PRODUCT MANUAL
TR500010

ADVECO

EB0025/EB0028/EB0030

Control Panels with Automatic Changeover, SMS and HR

Installation, Operation and Maintenance Manual

PRACTICAL, EFFICIENT & SUSTAINABLE
BUILDING SERVICES SOLUTIONS

Warnings

This manual should be read and understood carefully prior to installation or operation of any part of the EB0025, EB0028 or EB0030 control panel. Failure to read this manual or to follow its printed instructions may lead to personal injury, damage to the panel and damage to the water heating installation. These instructions should be kept in a safe and accessible place near the water heating unit.
The EB0025, EB0028 or EB0030 control panel should be stored in a safe place prior to installation to prevent damage.

Contents

Product Description

The Adveco range of EB0025, EB0028 and EB0030 control panels are complete wiring stations for a water heating installation, providing power to primary and secondary heat sources to ensure a reliable supply of hot water. Delivered prewired and ready to wall mount in an IP65-rated protective box, the panels include automatic changeover functions from duty to a backup heat sources in response to a fault, a change in hot water demand or differential tariff supplies.

All control panels include a system isolator, internal aerial, overload protection and volt-free contacts for BMS error signal support. Optional heat recovery controls are included within the panels as standard, for use with the Adveco HR001 Heat Recovery Box and Danfoss condenser units, or Scutts condenser units. Also included in each panel is a GSM module designed to keep off-site facilities management informed of any appliance faults; this will automatically send text and/or email alerts to the relevant service contacts immediately upon failure of a primary heat source, as well as delivering a periodic healthy status report.

Adveco EB0025 Control Panel:

The EB0025 control panel includes a gas to electric auto-changeover function and is designed for use with an SGE, SGS or BFC condensing gas-fired water heater with an electric backup heating element of up to 9kW capacity. This produces a highly efficient and reliable water heating solution, with a gas-fired primary heat source optionally supporting a fridge/freezer heat recovery process with additional electric immersion heater backup.

Adveco EB0028 Control Panel:

The EB0028 control panel includes an electric to electric changeover function and is designed for use with systems containing an ITE indirect electric water heater, or an IT indirect tank plus ST storage tank, with an EB0027 dual-circuit 18kW/9kW electric immersion heater. The primary electric immersion heater can be used to support an optional heat recovery process or provide the entire heating load, and contains an inbuilt 9kW backup to ensure a reliable supply of hot water. The control panel also includes a seven-day timeclock and controls for use with a destratification pump to be used for anti-Legionella purge cycling.

Adveco EB0030 Control Panel:

The EB0030 control panel includes a gas to electric auto-changeover function and is designed for use with a BFC or SGS condensing gas-fired water heater in addition to an IT indirect tank with backup electric immersion heater. The primary gas burner serves as a highly efficient source of hot water and can support preheating by optional fridge/freezer heat recovery processes, with up to 9kW of backup electric heating capacity. The control panel additionally includes a seven-day timeclock and controls for use with a destratification pump to be used for anti-Legionella purge cycling.

This system is available as a fully packaged, prefabricated solution, enclosed within purpose-built GRP housing for rooftop installation.

Installation Instructions

1. Requirements of the Installer

All installation work for this immersion heater kit must be carried out by an individual with the relevant qualifications and experiences to work with electrical systems and who is registered with an electrical regulatory body such as NICEIC, and should be compliant to:

- BS 7671:2008 IEE Wiring Regulations 17th Edition.
- BS EN 806 all parts.
- BS EN 60335-2-74, IEC 60335-2-74.
- Building Regulation Part G.
- Building Standards (Scotland) Regulations.
- Water Regulations.
- Health and Safety and Work Act 1974.
- Local Byelaws.

And any complementing or superseding documentation.
Adveco Limited accept no responsibility for failure to comply with the above or with safe working practices.

2. Location

For GSM module responsiveness, it is recommended that the control panel should be sited in an above ground area with good signal reception . Basement installations may require a remote antenna (not included).

The control panel should be mounted at an accessible height on a wall adjacent to the water heater. The wall should be strong enough to hold the panel and constructed of a suitable material to accommodate the panel fixings. Should the control panel be installed away from the water heater, additional isolators must be included near the heater and its components.

Cable connections for all panels enter through the floor of the enclosure and require 100mm of exterior clearance. All panel dimensions are included in the technical details on pages 7-9 and should be consulted prior to installation.

The EB0025 features a removable front panel and is suited for installation within cupboards or tight spaces. A minimum frontal clearance of 300mm is recommended for access.

The EB0028 and EB0030 models feature a hinged front panel. A frontal clearance of no less than 500mm must be present in order to open the panel door.

Installation Instructions

3. Installation Procedure

Warning: 400V circuits are present within the control panel. Suitable caution should be taken during the installation process.

- Remove the back panel and its mounted components from the enclosure, resulting in an empty box in order to prevent accidental damage to the components. Mark out and drill the necessary number of holes for glands on the floor of the panel. One gland is required for each cable feeding into the panel. Gland sizes must be correct for the cable they will accommodate.
- Mark out the mounting location on the wall using the supplied brackets. Drill and plug the wall, then reaffix the back panel to the box and mount the complete assembly. Ensure the box is properly assembled and securely fixed to the wall.
- A 400V rotary isolator should be installed feeding the control panel to provide means for safe isolation of the system.
- Cable sizes should be dictated by the electrical load of each component. The terminals within the control panel are of sufficient size to accommodate the largest cables that may be required.
- All cables must have correctly sized ferrules on the ends. A double ferrule must be used when two cables are used in one connection.
- All cable glands must provide mechanical protection against pull-out. Within the box the cable insulation should be cut back to near the gland.
- Unused heat recovery connections should be left empty.
- No additional link wires are required. All needed links are pre-installed.
- Following installation, the panel should be tested to and meet the requirements of NICEIC.

Maintenance Instructions

At minimum, the control panel should be checked annually by a qualified engineer. The unit must be fully isolated from the mains electricity supply prior to any inspection or maintenance work being carried out. The maintenance procedure should include at least the following checks:

- Visually inspect the interior of the panel for signs of overheating or distress. Any visible dust and dirt should be removed with careful use of compressed air only.
- Press the test buttons of all contactors to ensure free travel.
- Check the tightness of every terminal connection within the control panel, including building cable connections.
- With the panel still open, turn on the isolator and return power to the system. **Warning:** 400V/3ph power will now be live within the panel. Exercise suitable caution.
- Confirm that the lead heat source is still operational.
- Simulate a fault within the lead heat source. For an electrical unit, trip the circuit breaker supplying the primary heater. For a gas appliance, put the water heater in to fault.
- Confirm that a fault notification has been received from the GSM module. This can be done by checking with the manager of the store. Fault messages may take several minutes to arrive by email.
- Check the settings and operation of all thermostats within the system.
- Isolate the system and close the panel door.
- Check the time and programme of the programmable clock (if installed). The clock controls the destratification pump which should run no less frequently than twice per week, for two hours per cycle.

EB0025

1. Technical Details

Adveco Order Code:	EB0025
Supply:	415V/3ph/50Hz
Fault level:	10kA
Max load current:	16A/phase
Aerial:	Internal
Height:	400mm
Width:	300mm
Depth:	160mm
Weight:	5kg

Included Parts:

- E0047: Control panel with gas to electric auto-changeover function. Includes main isolator feeding a gas-fired water heater and an immersion heater, plus circuit breakers, volt-free contacts for BMS support and heat recovery options.
- E0012: GSM modem for automatic SMS or email notification of faults.

Suitable for use with:

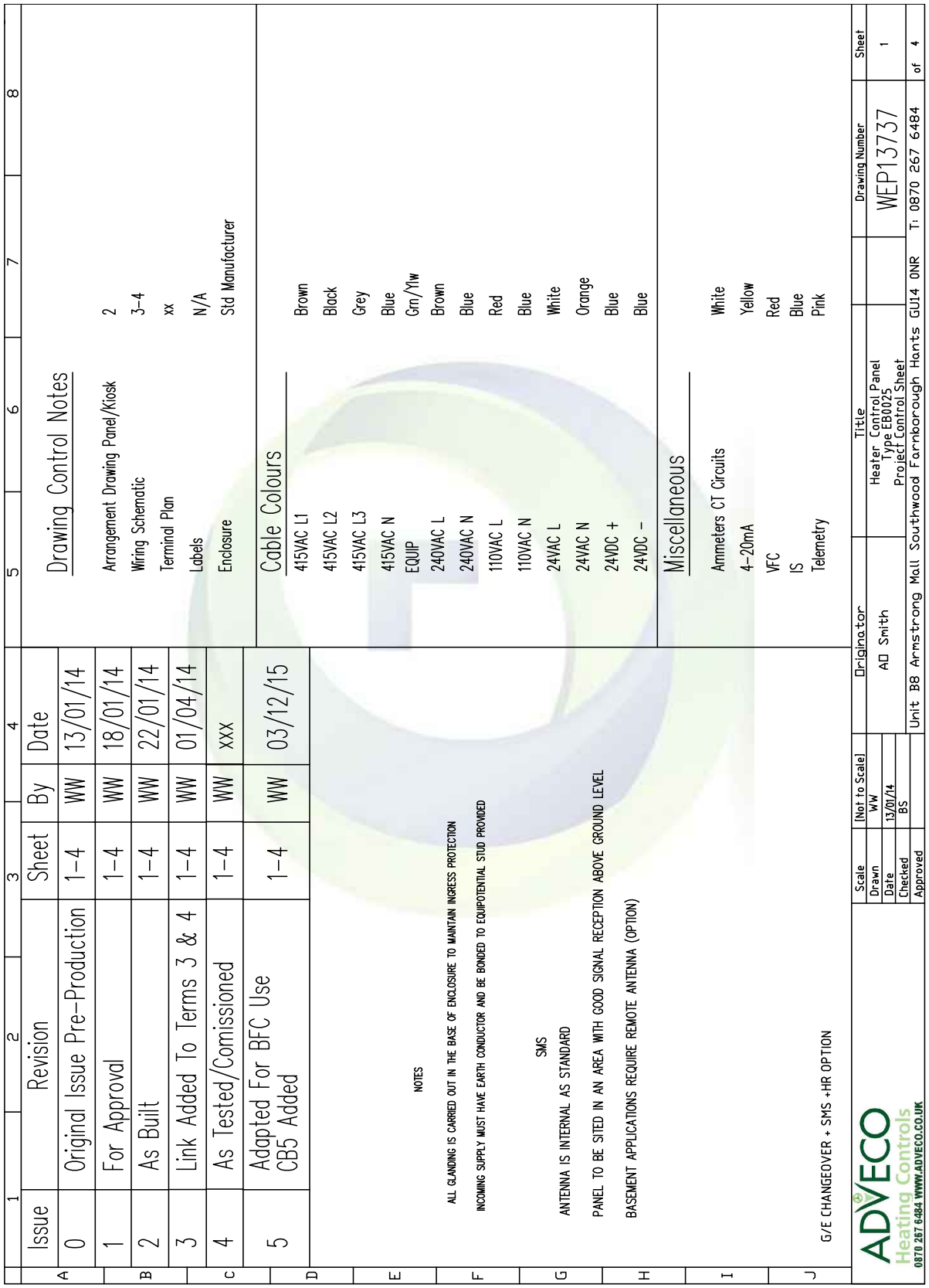
- SGE, SGS and BFC condensing gas-fired water heaters
- HR001 Heat Recovery Box

Compatible Ancillaries:

- EB0029: 9kW electric immersion heater assembly for use with BFC and SGS 30-60 water heaters
- 0304296S: 7.5kW electric immersion heater for use with SGE water heaters

EB0025

2. Wiring Diagrams



Issue	Revision	Sheet	By	Date
0	Original Issue Pre-Production	1–4	WW	13/01/14
1	For Approval	1–4	WW	18/01/14
2	As Built	1–4	WW	22/01/14
3	Link Added To Terms 3 & 4	1–4	WW	01/04/14
4	As Tested/Comissioned	1–4	WW	xxx
5	Adapted For BFC Use CB5 Added	1–4	WW	03/12/15

NOTES

ALL GLANDING IS CARRIED OUT IN THE BASE OF ENCLOSURE TO MAINTAIN INGRESS PROTECTION

INCOMING SUPPLY MUST HAVE EARTH CONDUCTOR AND BE BONDED TO EQUIPOTENTIAL STUD PROVIDED

SMS

ANTENNA IS INTERNAL AS STANDARD

PANEL TO BE SITED IN AN AREA WITH GOOD SIGNAL RECEPTION ABOVE GROUND LEVEL

BASEMENT APPLICATIONS REQUIRE REMOTE ANTENNA (OPTION)

