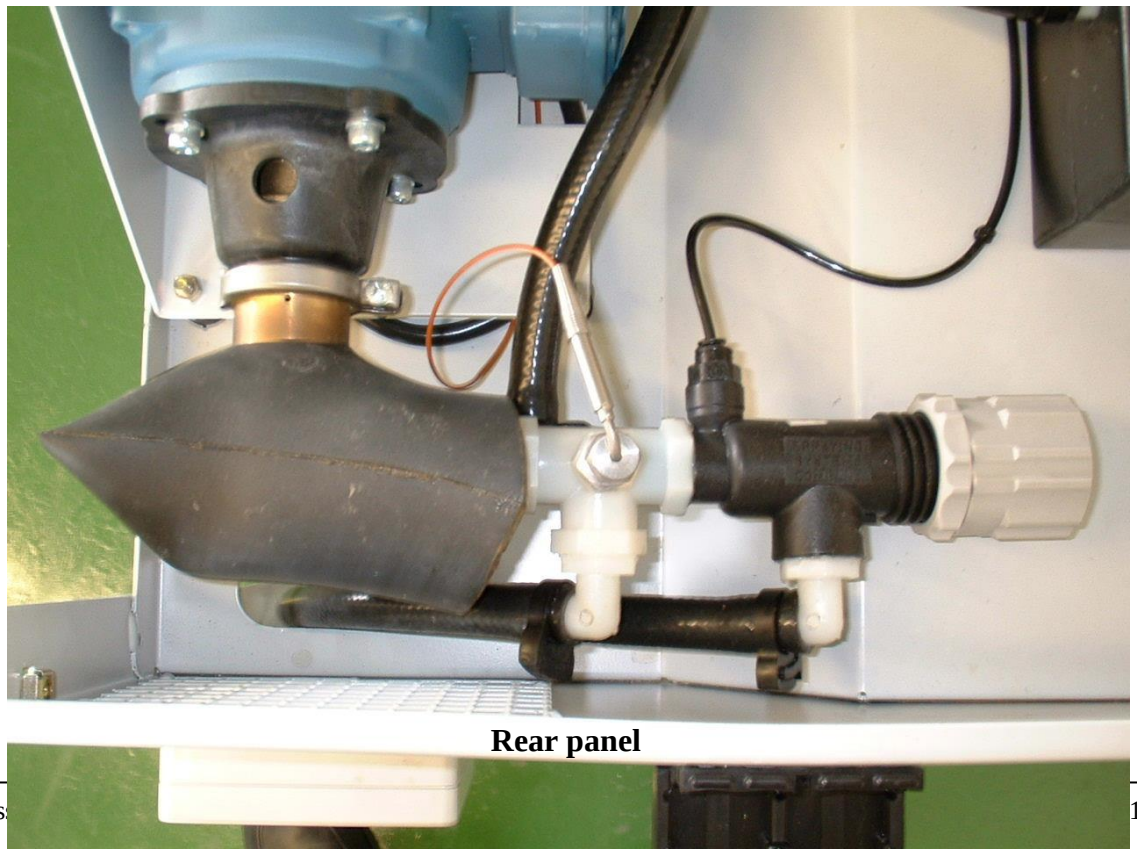


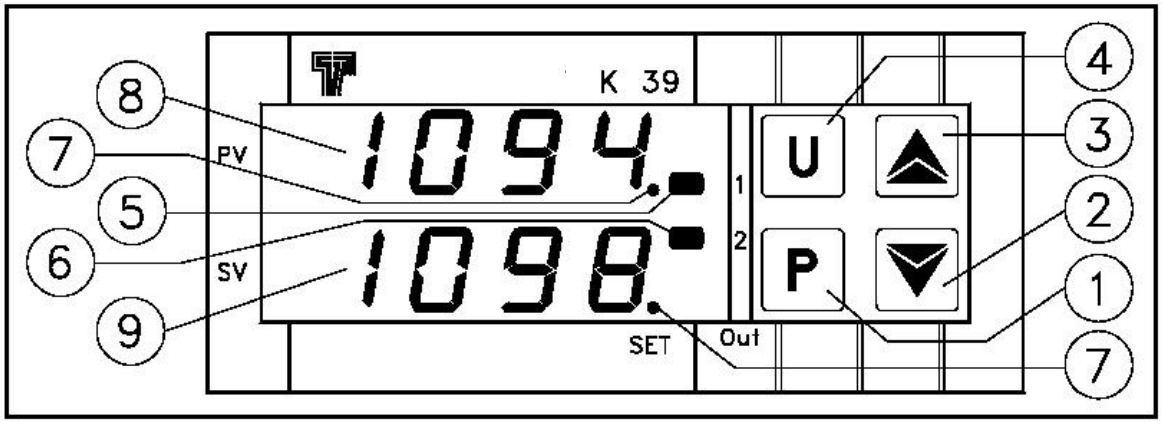
Figure 2: Pressure control valve location - viewed from above



3.0 Operation

K12 chillers have been configured to provide temperature stability to ±0.1°C.