G/E CHANGEOVER + SMS +HR OPTION

Drawing Control Notes

Arrangement Drawing Panel/Kiosk	2
Wiring Schematic	3-4
Terminal Plan	xx
Labels	N/A
Enclosure	Std Manufacturer

Cable Colours

415VAC L1	Brown
415VAC L2	Black
415VAC L3	Grey
415VAC N	Blue
EQUIP	Grn/Ylw
240VAC L	Brown
240VAC N	Blue
110VAC L	Red
110VAC N	Blue
24VAC L	White
24VAC N	Orange
24VDC +	Blue
24VDC -	Blue

Miscellaneous

Ammeters CT Circuits	White
4-20mA	Yellow
VFC	Red
IS	Blue
Telemetry	Pink

ADVECO Heating Controls
0870 267 6484 WWW.ADVECO.CO.UK

Scale: (Not to Scale)
Drawn: WW
Date: 13/01/14
Checked: BS
Approved:

Originator: AO Smith

Title: Heater Control Panel Type EB0025 Project Control Sheet

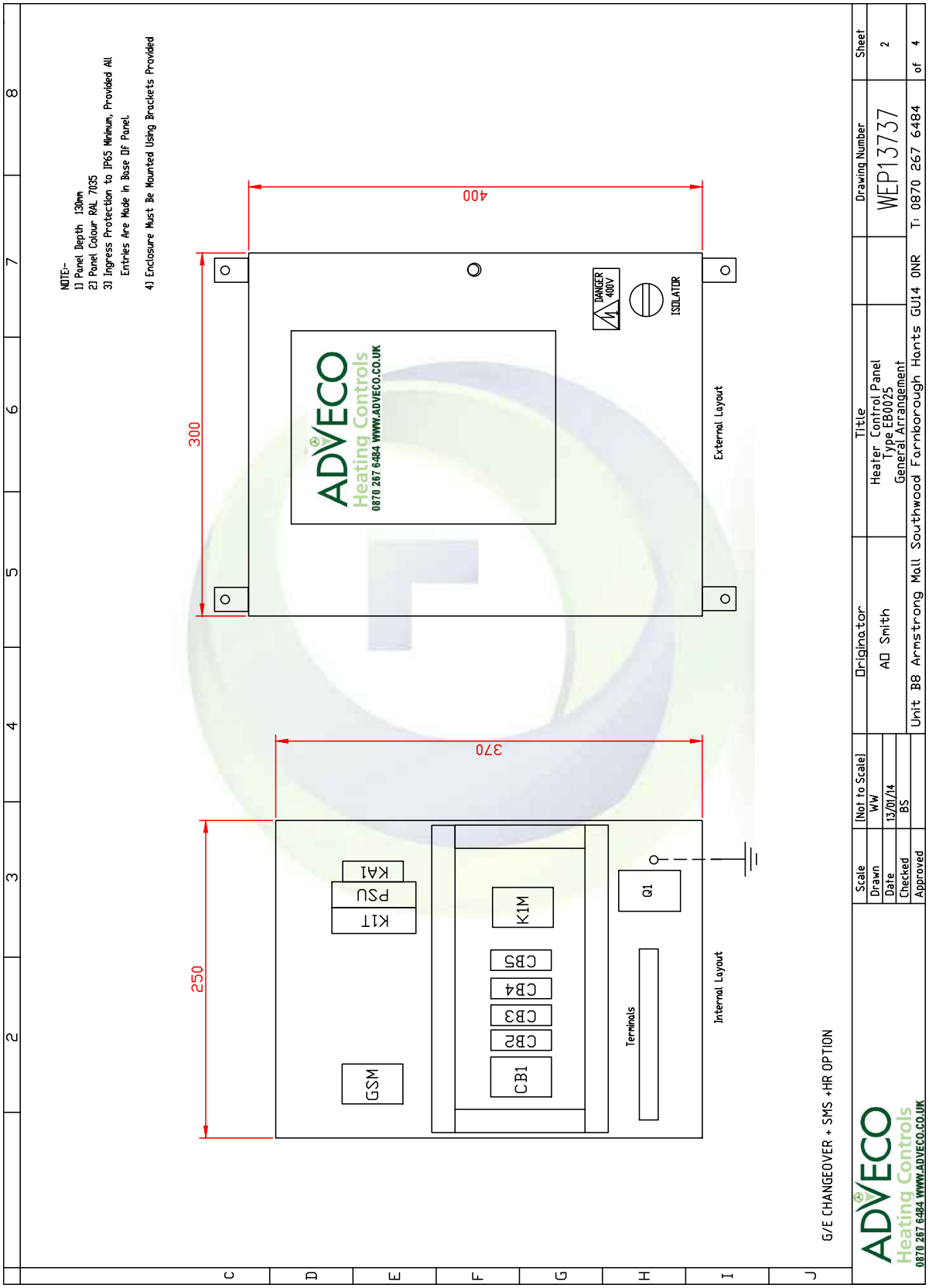
Unit B8 Armstrong Mall Southwood Farnborough Hants GU14 0NR T: 0870 267 6484

Drawing Number: WEP13737

Sheet 1 of 4

EB0025

2. Wiring Diagrams



EB0025

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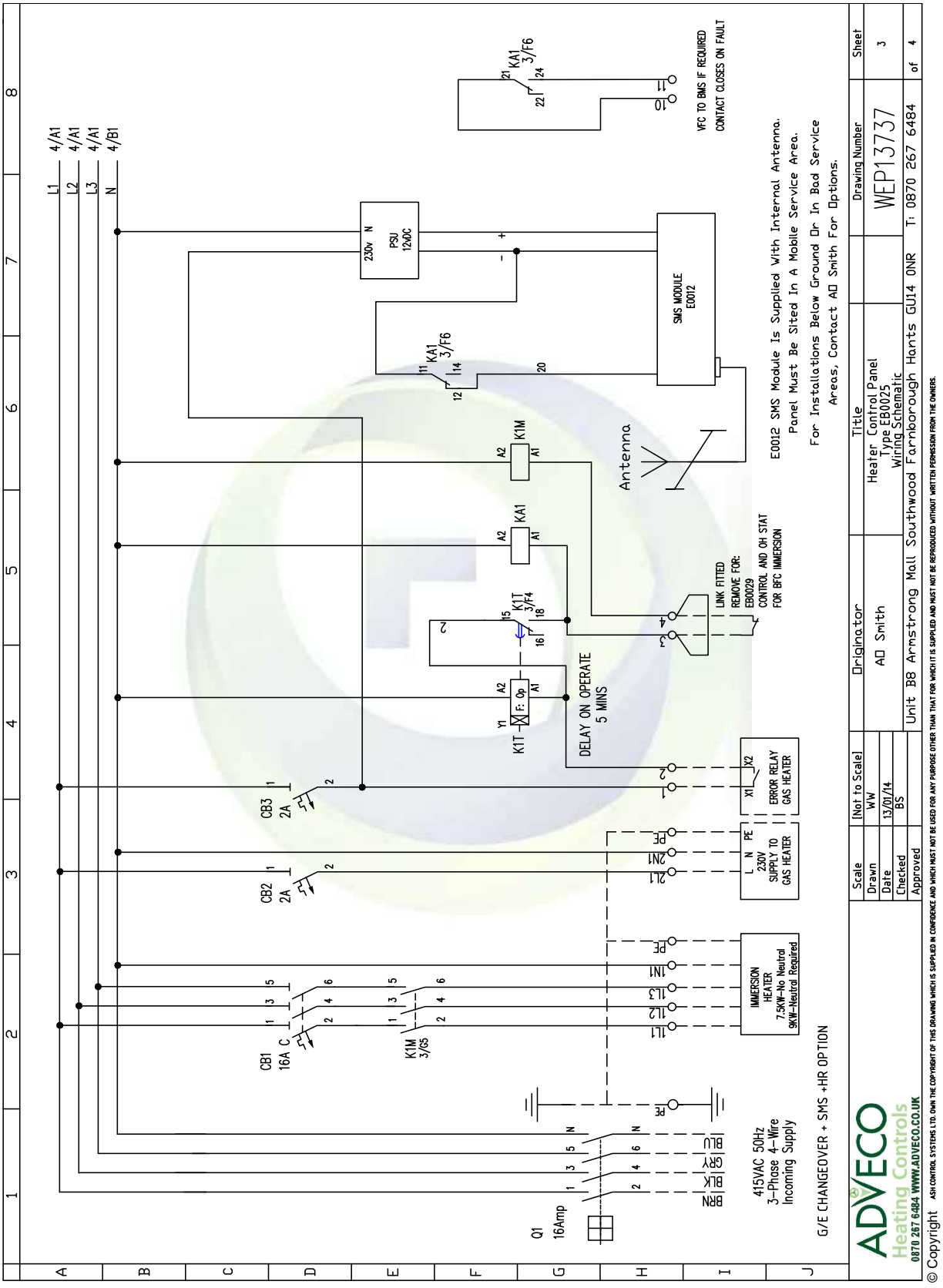

EB0025

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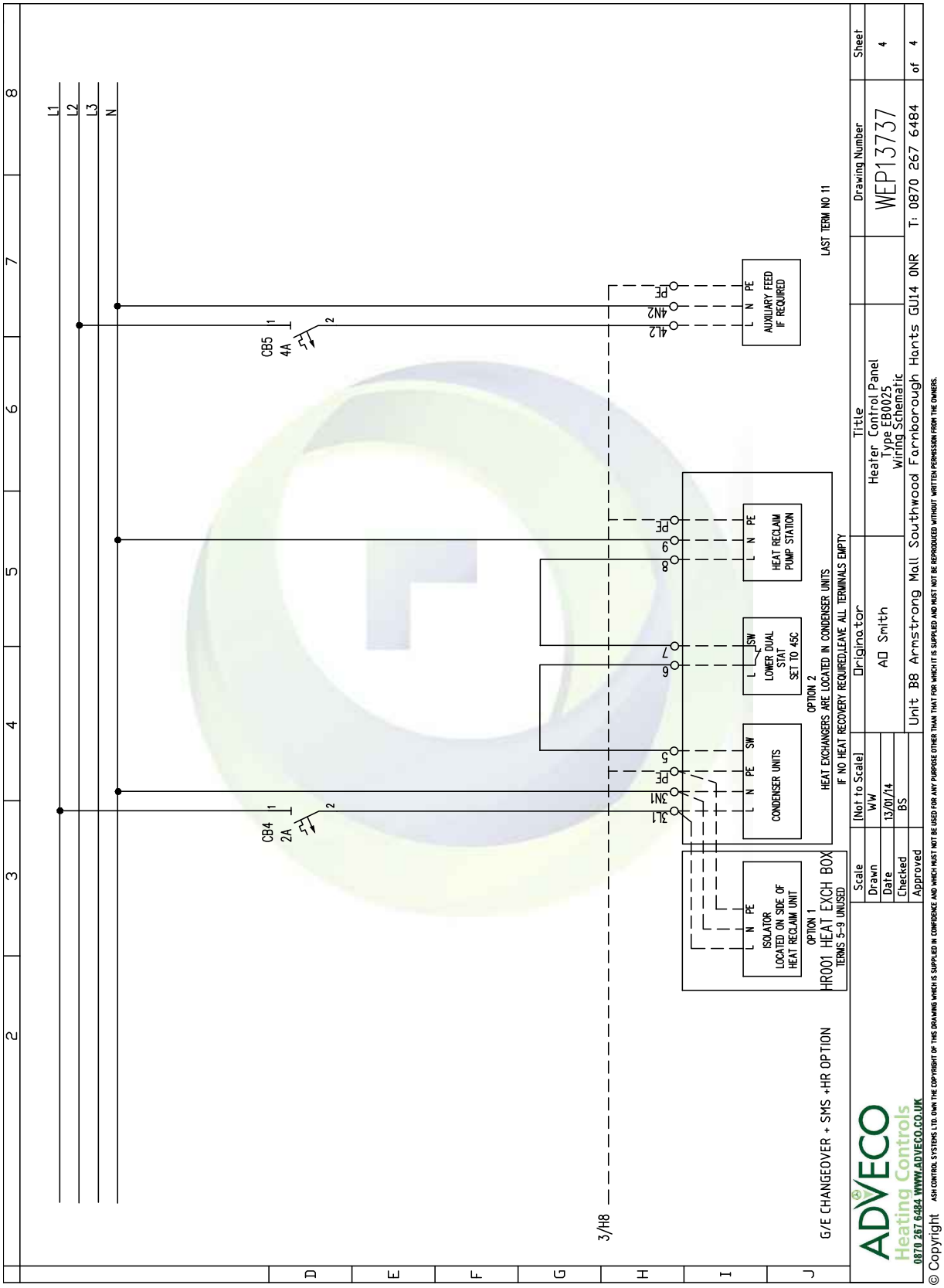

EB0025

3. Troubleshooting

Is there hot water?

NO –

Does the water heater have power?

No – Test Main Isolator on Control Panel and CB2 then SGE thermocontroller.

Yes –

Is the SGE water heater displaying a fault?

No – SGE is working, check for plumbing faults in system.

Yes –

Did the restaurant receive an email fault notification?

No – Test SMS device, CB3, KA1, K1T, Error Relay.

Yes –

Is the Standby Immersion on? (is the LED on?)

Yes – Repair SGE water heater fault, test Immersion heater.

No – Test Immersion Heater, K1M, CB1, K1T and Error Relay.

YES –

Is the SGE water heater displaying a fault?

Yes –

Did the restaurant receive an email fault notification?

No – Test SMS device, CB3, KA1, K1T, Error Relay.

Yes –

Is the Standby Immersion on? (is the LED on?)

Yes – Repair SGE water heater fault, test Immersion heater.

No – Test Immersion Heater, K1M, CB1, K1T and Error Relay.

No –

Did the restaurant receive an email fault notification?

Yes – is the restaurant running on a generator, had power cuts, or had an engineer on site carrying out any servicing activities?

No –

Does the Heat Recovery system run when the chiller or freezer runs?

No – Test Heat Recovery System.

Yes – Hot water system operating correctly.

EB0025

3. Troubleshooting

Part Name:	Immersion Heater - 7.5kW / 9kW
Adveco Part Number:	7.5kW: 0304296S / 9kW: EB0016
Function:	Immersion Heater 7.5kW provides electrical backup water heating.
Specifics:	The 9kW immersion heater is 3 phase and has the control and overheat stat built into the housing. It has a green LED to indicate running.
Fault:	If there is a fault with the immersion heater 9kW it will not operate.
Testing:	

1. With the power off, Measure resistance between 1L1/1N1, 1L2/1N1, and 1L3/1N1 in the control panel. The correct reading is 21Ω for the 7.5kW heater and 18Ω for the 9kW heater. If any phase is open circuit, replace the Immersion heater.

2. With the power on, CB1, CB2, and CB3 on, put the SGE in fault and wait 5 minutes then measure voltage between 1L1/E, 1L2/E, and 1L3/E. The correct reading is 230V. If 0V at these points, test K1M.

3. With the power on, CB1, CB2, and CB3 on, and the temperature control dial on the immersion heater turned all the way clockwise, put the SGE in fault and wait 5 minutes then measure current in cables from 1L1, 1L2, and 1L3. The correct reading is approximately 11A (but this will vary with the site voltage). If 0A to all phases then:

   With the power off remove the lid from the Immersion Heater Housing and locate the control and overheat stats. Press the reset button on the overheat stat and repeat current test. If 11A/phase found, remove the stats from the immersion housing and calibrate them with warm water. Replace if either is faulty. If still 0 Amps to all phases then:

   With the power off, and the temperature in the tank below the control and overheat set points, test continuity between terminals of the stats. The correct reading is closed circuit. If open circuit, replace faulty stat.

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3. Troubleshooting

Part Name:	BFC Error Relay Error
Wiring Diagram Key:	Relay Gas Heater
Function:	Relay within SGE/BFC water heater. Normally open, closes on fault with gas side of the water heater.
Testing:	

1. With the power off, test **continuity** between terminals 1,2 in the control panel. The correct reading is open circuit. If closed circuit, check to see if a link has been added between 1,2 in the control panel, or X1, X2 in the water heater terminal box. If not, investigate water heater.

2. With the power on and CB3 on, measure **voltage** between terminal 1 and Earth. The correct reading is 230V. If 0V, test CB3.

3. With the power on, CB2 and CB3 on, confirm that the BFC water heater is on and healthy. If the BFC is off, measure **voltage** between 2L1 and Earth. The correct reading is 230V. If 0V, test CB2. If 230V, test BFC water heater (refer to BFC manual).

4. With the power on, CB2 and CB3 on and BFC healthy, trip BFC by turning off the gas isolation valve. When the SGE goes into fault and displays an error code on the screen, measure **voltage** between terminal 2 and Earth. The correct reading is 230V. If 0V, test BFC thermocontroller (refer to BFC Manual).

Part Name:	Timer Relay
Wiring Diagram Key:	K1T
Adveco Part Number:	E00TIM M/F
Function:	Timer relay used to create 5 minute delay after the error relay closes before the immersion heater switches on and sends a fault text message to reduce nuisance messages from minor self-resetting blocking codes.
Correct Operation:	When set to Op, 60s, and 5, the unit is set to close the relay after 5 minutes (five lots of 60 seconds).
Testing:	

1. With the power off, confirm the timer relay is set to Op, 5, 60s, set correctly if necessary.

2. With the power off, test **continuity** between terminal 15/18 of K1T. The correct reading is open circuit. If closed circuit, replace K1T.

3. With the power off, test **continuity** between A2 of K1T and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.

4. With the power on, CB2 on, and CB3 on, fault out the SGE water heater and measure the **voltage** between A1 and Earth, 15 and Earth, and Y1 and Earth. The correct reading is 230V. If 0V, test CB3, and Error Relay.

5. With the power on, CB2 on, CB3 on, and the SGE water heater having been at fault for at least 5 minutes, measure the **voltage** between 18 and Earth. The correct reading is 230V. If 0V, replace K1T.

EB0025

3. Troubleshooting

Part Name:	3 Phase Contactor
Wiring Diagram Key:	K1M
Adveco Part Number:	E00CONT18230
Manufacturer's Part Details:	Schneider
Function:	K1M switches Immersion Heater 7.5kW / 9kW on when the coil is energised.
Specifics:	K1M Contactor should operate 5 minutes after the BFC/SGE water heater goes into fault mode.
Fault:	If K1M is faulty the backup immersion heater will not switch.
Testing:	

1. With the power off, test **continuity** between terminals 1L1 and 2T1 of K1M. The correct reading is open circuit. Next test **continuity** between terminals 1L1 and 2T1 while pressing the contactor test button. The correct reading is closed circuit. Repeat tests for 3L2/4T2 and 5L3/6T3. If the continuity is not correct, does not change or the test button is stuck, replace K1M.
2. With the power off, test **continuity** between A2 of K1M and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.
3. With the power on and CB1 on, measure the **voltage** between 1L1/E, 3L2/E, and 5L3/E. The correct reading is 230V. If 0V, test CB1.
4. With the power on, CB2 on, and CB3 on, fault out the BFC/SGE water heater, wait 5 minutes and measure the **voltage** between A1 and Earth. The correct reading is 230V. If 0V, test CB3, K1T, Error Relay, and the link or stat between terminals 3/4.
5. With the power on, CB2 on, CB3 on, the BFC/SGE water heater in fault and 230V on A1, measure the **voltage** between 2T1/E, 4T2/E, and 6T3/E. The correct reading is 230V. If 0V, replace K1M.

EB0025

3. Troubleshooting

Part Name:	240V Relay
Wiring Diagram Key:	KA1
Adveco Part Number:	E00P REL 230
Function:	KA1 changes state when there is a fault. This causes the SMS device to send out fault notification. It also closes the BMS fault contacts.
Specifics:	Relay KA1 becomes energised 5 minutes after a BFC/SGE fault.
Testing:	

1. With the power off, test **continuity** between terminal 11 to 12 of KA1. The correct reading is closed circuit. If open circuit, replace KA1.
2. With the power off, test **continuity** between terminal 21 to 24 of KA1. The correct reading is open circuit. If closed circuit, replace KA1.
3. With the power off, test **continuity** between A2 of KA1 and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.
4. With the power on, CB2 on, and CB3 on, fault out the SGE water heater, wait 5 minutes and measure the **voltage** between A1 and Earth. The correct reading is 230V. If 0V, test K1T.
5. With the power on, CB2 on, and CB3 on, fault out the SGE water heater, wait 5 minutes and test **continuity** between 11 and 12. The correct reading is open circuit. If closed circuit, replace KA1.

Part Name:	SMS Module
Adveco Part Number:	E0012
Manufacturer's Part Details:	Enfora MT1200, MT2500 or MT4000
Function:	To send a text message to a prearranged number when a system fault occurs which is turned into an email and sent to the store and other places.
Specifics:	Systems sold before January 2016 are likely to contain MT2500 models. From January 2016 onwards, systems are likely to contain MT4000 models. Newer systems may contain the MT1200. Operation and maintenance is the same in both cases.
Testing:	

1. With the power on and CB3 on, confirm there are two green LED's on the SMS device. If there are none, test Power Supply. If there is only one, the SMS device has no mobile service.
2. With the power on, CB3 and CB2 on, put the BFC/SGE into fault and ask the store manager if a fault email is received within 10 minutes. If not, pull the connector cable from the SMS device and see if the store receives an email within 10 minutes. If an email is received, test KA1. If an email is not received, call AO Smith to check if a text message has been received and take advice from there.

EB0025

3. Troubleshooting

Part Name:	Circuit Breakers
Wiring Diagram Key:	CB1 through CB
Manufacturer's Part Details:	Schneider
Function:	Circuit breakers protect the circuits from over current. They come in single phase or three phase blocks. They are rated in Amps based on the load they supply.
Testing:	

1. With the power on and the circuit breaker switched to off, measure the voltage between the top terminals of the breaker (terminal 1, plus terminals 3 and 5 for three phase breakers) and Earth, and then the bottom terminal (terminal 2, plus terminals 4 and 6 for three phase breakers) and Earth. The correct readings are 230V on the live side 1,3,5; and 0V on the load side 2,4,6. If 0V on the live side, test Main Isolator. If 230V on load side replace circuit breaker.

2. With the power on and the circuit breaker switched to on, measure the voltage between the load terminal (terminal 2) of the breaker and Earth, repeat for terminals 4,6 for three phase breakers. The correct reading is 230V. If 0V replace Circuit Breaker

3. Put a load on the breaker by switching on the immersion heater or other downstream component. If the breaker trips investigate the components and the wiring for a short. Swap two equal rated breakers if no fault can be found to test for breaker fault or system fault.

EB0025

3. Troubleshooting

Part Name:	Power Supply Unit
Wiring Diagram Key:	PSU
Adveco Part Number:	E00PSU230/12
Function:	To provide 12V DC to the SMS device.
Testing:	

1. With the power on and CB3 on, measure the voltage to the power supply at terminals L, N. The correct reading is 230V. If 0V, test CB3.

2. With the power on and CB3 on, measure the voltage from the power supply between terminal +V and –V. The correct reading is 12V DC. If outside of range of 12 ± 4V, then replace power supply.

Part Name:	Heat Recovery System – HR001
Adveco Part Number:	HR001
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the heat recovery box. The heat recovery box includes the controls and pumps necessary to run the heat recovery system.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery box between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.
2. With Voltage at terminal 3L1, the heat recovery system should operate. If not, tests must be carried out within the HR001 on the controllers and pumps. Ensure there is fluid in the system.

EB0025

3. Troubleshooting

Part Name:	Heat Recovery System – Fosters/Scutts
Manufacturer's Part Details:	Scutt's Condender Units
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the condenser. When the compressor runs, it is wired to pull in a relay. This will cause the motorised zone valve to open. When fully open the microswitch within the motorised valve will close providing a switched live back to the control panel. This switched live will operate the pump station PS1.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery system between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.

2. With the power on and CB4 on, and both Fosters condenser units isolated (off on both isolators), measure the voltage for the switched live between terminal 9 and Earth. The correct reading is 0V. If 230V is present, check the state of the motorised valve: If indicator is perpendicular with the pipe then replace the motorised valve. If the indicator is in line with the pipe then further checks are necessary to see if the valve orientation is wrong (valve moves opposite to the way it should), or if the valve is faulty (will not move).

3. With the power on, CB4 on, and one Fosters unit powered on and running, measure the voltage between terminal 9 and Earth. The correct reading is 230V. If 0V, test relay and motorised valve in condenser unit.

4. With the power off, test continuity between terminals 6 and 7. The correct reading is closed circuit. If open circuit, check dual stat over heat has not tripped, and tank temperature is below set point. Replace Dual Stat if faulty.

5. With the power on, CB4 on, the fridge or freezer on, and 230V at terminal 9, measure the voltage between terminal 8 and Earth. The correct reading is 230V. If 0V, further tests on the Dual Stat are necessary.