K series chillers are fitted with a high performance 3 term PID controller, which is capable of controlling temperature to within 0.1°C of set point. In addition, there is a high and low temperature warning via the LED on the display of the controller, which is triggered if the temperature deviates more than 10°C from the set point.



3.1 – Changing the Set Point

This procedure permits rapid programming of the active Set Point and possibly the alarm thresholds.

Push the ‘P’ button, then release it. The display will flash ‘SP 1’.

To modify the set point, press the ‘UP’ button to increase it or the ‘DOWN’ button to decrease it.

Once the new set temperature is displayed Push the ‘P’ button, then release it. The value is stored automatically after approximately 10 seconds, ‘SP 1’ will continue to flash during this time.

K39 Controller error messages

Error	Reason	Action
- - - -	Probe interrupted	Verify the correct connection between probe and instrument and then verify the correct functioning of the probe
uuuu	The measured variable is under the probe's limits (under-range)	
oooo	The measured variable is over the probe's limits (over-range)	
ErAt	Auto-tuning not possible because the process value is higher (with "Func" =HEAt) than [SP- |SP/2|] or lower (with "Func" =CooL) than [SP+ |SP/2|].	Swap the instrument to OFF control (OFF) and then to automatic control (rEG) in order to make the error message disappear. Once the error has been found, try to repeat the auto-tuning.
noAt	Auto-tuning not finished within 12 hours	Check the functioning of probe and actuator and try to repeat the auto-tuning.
LbA	Loop control interrupted (Loop break alarm)	Check the working of probe and actuator and swap the instrument to (rEG) control
ErEP	Possible anomaly of the EEPROM memory	Push key "P"

If the set point is moved more than 10°C the alarm may be triggered. The alarm will silence as soon as the set and measured temperatures are within 10°C. It is only possible to set the temperature outside the preset values of +4°C and +35°C for chillers with optional high and low temperature range extensions.

4.0 Maintenance and service requirements

Caution: Failure to carry out service at the specified intervals may permanently damage your equipment.

Interval	Actions
Weekly	Check fluid level
Monthly	Check the condenser (air intake) is free from obstructions or accumulations of debris. Cleaning may be achieved with a domestic vacuum cleaner with brush attachment.*
Annually	Change the fluid. Check for fluid leaks throughout the whole system. Check the condenser for fouling.

* **Caution:** Never blow the condenser out with compressed air.

4.1 – Troubleshooting

This section outlines common refrigeration system faults. In most cases a refrigeration service technician will have to carry out the necessary repairs as these involve specialist skills and tools. It is very important that the prime cause of the problem is identified and rectified.

Whenever service or repair work is carried out on the refrigeration system, the refrigerant should be pumped into a recovery vessel if it cannot be held in the system receiver. If the refrigerant is uncontaminated, it can be re-used. Otherwise, it should be returned to the refrigerant manufacturer for recycling. Legally, companies other than refrigerant manufacturers may recycle refrigerant, but checks should be made to ensure the quality of the recycled product is acceptable. Refrigerants should not be vented to the atmosphere because of their unacceptably high ozone depletion potentials and greenhouse strengths.

The tables below address each of the symptoms listed. The left hand column gives the possible *causes*, the next column identifies *checks* that should be carried out and the right hand column identifies *actions*, which should be taken. The shaded checks and actions are those, which should only be carried out by a refrigeration service technician, and give an indication to the end user of the type of rectification necessary. Unshaded checks and actions are those, which the end user can undertake. The list is not exhaustive, but covers the most common problems encountered in commercial refrigeration.

Symptom: Chiller too warm

Cause…	Check…	Action…
Compressor not running	Power on?	Switch on
	Compressor failed?	Compare measured motor winding resistances against manufacturer's values
	Compressor start/run relay or capacitor failed?	Find reason and rectify fault
	Compressor tripped on controls or pressure switches?	Check high/low pressure trips and fluid level before repairing wiring

continued…

Symptom: Chiller too warm

Cause…	Check…	Action…
Compressor not running	Loose wiring?	Locate and correct cause of fault.
	Fuses and/or earth leakage trip OK?	Check crimped terminals
	Phase failure of 3 phase supplies	Check orientation of phases by looking at fluid flow direction.