6. With Voltage at terminal 8 the pump station should run. If not, test the pump, also ensure system has fluid in it.

EB0028

1. Technical Details

Adveco Order Code:	EB0028
Supply:	415V/3ph/50Hz
Fault level:	10kA
Max load current:	30A/phase
Aerial:	Internal
Height:	500mm
Width:	400mm
Depth:	210mm
Weight:	5kg

Included Parts:

- E0049: Control panel with electric to electric auto-changeover function. Includes main isolator feeding two independent immersion heaters, plus circuit breakers, volt-free contacts for BMS support and heat recovery options.
- E0012: GSM modem for automatic SMS or email notification of faults.

Suitable for use with:

- IT, ITE and ITS 300-1000 range of indirect water heaters
- ST 300-1000 storage tanks
- SSB, SSI and SST 500-2500 range of stainless steel cylinders
- HR001 Heat Recovery Box

Compatible Ancillaries:

- EB0027: Dual circuit 18kW + 9kW electric immersion heater assembly for ST/IT/ITE/ITS 300-500 and SSB/SSI/SST 500-2500
- EB0018(A): 18kW electric immersion heater assembly for all above vessels
- EB0016(A): 9kW electric immersion heater assembly for all above vessels
- Other lower capacity immersion heater assemblies are available as required.

Issue	Revision	Sheet	By	Date
0	Original Issue Pre-Production	1-4	WW	11/03/14
1	For Approval	1-4	WW	18/03/14
2	As Built	1-4	WW	24/03/14
3	As Tested/Comissioned	1-4	WW	xxx
4	CB3 Aux Added	1-4	WW	27/05/14
5	NVR And E0010 Added	1-5	WW	16/01/15
6	NVR Removed	1-5	WW	27/05/15
7	System Healthy Led Added	5	WW	24/08/16

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ALL GLANDING IS CARRIED OUT IN THE BASE OF ENCLOSURE TO MAINTAIN INGRESS PROTECTION

INCOMING SUPPLY MUST HAVE EARTH CONDUCTOR AND BE BONDED TO EQUIPOTENTIAL STUD PROVIDED

SMS

ANTENNA IS INTERNAL AS STANDARD

PANEL TO BE SITED IN AN AREA WITH GOOD SIGNAL RECEPTION ABOVE GROUND LEVEL

BASEMENT APPLICATIONS REQUIRE REMOTE ANTENNA (OPTION)

TYPE 18/9 CHANGEOVER + SMS +HR OPTION

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415VAC L2	Black
415VAC L3	Grey
415VAC N	Blue
EQUIP	Grn/Ylw
240VAC L	Brown
240VAC N	Blue
110VAC L	Red
110VAC N	Blue
24VAC L	White
24VAC N	Orange
24VDC +	Blue
24VDC -	Blue

Miscellaneous

Ammeters CT Circuits	White
4-20mA	Yellow
VFC	Red
IS	Blue
Telemetry	Pink

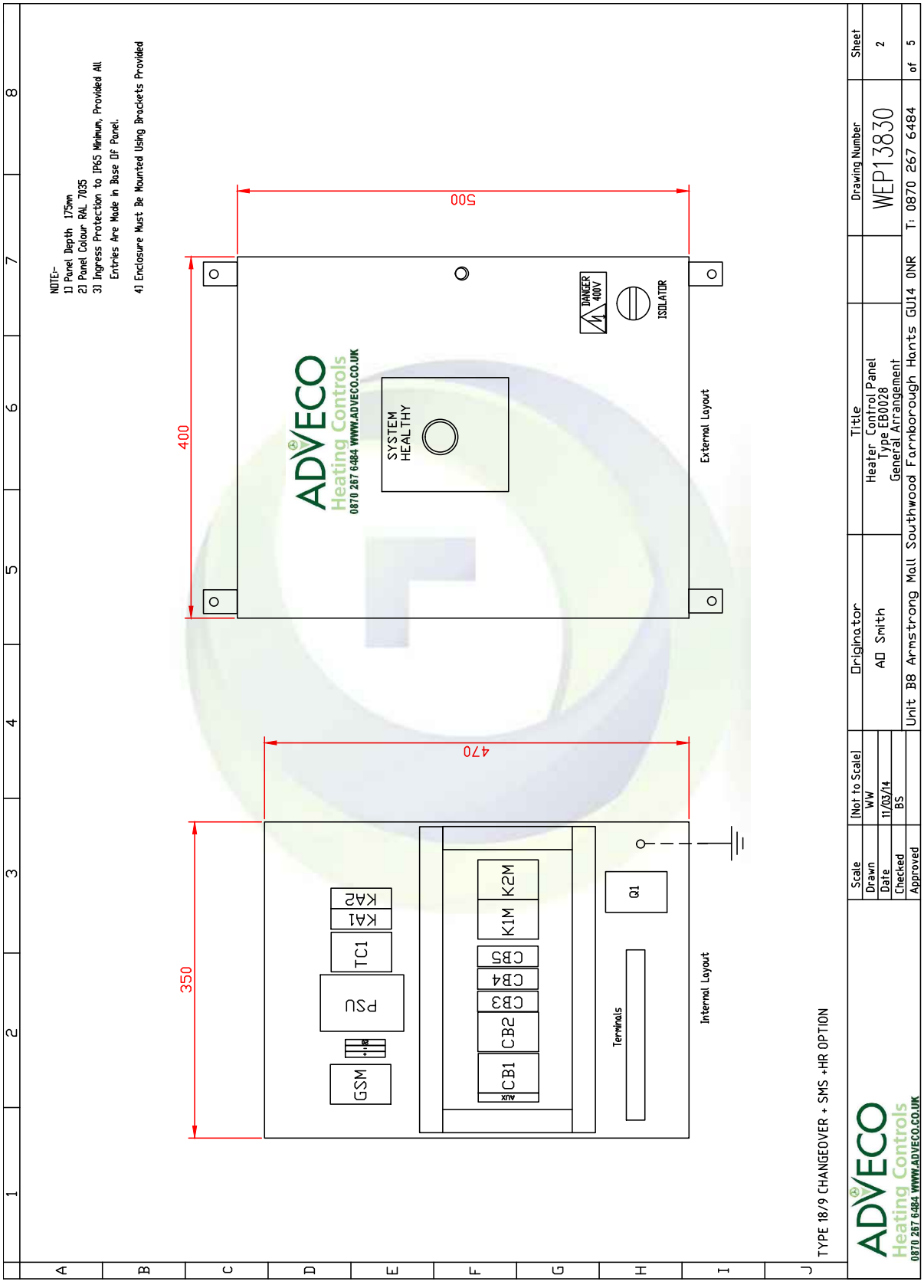
ADVECO Heating Controls
0870 267 6484 WWW.ADVECO.CO.UK

Scale	[Not to Scale]
Drawn	WW
Date	11/03/14
Checked	BS
Approved	

Originator	Title		Drawing Number	Sheet
AO Smith	Heater Control Panel Type EB0028 Project Control Sheet		WEP13830	1
Unit B8 Armstrong Mall Southwood Farnborough Hants GU14 0NR		T: 0870 267 6484		of 5