Symptom: Chiller too warm

Cause…	Check…	Action…
Compressor is running, but under the following conditions:		
Low evaporating pressure	Refrigerant volume OK?	Find leaks, repair, add refrigerant
	Evaporator fouled?	Clean evaporator
	Evaporator iced?	Adjust defrost settings or repair defrost system
High condensing pressure	Refrigerant volume OK?	Reduce refrigerant charge
	Condenser fouled?	Clean condenser
	Fan motor/blade OK?	Repair/replace
Incorrect superheat	TEV setting correct?	Adjust TEV
Evaporator or condenser fans working incorrectly	Direction of rotation OK?	Reverse rotation
	Fan motor/blade OK?	Repair/replace
Evaporator or condenser air flow restricted	Condenser fouled?	Clear fouling from air-side face of condenser
	Fin block fouled?	Blow through fin block with compressed air, or with specialist fin block cleaner
	Evaporator fin block frozen?	Adjust defrost settings or repair defrost system
Prolonged bubbles in liquid line sight glass	Refrigerant volume OK?	Find leaks, repair, add refrigerant
	Pressure drop through filters?	Clean filters
	Condenser blockage?	Clean condenser

Symptom: Chiller too cold

Cause…	Check…	Action…
Thermostat	Temperature and differential OK?	Adjust setting to maximum level for product quality
	Thermostat / bulb damaged?	Repair/replace
Equipment runs continuously	Control circuit OK?	Correct faulty wiring/control

Symptom: Unit cycles rapidly or shuts down after short period of operation

Cause…	Check…	Action…
Thermostat	Temperature and differential OK?	Adjust setting to maximum level for product quality
LP switch	Refrigerant volume OK?	Find leaks, repair, add refrigerant
	Evaporator fouled/iced?	Clean evaporator, repair/adjust defrost system
	Water-cooled condenser control valve failed open?	Check for running water when chiller is shut down
HP switch	Condenser fouled?	Clean condenser
	Fan assembly damaged?	Repair/replace
	Poor water supply to water-cooled condenser? Failed valve?	Check cooling water supply/temperature/pressure. Check water flow out of chiller when running
	Ambient too high / inadequate air flow?	Reduce ambient / increase cool air supply to condenser
Discharge temperature protection	As for HP switch, above	As for HP switch, above

Symptom: Other malfunction

Cause…	Check…	Action…
Compressor noisy	3 phase direction OK?	Correct orientation
	Compressor mounting vibration?	Improve vibration isolation
	Compressor oil level OK?	Repair leaks, add oil
	Drive and alignment of open compressors OK?	Repair drive and/or realign motor and compressor
	Electrical supply unbalanced?	Correct supply
Condensing unit noisy	Condensing unit pipe work OK?	Improve isolation and fixing

continued…

Symptom: Other malfunction

Cause…	Check…	Action…
Condenser or evaporator fan noisy	Fixing of fan to motor shaft OK?	Tighten
	Motor bearings OK?	Lubricate or replace motor
	Fan blade OK?	Repair/replace
	Motor mounting bolts OK?	Tighten

5.0 Warranty terms and conditions

i. ATC provides a comprehensive return to base **2 year parts, 1 year labour warranty** from delivery as standard on all new K series chillers, provided that they have been installed and operated in accordance with this manual.

ii. At the discretion of ATC, goods may be serviced on site or a service loan unit may be supplied. Warranty cover excludes the cost of travel by engineers and loan unit rental charges.

iii. During the first year of the warranty period, freight costs to and from ATC are for ATC's account.

iv. During the second year of the warranty, freight costs to and from ATC are for the customer's account.

v. A purchase order is required on the Returned Material Declaration Form, which will only be charged to if there is any non-warranty work involved, or if the original packaging is not available and either an empty crate is required and/or new packaging for the repaired unit is required.

Registration

Please complete the warranty registration and return to ATC for initiation of warranty cover.

5.1 Return of goods procedure

If the unit is damaged during transit, or subsequently develops a fault requiring its return to ATC, the following procedure must be followed.

1. Call the ATC service point
   - You will be issued with a Return Materials Authorisation number ('Q number') and a Return Machine Declaration (RMD) form by fax. A copy of the RMD form on page 21 of this manual.
2. Return the completed RMD form to ATC by fax, together with your purchase order number.
3. Pack the returning item securely, enclosing a copy of the completed RMD form, and ensure that the packaging is clearly labelled with the Q number. Neither ATC nor your shipper will be liable for any damage incurred in transit.
4. Upon receipt of the completed RMD form, an engineer will be allocated or a service loan unit* will be despatched if available.

* Please note that ATC will raise an invoice as part of the service loan procedure, and you will receive a credit against this upon the safe return of the loan unit.