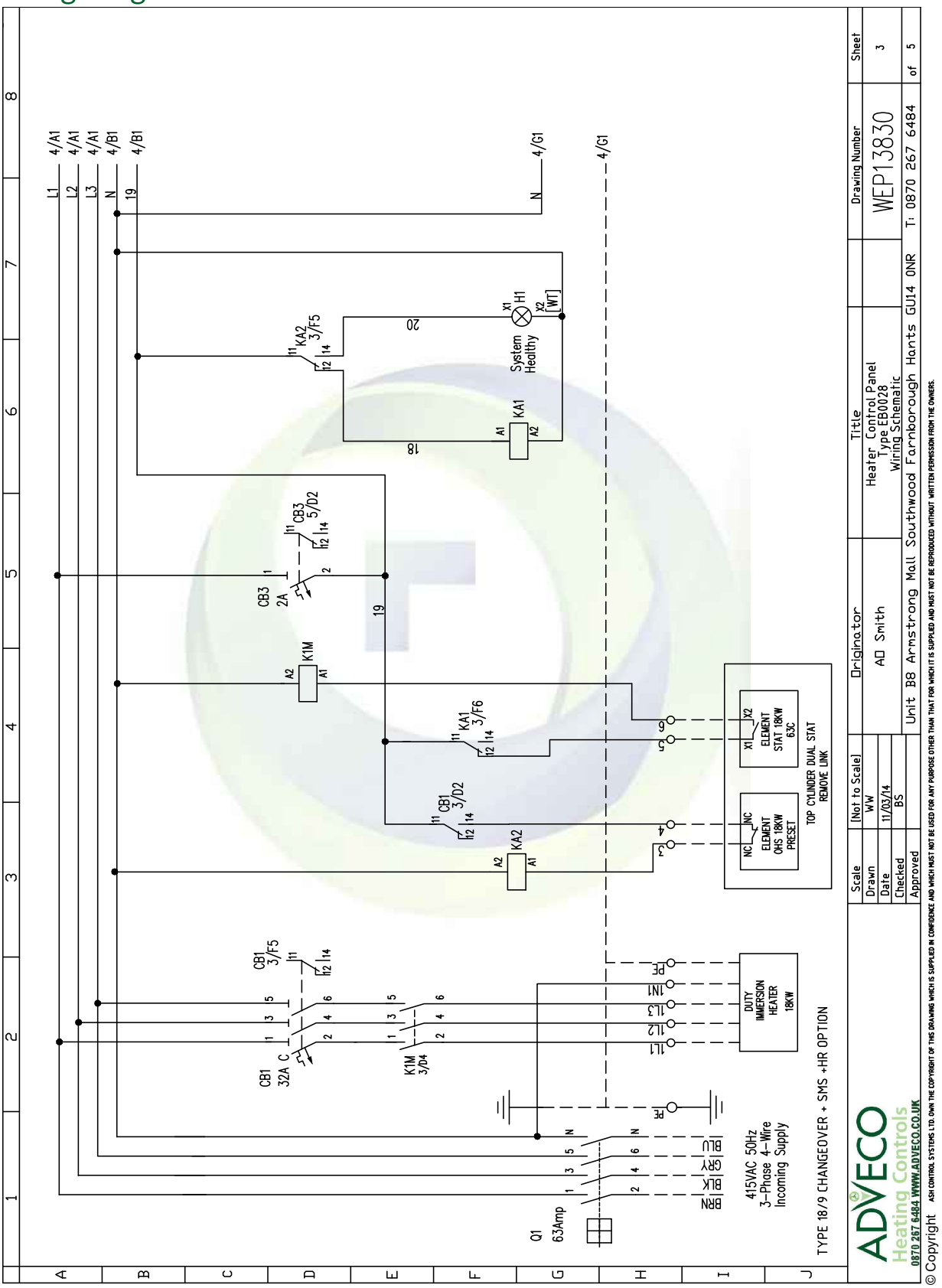
EB0028

2. Wiring Diagrams



EB0028

2. Wiring Diagrams



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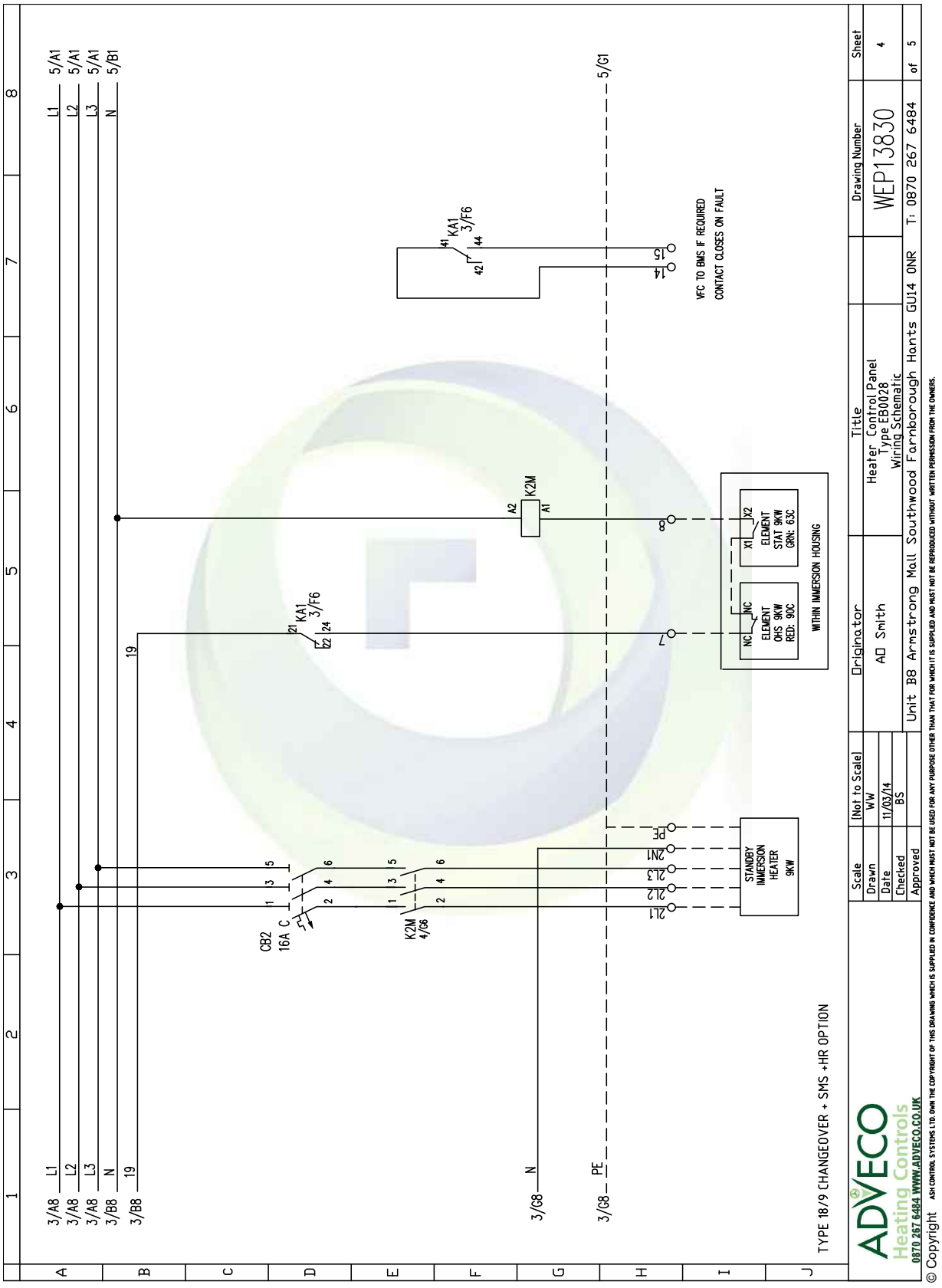
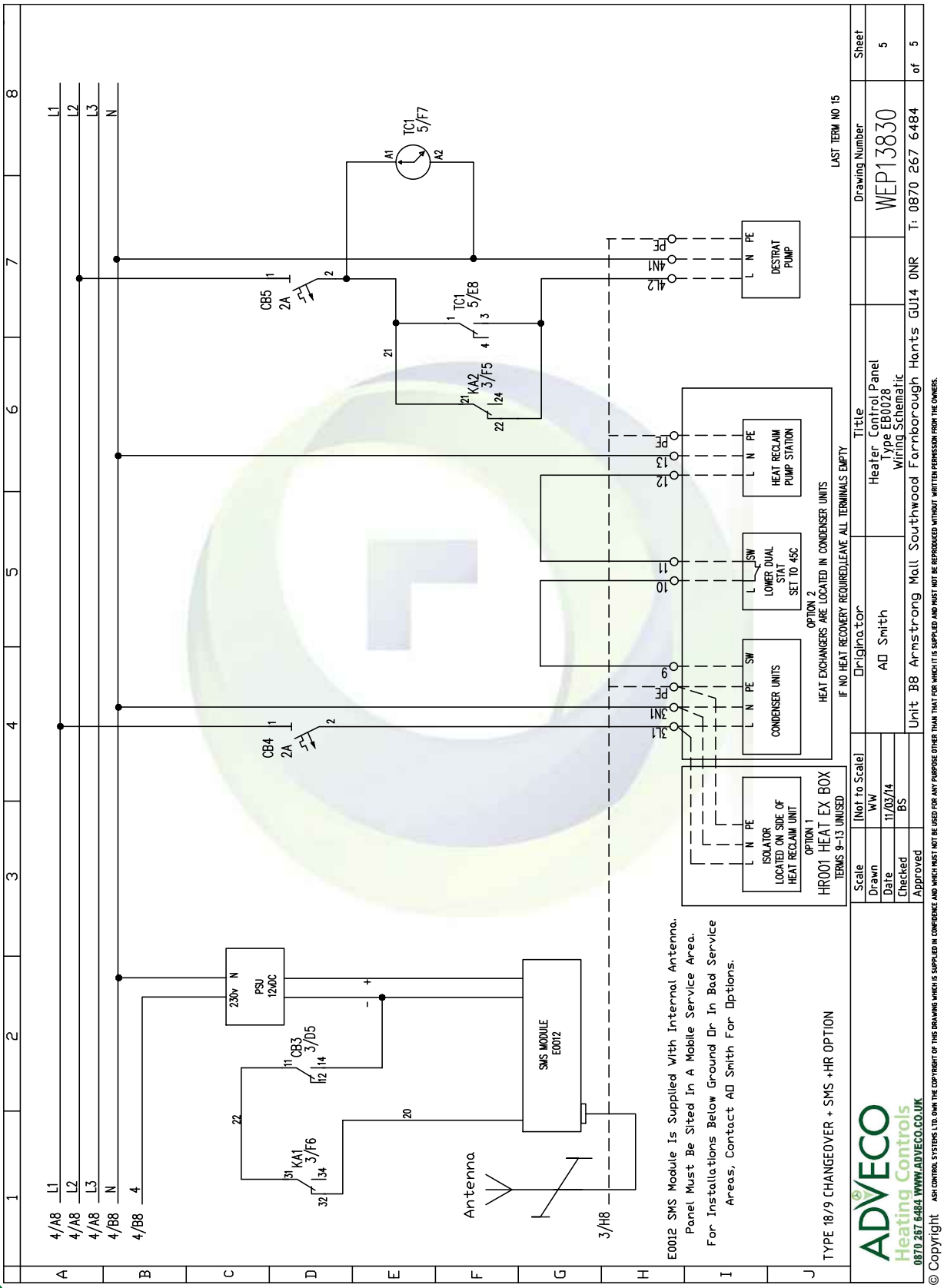
2. Wiring Diagrams



EB0028

2. Wiring Diagrams



EB0028

3. Troubleshooting

Is there hot water?

NO –

Is the Standby Immersion on? (measure current through 2L1,2L2,2L3)

Yes – Test Duty Immersion Heater, Housing Element Stat backup, KA1, KA2

No –

Is the Duty Immersion Heater on? (measure current through 1L1,1L2,1L3)

Yes – Test Duty Immersion Heater and Dual Stat-Element Stat 18kW

No – Test Main Isolator, CB1, CB2, KA1, KA2, all Overheat stats

YES –

Is the water too hot?

Yes – Test Dual Stat-Element Stat 18kW, Housing Element Stat backup and Destrat Pump

No – Is the Duty Immersion Heater operating?

No – Test Duty Immersion Heater

Yes – Does the Standby Immersion operate if you trip CB1?

No – Test Standby Immersion Heater

Yes –

Does the restaurant receive an email fault notification?

Does the Destrat Pump operate?

No – Test KA1, KA2, plus SMS device and/or Destrat Pump.

Yes – Does the Heat Recovery system run when the chiller or freezer runs?

No – Test Heat Recovery System.

Yes – Hot water system operating correctly.

EB0028

3. Troubleshooting

Part Name:	Duty Immersion Heater - 18kW Circuit
Adveco Part Number:	EB0027
Function:	Duty Immersion Heater 18kW is the lead heater to supply hot water to the building. It is combined in the housing with the backup immersion heater.
Specifics:	The 18kW element is made up of 3 circuits of 6kW, and each circuit is made up of three 2kW rods connected by links. All neutrals are connected together.
Testing:	

1. With the power off, measure the resistance between 1L1/1N1, 1L2/1N1, and 1L3/1N1 in the control panel. The correct reading is 9Ω. If a rod element has failed then the resistance will be 13Ω, and if two have failed then the measured resistance will be 26Ω.

2. With the power on, all CB's on, and the Dual Stat - Element Stat 18kW turned all the way up, measure voltage between 1L1/E, 1L2/E, and 1L3/E. The correct reading is 230V. If 0V is measured at these points, proceed to test K1M.

3. With the power on, all CB's on, and the Dual Stat - Element Stat 18kW turned all the way up, measure the current in the cables from 1L1, 1L2, and 1L3. The correct reading is approximately 26A, but will vary slightly depending upon site voltage. If a value of approximately 17A is measured, a single rod element has failed. Further failures will return lower amperages, and 2kW of heating output is lost for each failed rod. It is recommended that the immersion heater is not replaced until the total lost capacity reaches 8kW, or there is a phase imbalance greater than 4kW.

EB0028

3. Troubleshooting

Part Name:	Standby Immersion Heater – lower kW circuit
Adveco Part Number:	EB0027
Function:	The Standby Immersion Heater is the backup heater to supply hot water to the building in case of fault with the Duty Immersion Heater. They are combined in the same housing.
Specifics:	The current Standby Immersion Heater is a 9kW circuit made up of three 3kW rods. Originally the Standby Immersion Heater was a 6kW circuit made up of three 2kW rods. Regardless of which one, each of the three phases go on to a single rod pin, and all neutrals are connected together.
Testing:	

1. With the power off, Measure resistance between 2L1/2N1, 2L2/2N1, and 2L3/2N1 in the control panel. The correct reading is 18 Ω for a 9kW standby, or 26Ω for a 6kW standby. If the rod element has failed, then the resistance will be 0Ω. If two rods have failed, it is recommended to consider replacement.

2. With the power on, CB2 and CB3 on, CB1 tripped, and the Housing Element Stat Standby turned all the way up, measure voltage between 2L1/E, 2L2/E, and 2L3/E. The correct reading is 230V. If 0V at these points, test K2M.

3. With the power on, CB2 and CB3 on, CB1 off, and the Housing Element Stat Standby turned all the way up, measure current in cables from 2L1, 2L2, and 2L3. The correct reading is approximately 9A, but will vary with site voltage. If 0A, then the rod has failed. If two rods have failed, it is recommended to consider replacement.

EB0028

3. Troubleshooting

Part Name:	Housing Element Stat backup Housing Element OHS backup Dual Stat-Element Stat Dual Stat-Element OHS
Adveco Part Number:	E0043 E0044 E0010
Function:	Control and Overheat protection. Switch power on/off the contactor coil when there is a demand for heat.
Correct Operation:	Control Stats should be set to 63°C if they control the water heating system, and 45°C if they control the Scutt's heat recovery system. Overheat stats are preset to 80°C or 90°C.
Testing:	

1. Turn off the power to the system and lock off the isolator.
2. Remove the lid and locate the control and overheat stat.
3. Remove the cabling from the Stat/OHS that is suspect and label the wires.
4. Remove the Stat/OHS that is suspect from the pocket. Once removed let the stat adjust to ambient conditions.
5. Test continuity between the terminals of the stat/OHS with the control stat dial turned all the way up and the OHS stat not tripped. Correct value Control stat: open circuit OHS: closed circuit. Replace if incorrect.
6. Turn the Stat temperature setting all the way down, hold the sensor in your hand to warm it, and test continuity between terminals of the stat (correct value: open circuit) If closed circuit replace stat.
7. With the control stat temperature setting turned all the way down, and the sensor held in your hand, test continuity between terminals while slowly increasing the setpoint on the stat. The contacts should close when the dial indicator is around 35C. If the dial indicator is not around 35C when it switches then test calibration.
8. Calibration Test:
   Carefully place the Control Stat / OHS sensor in heated water and measure the temperature at which the stat / OHS changes state. If it is not accurate with the indicator then replace.
9. With the Stat / OHS returned to its pocket and wired up and the control system and settings set so that the stat/ohs should call for heat measure the voltage between each terminal of the stat / ohs and earth. If they are both healthy and calling there should be 230V at all terminals. If 0V test controls upstream.

EB0028

3. Troubleshooting

Part Name:	3 Phase Contactor
Wiring Diagram Key:	K1M
Adveco Part Number:	E00CONT30230
Manufacturer's Part Details:	Schneider
Function:	K1M switches Duty Element 18kW on when the coil is energised.
Specifics:	K1M Contactor should operate when Dual Stat-Element Stat 18kW in the cylinder calls for heat *if* Dual Stat-Element OHS 18kW, CB3 and CB1 Auxiliary are all healthy (not tripped) and KA1 is de-energised.
Testing:	

1. With the power off, test continuity between the terminals 1L1 and 2T1 of K1M. The correct reading is open circuit. Next, test continuity between terminals 1L1 and 2T1 while pressing the contactor test button. The correct reading is now closed circuit. Repeat this test for 3L2/4T2 and 5L3/6T3. If the continuity is not correct, does not change, or the test button is stuck, replace K1M.

2. With the power off, test continuity between A2 of K1M and the neutral of the isolator. The correct reading is closed circuit. If it is open circuit, investigate the wiring.

3. With the power on and CB1 on, measure the voltage between 1L1/E, 3L2/E, and 5L3/E. The correct reading is 230V. If 0V is measured, proceed to test CB1.

4. With the power on and CB3 on, and Dual Stat-Element Stat 18kW turned up all the way, measure the voltage between A1 and Earth. The correct reading is 230V. If 0V is measured, proceed to test CB3, K1T, and Dual Stat-Element Stat 18kW.

5. With the power on, CB1 on, and voltage at A1, measure the voltage between 2T1/E, 4T2/E, and 6T3/E. The correct reading is 230V. If 0V is measured, replace K1M.

EB0028

3. Troubleshooting

Part Name:	3 Phase Contactor
Wiring Diagram Key:	K2M
Adveco Part Number:	E00CONT18230
Manufacturer's Part Details:	Schneider
Function:	K2M switches the Standby Immersion Heater on when the coil is energised.
Specifics:	K2M Contactor should operate when Housing Element Stat Standby in the immersion housing calls for heat if the Duty Immersion Heater circuit has tripped, KA1 is energised, and Housing Element OHS Standby is healthy.
Testing:	

1. With the power off, Test continuity between terminals 1L1 and 2T1 of K2M. The correct reading is open circuit. Next test continuity between terminals 1L1 and 2T1 while pressing the contactor test button. The correct reading is closed circuit. Repeat tests for 3L2/4T2 and 5L3/6T3. If the continuity is not correct, does not change or the test button is stuck, replace K2M.

2. With the power off test continuity between A2 of K2M and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.

3. With the power on and CB2 on, measure the voltage between 1L1/E, 3L2/E, and 5L3/E. The correct reading is 230V. If 0V, then test CB2.

4. With the power on, CB3 on, CB1 off, and Housing Element Stat Standby turned up all the way, measure the voltage between A1 and Earth. The correct reading is 230V. If 0V, test CB3, KA1, Housing Element Stat Standby, and Housing Element OHS Standby.

5. With the power on, CB2 on, CB3 on, CB1 off and voltage at A1, measure the voltage between 2T1/E, 4T2/E, and 6T3/E. The correct reading is 230V. If 0V, then replace K1M.

EB0028

3. Troubleshooting

Part Name:	240V Relay
Wiring Diagram Key:	KA1
Adveco Part Number:	E004P REL 230
Function:	KA1, which is switched by KA2 in a system fault situation, determines whether Dual Stat-Element Stat 18kW or Housing-Element Stat Backup is live. This is done by wiring one to KA1 normally open contacts and the other to KA1 normally closed contacts. KA1 will also signal a fault to the SMS device, and close contacts to indicate a fault to the BMS at control panel terminals 14/15.
Specifics:	KA1 is in its de-energised state when the system is healthy. This allows voltage to the Dual Stat-Element Stat 18kW through the NC connections. When KA2 changes state due to a system fault then KA1 is energised. This removes voltage from Dual Stat-Element Stat 18kW, and allows voltage to the Housing-Element Stat Backup to activate the backup element.
Correct Operation:	When the system is healthy KA1 should be de-energised and KA2 should be energised. When KA2 de-energises due to a fault with CB1 or Dual Stat-Element OHS 18kW then KA1 should energise.
Testing:	

1. With the power off, test **continuity** between terminal 21/22 of KA1. The correct reading is *closed circuit*. Continue to test **continuity** between 21/22 while pressing in the orange test button. The correct reading is now *open circuit*. If the continuity does not change, is not correct, or the test button is stuck, replace KA1.

2. With the power off, test **continuity** between terminal 21/24 of KA1. The correct reading is *open circuit*. Continue to test **continuity** between 21/24 while pressing in the orange test button. The correct reading is now *open circuit*. Repeat test for terminals 11/14. If the continuity does not change, is not correct, or the test button is stuck, replace KA1.

3. With the power off test **continuity** between A2 of KA1 and the neutral of the isolator. The correct reading is *closed circuit*. If open circuit investigate the wiring.

4. With the power on and CB3 on, measure the **voltage** between 21/E and 31/E. The correct reading is 230V. If 0V then test CB3.

5. With the power on, CB1 and CB3 on, measure the **voltage** between A1 and Earth. The correct reading is 0V. If 230V, test CB1 Aux, Dual Stat-Element OHS 18kW, KA2.

6. With the power on, CB1 and CB3 on, and 0V at A1, measure the **voltage** between 32/E. The correct reading is 230V. If 0V replace KA1.

7. With the power on, CB1 and CB3 on, and 0V at A1, measure the **voltage** between 24/E. The correct reading is 0V. If 230V replace KA1.

8. With the power on, CB1 and CB3 on, and 0V at A1, trip CB1 and measure the **voltage** between A1 and Earth. The correct reading is 230V. If 0V, test CB1 Aux, KA2.

9. With power on, CB3 on, CB1 tripped, and 230V at A1, measure the **voltage** between 32/E. The correct reading is 0V. If 230V replace KA1.

10. With power on, CB3 on, CB1 tripped, and 230V at A1, measure the **voltage** between 24/E. The correct reading is 230V. If 0V replace KA1.

EB0028

3. Troubleshooting

Part Name:	240V Relay
Wiring Diagram Key:	KA2
Adveco Part Number:	E002P REL 230
Function:	KA2 changes the state of KA1 when there is a fault. This switches the load between the duty immersion heater and the backup immersion heater. KA2 will also activate the destrat pump in a system fault condition.
Specifics:	Relay KA2 is kept energised when the system is healthy by a live supply fed to its coil A1 at all times when CB3 is on, and CB1 auxiliary and Dual Stat-Element OHS 18kW are healthy (closed circuit.) When either CB1 Auxiliary or Dual Stat-Element OHS 18kW trips, the live feed to A1 of KA1 is lost and KA2 de-energises which causes the NC contacts between terminals 11 and 12 to close thereby energising KA1. When de-energised KA2 will also switch the destrat pump on (bypassing the timeclock) and run the pump permanently.
Correct Operation:	When the system is healthy KA2 should be energised (pulled in) at all times, this may be indicated by an LED (if fitted.) When the Dual Stat-Element OHS 18kW or CB1 trip KA2 should de-energise.
Testing:	

1. With the power off, test **continuity** between terminal 11 to 12 and 21 to 22 of KA2. The correct reading is *closed circuit*. If open circuit replace KA2.
2. With the power off test **continuity** between A2 of KA2 and the neutral of the isolator. The correct reading is *closed circuit*. If open circuit investigate the wiring.
3. With the power on and CB3 on, measure the **voltage** between 11/E. The correct reading is 230V. If 0V then test CB3.
4. With the power on and CB5 on, measure the **voltage** between 21/E. The correct reading is 230V. If 0V then test CB5.
5. With the power on, CB1 and CB3 on, measure the **voltage** between A1 and Earth. The correct reading is 230V. If 0V, test CB1 Aux, Dual Stat-Element OHS 18kW.
6. With the power on, CB1 and CB3 on, and 230V at A1, measure the **voltage** between 12/E. The correct reading is 0V. If 230V replace KA2.
7. With the power on, CB1, CB3, CB5 on, and 230V at A1, measure the **voltage** between 22/E. The correct reading is 0V. If 230V replace KA2.
8. With the power on, CB1, CB3, CB5 on, and 230V at A1, trip CB1 and then measure the **voltage** between A1 and Earth. The correct reading is 0V. If 230V, test CB1 Aux.
9. With power on, CB3 and CB5 on, CB1 tripped, and 0V at A1, measure the **voltage** between 12/E. The correct reading is 230V. If 0V replace KA2.
10. With power on, CB3 and CB5 on, CB1 tripped, and 0V at A1, measure the **voltage** between 22/E. The correct reading is 230V. If 0V replace KA2.

EB0028

3. Troubleshooting

Part Name:	Destrat Pump
Adveco Part Number:	MB0001
Function:	To aid in thermal disinfection of the tank periodically, and to mix the contents when operating on the backup element.
Specifics:	The bottom half of the tank is held at temperatures between 20°C and 40°C for much of the operation of the system. The destrat pump is used to heat the entire tank twice per week. It is also used when the standby immersion heater is operating to create a mixing effect in the tank to overcome inaccuracies of flange mounted stats.
Testing:	

1. With the power on, CB5 on, and CB1 tripped, confirm that the pump is operating. If not, measure voltage between 4L2 and Earth. The correct reading is 230V. If 0V, test KA2 and CB5. If 230V but pump does not run, check pump and replace if necessary. Once pump is confirmed to operate, test Timeclock.

Part Name:	Timeclock
Wiring Diagram Key:	TC1
Adveco Part Number:	E00TC1
Function:	To run the destrat pump twice a week for 2 hours.
Testing:	

1. With the power on, confirm the timeclock is set to the correct day and time, that the timeclock is set to run the program, and that the program includes two on periods per week, 3-4 days apart, for at least 2 hours but for no more than 4 hours.

2. With the power on, put the timeclock into Hand (manual) operation and confirm the pump runs. If not, test CB5 and pump, then replace timeclock.

3. With the power on, add a run period to the program for the day and time you are there and confirm that the pump runs.

EB0028

3. Troubleshooting

Part Name:	SMS Module
Adveco Part Number:	E0012
Manufacturer's Part Details:	Enfora MT1200, MT2500 or MT4000
Function:	To send a text message to a prearranged number when a system fault occurs which is turned into an email and sent to the store and other places.
Specifics:	Systems sold before January 2016 are likely to contain MT2500 models. From January 2016 onwards, systems are likely to contain MT4000 models. Newer systems may contain the MT1200. Operation and maintenance is the same in both cases.
Testing:	

1. With the power on and CB3 on, confirm there are two green LED's on the SMS device. If there are none, test Power Supply. If there is only one, the SMS device has no mobile service.

2. With the power on, CB3 and CB2 on, put the BFC/SGE into fault and ask the store manager if a fault email is received within 10 minutes. If not, pull the connector cable from the SMS device and see if the store receives an email within 10 minutes. If an email is received, test KA1. If an email is not received, call AO Smith to check if a text message has been received and take advice from there.

EB0028

3. Troubleshooting

Part Name:	Circuit Breaker Auxiliary Switch
Wiring Diagram Key:	CB1 11/12
Adveco Part Number:	EB00MCBAUX
Manufacturer's Part Details:	Schneider
Function:	To signal the system to change to back up element and send a fault code in case the circuit breaker trips.
Specifics:	When the main circuit breaker for the lead element, CB1, trips the CB1 Auxiliary switch goes open circuit and stops voltage from reaching KA2 which causes the system to changeover.
Testing:	

1. With the power off and CB1 off test continuity between the terminals with the cables 19 and 4 in them. The correct reading is open circuit. If it is closed circuit confirm the cables are in the common and normally open terminals (polarity not important). If wired correctly but closed circuit, replace CB1 Aux.
2. With the power off and CB1 on test continuity between the terminals with the cables of CB1 Aux. The correct reading is closed circuit. If open circuit, replace CB1 Aux.
3. With the power on and CB1 on measure the voltage between the terminals with the cables in CB1 Aux and earth one at a time. The correct reading is 230V. If 0V, test CB3.

EB0028

3. Troubleshooting

Part Name:	Circuit Breakers
Wiring Diagram Key:	CB1 through CB
Manufacturer's Part Details:	Schneider
Function:	Circuit breakers protect the circuits from over current. They come in single phase or three phase blocks. They are rated in Amps based on the load they supply.
Testing:	

1. With the power on and the circuit breaker switched to off, measure the voltage between the top terminals of the breaker (terminal 1, plus terminals 3 and 5 for three phase breakers) and Earth, and then the bottom terminal (terminal 2, plus terminals 4 and 6 for three phase breakers) and Earth. The correct readings are 230V on the live side 1,3,5; and 0V on the load side 2,4,6. If 0V on the live side, test Main Isolator. If 230V on load side replace circuit breaker.

2. With the power on and the circuit breaker switched to on, measure the voltage between the load terminal (terminal 2) of the breaker and Earth, repeat for terminals 4,6 for three phase breakers. The correct reading is 230V. If 0V replace Circuit Breaker

3. Put a load on the breaker by switching on the immersion heater or other downstream component. If the breaker trips investigate the components and the wiring for a short. Swap two equal rated breakers if no fault can be found to test for breaker fault or system fault.

EB0028

3. Troubleshooting

Part Name:	Power Supply Unit
Wiring Diagram Key:	PSU
Adveco Part Number:	E00PSU230/12
Function:	To provide 12V DC to the SMS device.
Testing:	

1. With the power on and CB3 on, measure the voltage to the power supply at terminals L, N. The correct reading is 230V. If 0V, test CB3.

2. With the power on and CB3 on, measure the voltage from the power supply between terminal +V and –V. The correct reading is 12V DC. If outside of range of 12 ± 4V, then replace power supply.