Address for return units:

Applied Thermal Control Ltd.
Goods Inward
Garden Court
Gee Road
Whitwick
LE67 4NB

Tel: +44 (0) 1530 839998

6.0 Dimensions and performance, K series

6.1 Dimensions and performance, K12

APPLIED THERMAL CONTROL K12
High precision recirculating chiller

Feature	**K12**
Dimensions L x W x H (Air cooled)	775 x 510 x 1130 mm
Dimensions L x W x H (Water cooled)	775 x 510 x 853 mm
Cooling capacity (fluid @ 18°C)	14000 watts
Microprocessor-based temperature controller	3 term P.I.D digital
Temperature adjustable	1°C increments
Temperature stability	+/- 0.1 °C
Temperature range	+4° to +35°C
Extended temperature range - Optional	-20° to +70°C
Digital temperature display	Standard
Temperature alarm - Standard off-set +/- 10°C	Adjustable High / Low
Low fluid level alarm Option	Visual
Low flow alarm option	Visual
Auto diagnostic functions	Controller and sensor
System volume	7 litres
Pressure control system	Standard fitment internal - user adjustable
Compatible fluids	Hexid fluids / water / propylene glycol
Fluid connections	12mm i.d. hose tails & 3/4” BSP male
Pump P10	10 Litres per minute, up to 150 psi (10 bar)
Pump P17	17 Litres per minute, up to 150 psi (10 bar)
Weight	125kg
Wheels for mobility	Standard (2 locking)
Power requirements	12 amps 415 VAC, 3ph, 50/60Hz 18 amps 208VAC, 3ph, 60Hz
Warranty	2 years parts one year labour.
Computer interface optional	RS 485 serial to modbus standard
Water cooled condenser	Optional

EC Declaration of Conformity

Applied Thermal Control Ltd.

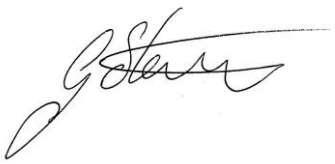
Garden Court
Gee Road
Whitwick
LE67 4NB
UK

K series chiller range (all standard configurations)

Serial Number: ……

The equipment meets the requirements of the Machinery Directive 2006/42/EC and the Low Voltage Directive 2006/95/EC

Meets the directive on Electromagnetic compatibility
89-336-EEC Specifications EN50081-1 (1992) (Emissions)
and EN50082-1 (1992) Immunity



Robert Poniatowski
Managing Director

Glenn Stevens
Production Manager

In case of repair requirement, please complete both parts of the form, and fax to ATC

Part 1: Returned Material Declaration Form

Returns Number: **Q**1_ - ___

Your Name and Address:

……
……
……
……

Your purchase order number:

……

Machine part number:

……

Machine serial number:

……

Collection for return to ATC – please tick one:

ATC to arrange shipment ☐

Customer to arrange shipment ☐

Reason for return:

……

If faulty, list symptoms:

……

Address for delivery of machine
(if different from 1, above):

……
……
……
……

Please note that a minimum non-refundable inspection fee of £60 will be charged on all equipment returned for repair with the exception of equipment still under warranty.

PART 2: HEALTH & SAFETY DECLARATION

Machine part number:

……

Machine serial number:

……

I, ……., of ……., confirm that the above unit is free from chemical, biological or nuclear hazard and that the unit presents no physical hazard, including electrical.

Signed and dated:

……

Appendix 1: Water cooled condenser option

The water-cooled condenser option is available as an alternative to the air-cooled standard version.

Chillers with a water-cooled condenser require an in-house cooling water supply, which meets the following recommended specifications:

- 10 litres/minute
- 1 bar minimum differential pressure across chiller
- 25°C maximum temperature, but lower is better

The modulation valve, which can be found behind the left hand grille towards the rear of the chiller, does not require adjustment. It is factory set to control the refrigeration system at an optimum pressure and temperature.

Coolant and house water connections
There are two pairs of water connections on the rear of water-cooled chillers. The left hand pair are the recirculating coolant connections; these are the connections for the coolant supply to your application. The right hand pair are the connections for the house water supply.

Standard configuration for both coolant and house water is

Inlet	Right
Outlet	Left

with respect to the chiller unit.

All other operation features are the same as those described in the main body of this manual.

Appendix 2: Integral deionising cartridge option

If your K series chiller is supplied with the integral deionising cartridge, it is **very important that this cartridge is replaced every three months, or when the cartridge media in the appropriate window turns from blue to brown, whichever is the sooner.**

The only approved replacement cartridge is order code WA012, available from ATC or from our authorised distributors.

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Index