Part Name:	Heat Recovery System – HR001
Adveco Part Number:	HR001
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the heat recovery box. The heat recovery box includes the controls and pumps necessary to run the heat recovery system.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery box between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.
2. With Voltage at terminal 3L1, the heat recovery system should operate. If not, tests must be carried out within the HR001 on the controllers and pumps. Ensure there is fluid in the system.

EB0028

3. Troubleshooting

Part Name:	Heat Recovery System – Fosters/Scutts
Manufacturer's Part Details:	Scutt's Condender Units
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the condenser. When the compressor runs, it is wired to pull in a relay. This will cause the motorised zone valve to open. When fully open the microswitch within the motorised valve will close providing a switched live back to the control panel. This switched live will operate the pump station PS1.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery system between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.

2. With the power on and CB4 on, and both Fosters condenser units isolated (off on both isolators), measure the voltage for the switched live between terminal 9 and Earth. The correct reading is 0V. If 230V is present, check the state of the motorised valve: If indicator is perpendicular with the pipe then replace the motorised valve. If the indicator is in line with the pipe then further checks are necessary to see if the valve orientation is wrong (valve moves opposite to the way it should), or if the valve is faulty (will not move).

3. With the power on, CB4 on, and one Fosters unit powered on and running, measure the voltage between terminal 9 and Earth. The correct reading is 230V. If 0V, test relay and motorised valve in condenser unit.

4. With the power off, test continuity between terminals 6 and 7. The correct reading is closed circuit. If open circuit, check dual stat over heat has not tripped, and tank temperature is below set point. Replace Dual Stat if faulty.

5. With the power on, CB4 on, the fridge or freezer on, and 230V at terminal 9, measure the voltage between terminal 8 and Earth. The correct reading is 230V. If 0V, further tests on the Dual Stat are necessary.

6. With Voltage at terminal 8 the pump station should run. If not, test the pump, also ensure system has fluid in it.

EB0030

1. Technical Details

Adveco Order Code:	EB0030
Supply:	415V/3ph/50Hz
Fault level:	10kA
Max load current:	16A/phase
Aerial:	Internal
Height:	500mm
Width:	400mm
Depth:	210mm
Weight:	5kg

Included Parts:

- E0058: Control panel with gas to electric auto-changeover function. Includes main isolator feeding a gas-fired water heater and an immersion heater, plus circuit breakers, volt-free contacts for BMS support and heat recovery options. Includes pump controls for use with preheat vessels.
- E0012: GSM modem for automatic SMS or email notification of faults.

Suitable for use with:

- SGS and BFC condensing gas-fired water heaters with pre-heat consisting of:
- IT, ITE and ITS 300-1000 range of indirect water heaters. SSB, SSI and SST 500-2500 range of stainless steel cylinders.
- HR001 Heat Recovery Box

Compatible Ancillaries:

- EB0029: 9kW electric immersion heater assembly for use with BFC and SGS 30-60 water heaters

	Sheet	By	Date
	1–4	WW	11/03/14
	1–4	WW	30/06/15
	1–4	WW	xxx
sioned	1–4	WW	xxx
	1–5	WW	05/12/15

NOTES

ALL GLANDING IS CARRIED OUT IN THE BASE OF ENCLOSURE TO MAINTAIN INGRESS PROTECTION

INCOMING SUPPLY MUST HAVE EARTH CONDUCTOR AND BE BONDED TO EQUIPOTENTIAL STUD PROVIDED

SMS

ANTENNA IS INTERNAL AS STANDARD

PANEL TO BE SITED IN AN AREA WITH GOOD SIGNAL RECEPTION ABOVE GROUND LEVEL

BASEMENT APPLICATIONS REQUIRE REMOTE ANTENNA (OPTION)

TYPE G/E CHANGEOVER + SMS +HR OPTION
C/W PREHEAT

Drawing Control Notes

Arrangement Drawing Panel/Kiosk	2
Wiring Schematic	3–5
Terminal Plan	xx
Labels	N/A
Enclosure	Std Manufacturer

Cable Colours

415VAC L1	Brown
415VAC L2	Black
415VAC L3	Grey
415VAC N	Blue
EQUIP	Grn/Ylw
240VAC L	Brown
240VAC N	Blue
110VAC L	Red
110VAC N	Blue
24VAC L	White
24VAC N	Orange
24VDC +	Blue
24VDC –	Blue

Miscellaneous

Ammeters CT Circuits	White
4–20mA	Yellow
VFC	Red
IS	Blue
Telemetry	Pink

ADVECO Heating Controls
0870 267 6484 WWW.ADVECO.CO.UK

Scale	[Not to Scale]
Drawn	WW
Date	30/06/15
Checked	BS
Approved	

Originator	Title		Drawing Number	Sheet
AO Smith	Heater Control Panel Type EB0030 Project Control Sheet		WEP14488	1
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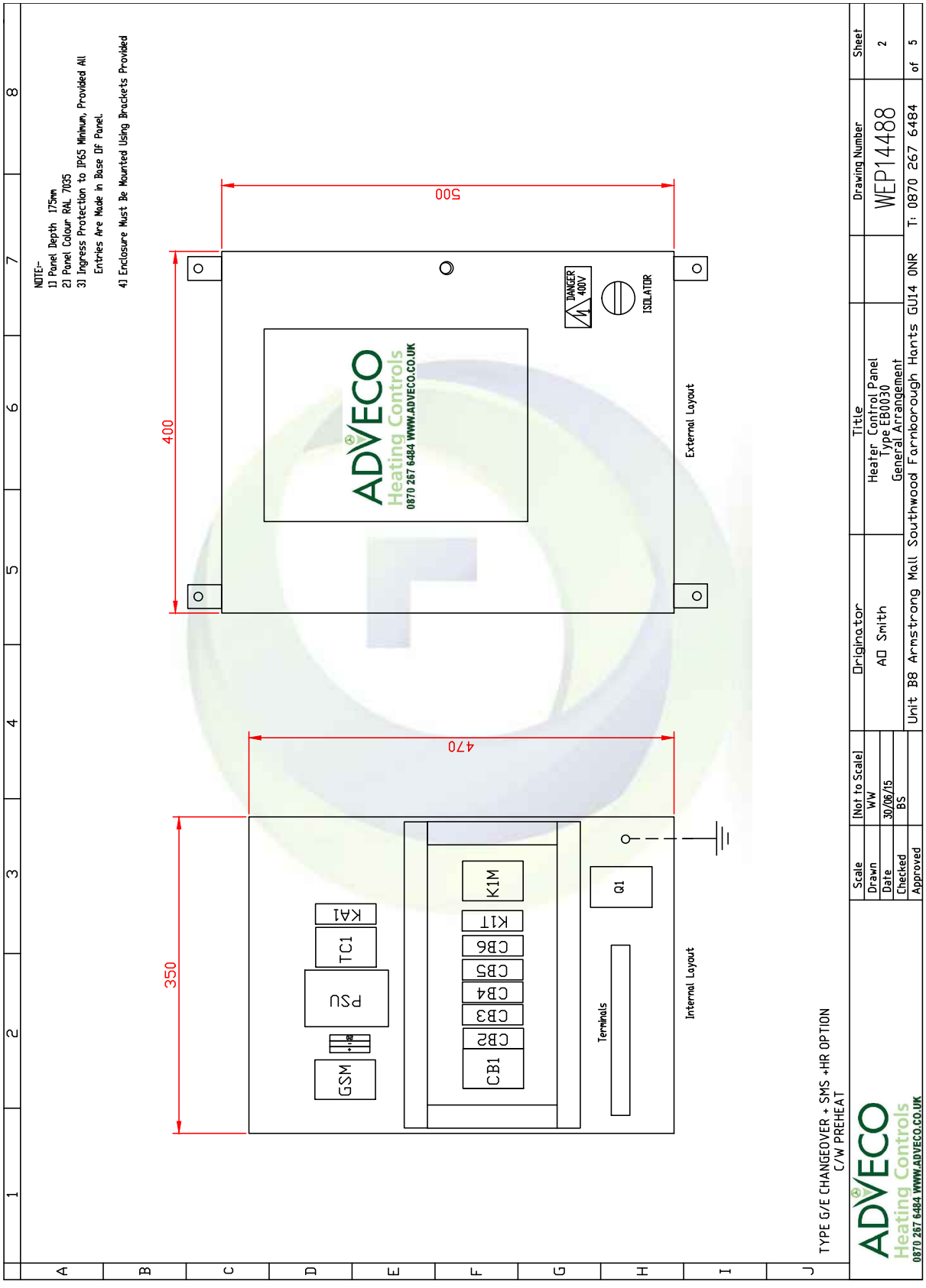
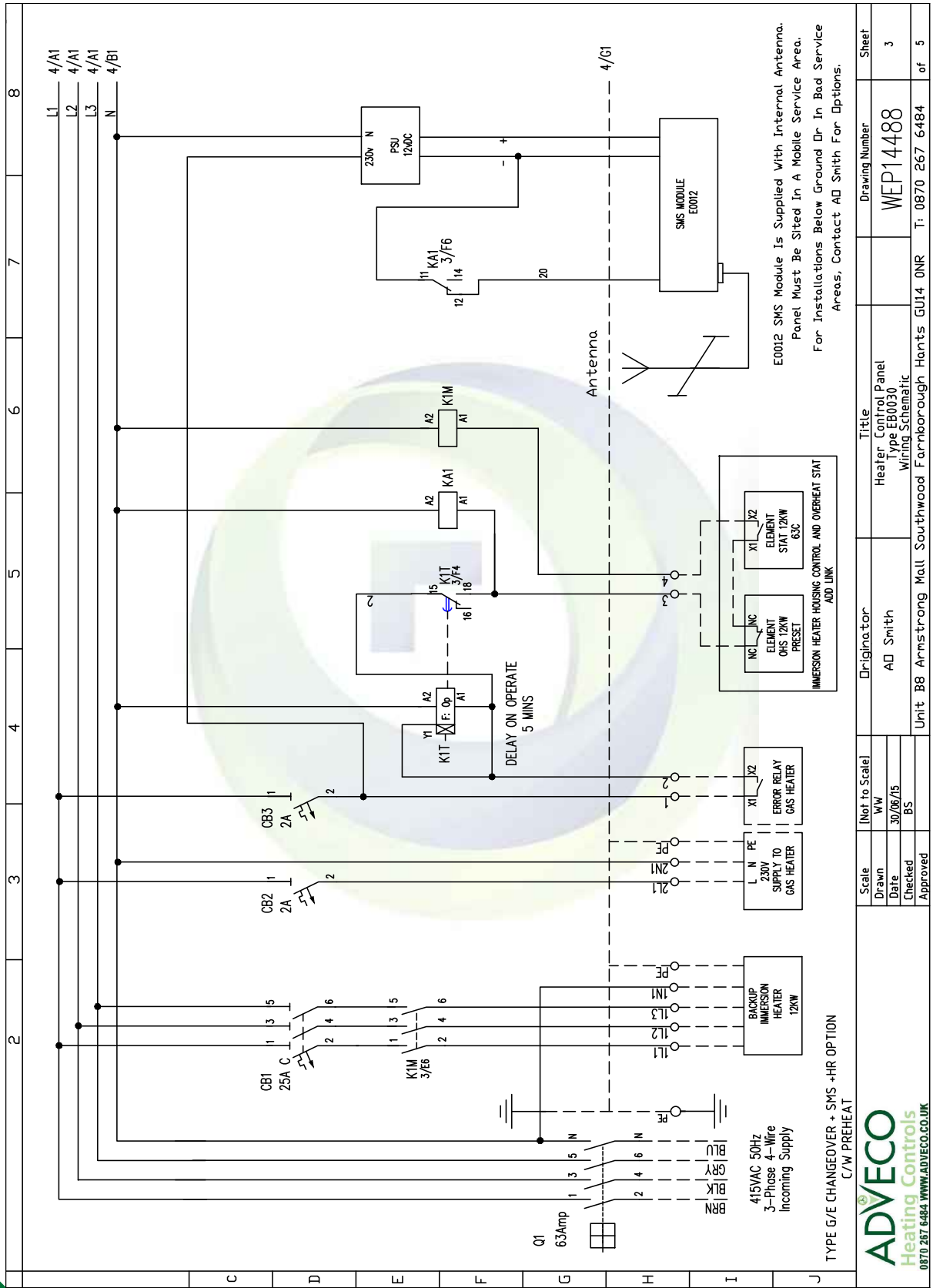
EB0030

2. Wiring Diagrams



EB0030

2. Wiring Diagrams



EB0030

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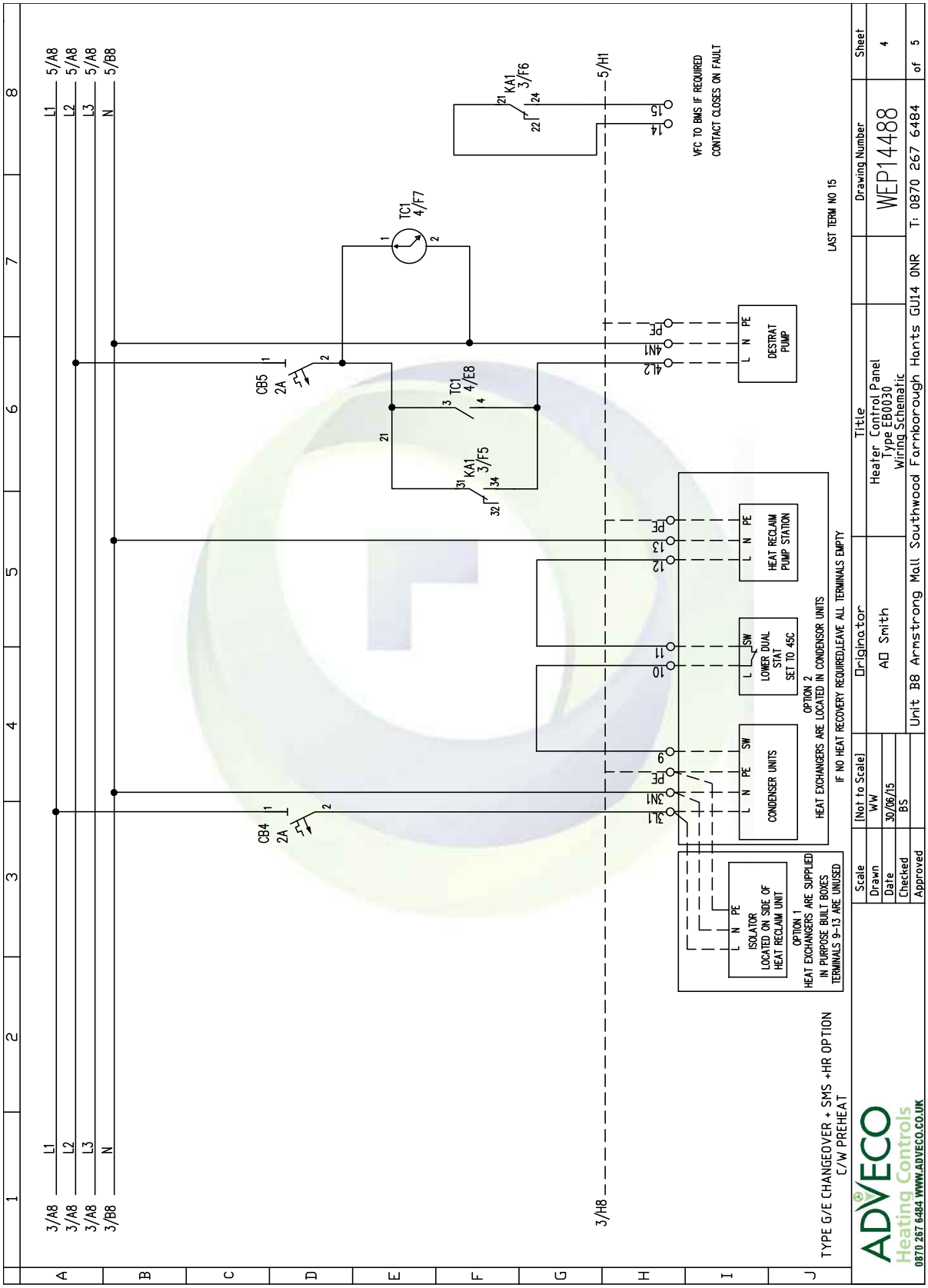

EB0030

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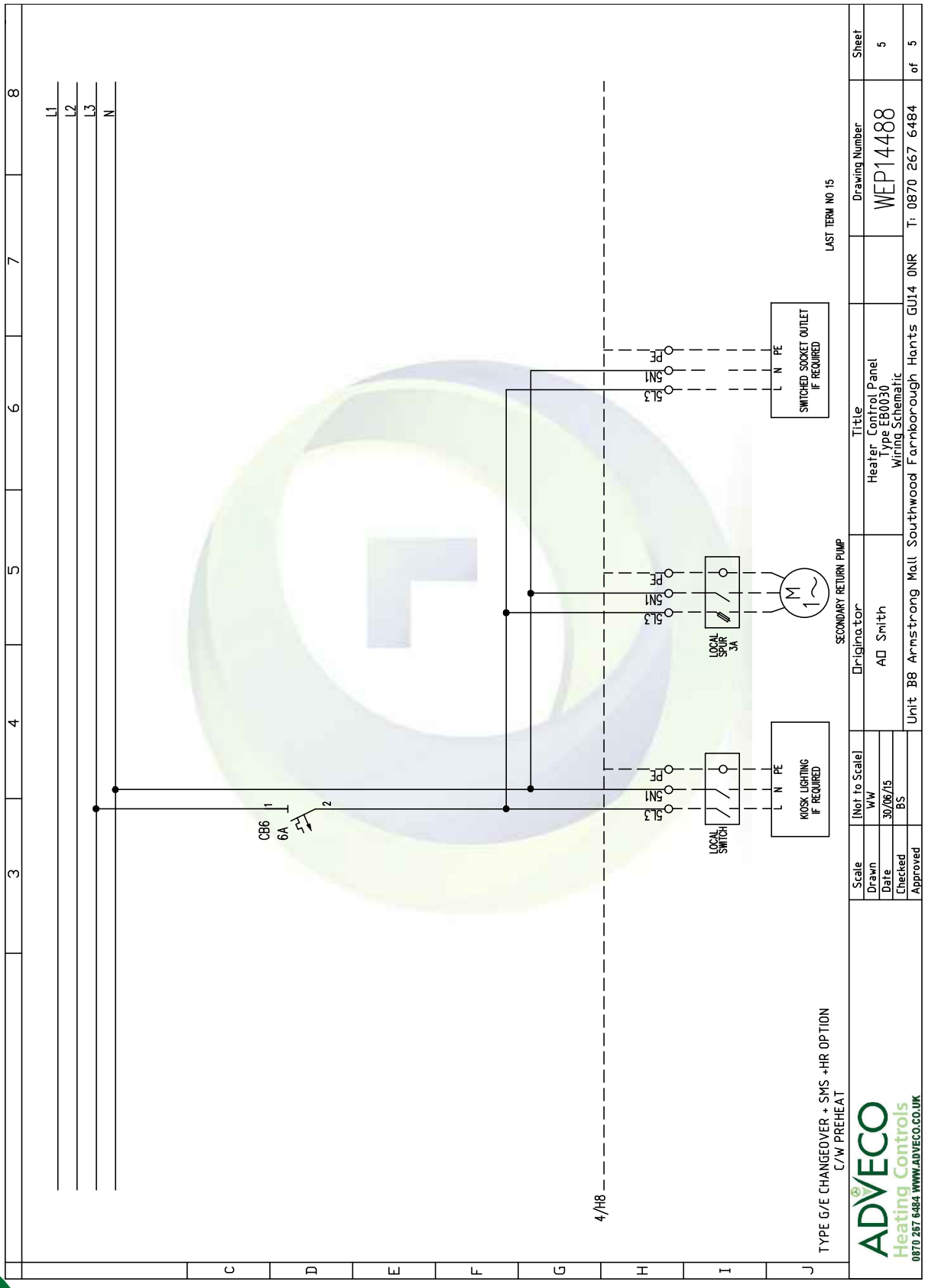

EB0030

3. Troubleshooting

Is there hot water?

NO –

Does the water heater have power?

No – Test Main Isolator on Control Panel and CB2 then BFC thermocontroller.

Yes –

Is the BFC water heater displaying a fault?

No – BFC is working, check for plumbing faults in system.

Yes –

Did the restaurant receive an email fault notification?

No – Test SMS device, CB3, KA1, K1T, Error Relay.

Yes –

Is the Standby Immersion on? (is the LED on?)

No – Test Immersion Heater, K1M, CB1, K1T and Error Relay.

Yes –

Does the Destrat Pump operate?

No – Test KA1 and Destrat Pump.

Yes – Repair BFC water heater fault, test Immersion Heater

YES –

Is the BFC water heater displaying a fault?

Yes –

Did the restaurant receive an email fault notification?

No – Test SMS device, CB3, KA1, K1T, Error Relay.

Yes –

Is the Standby Immersion on? (is the LED on?)

No – Test Immersion Heater, K1M, CB1, K1T and Error Relay.

Yes –

Does the Destrat Pump operate?

No – Test KA1 and Destrat Pump.

Yes – Repair BFC water heater fault, test Immersion Heater

No –

Did the restaurant receive an email fault notification?

Yes – is the restaurant running on a generator, had power cuts, or had an engineer on site carrying out any servicing activities?

No –

Does the Heat Recovery system run when the chiller or freezer runs?

No – Test Heat Recovery System.

Yes – Hot water system operating correctly.

EB0030

3. Troubleshooting

Part Name:	Immersion heater - 9 or 12kW
Adveco Part Number:	9kW: EB0029
Function:	Immersion heaters provide electrical backup water heating.
Specifics:	The 9 or 12kW immersion heater is mounted in the preheat vessel for a preheat/afterheat water heating arrangement. As it cannot directly heat the water heater when it is on, the destrat pump must also be on. These immersion heaters are 3 phase and have control and overheat stats included in the housing. The immersion heater has a 2.25" BSP connection and when necessary it is supplied with a flange plate to fit onto a 180mm flange.
Testing:	

1. With the power off, measure the resistance between 1L1/1N1, 1L2/1N1, and 1L3/1N1 in the control panel. The correct reading is 18Ω for the 9kW immersion heater and 13Ω for the 12kW heater. If a rod element has failed, the resistance will be 0Ω. If two rods have failed, it is recommended that a replacement heater is considered.

2. With the power on, CB1, CB2, and CB3 on, put the BFC in fault and wait 5 minutes before measuring the voltage between 1L1/E, 1L2/E, and 1L3/E. The correct reading is 230V. If 0V is measured, proceed to test K1M.

3. With the power on, CB1, CB2, and CB3 on and the temperature control dial on the immersion heater turned all the way up, put the BFC in fault and wait 5 minutes then measure the current in cables from 1L1, 1L2, and 1L3. The correct reading is approximately 13A for a 9kW heater and approximately 17A for a 12kW heater. If 0A is measured, then a rod has failed. If two rods have failed it is recommended that a replacement heater is considered. If 0A are measured to all phases, then proceed to test K1M.

EB0030

3. Troubleshooting

Part Name:	Housing Element Stat backup Housing Element OHS backup Dual Stat-Element Stat Dual Stat-Element OHS
Adveco Part Number:	E0043 E0044 E0010
Function:	Control and Overheat protection. Switch power on/off the contactor coil when there is a demand for heat.
Correct Operation:	Control Stats should be set to 63°C if they control the water heating system, and 45°C if they control the Scutt's heat recovery system. Overheat stats are preset to 80°C or 90°C.
Testing:	

1. Turn off the power to the system and lock off the isolator.
2. Remove the lid and locate the control and overheat stat.
3. Remove the cabling from the Stat/OHS that is suspect and label the wires.
4. Remove the Stat/OHS that is suspect from the pocket. Once removed let the stat adjust to ambient conditions.
5. Test continuity between the terminals of the stat/OHS with the control stat dial turned all the way up and the OHS stat not tripped. Correct value Control stat: open circuit OHS: closed circuit. Replace if incorrect.
6. Turn the Stat temperature setting all the way down, hold the sensor in your hand to warm it, and test continuity between terminals of the stat (correct value: open circuit) If closed circuit replace stat.
7. With the control stat temperature setting turned all the way down, and the sensor held in your hand, test continuity between terminals while slowly increasing the setpoint on the stat. The contacts should close when the dial indicator is around 35C. If the dial indicator is not around 35C when it switches then test calibration.
8. Calibration Test:
   Carefully place the Control Stat / OHS sensor in heated water and measure the temperature at which the stat / OHS changes state. If it is not accurate with the indicator then replace.
9. With the Stat / OHS returned to its pocket and wired up and the control system and settings set so that the stat/ohs should call for heat measure the voltage between each terminal of the stat / ohs and earth. If they are both healthy and calling there should be 230V at all terminals. If 0V test controls upstream.

EB0030

3. Troubleshooting

Part Name:	BFC Error Relay
Wiring Diagram Key:	Error Relay Gas Heater
Function:	Relay within BFC water heater. Normally open, closes on fault with gas side of the water heater.
Testing:	

1. With the power off, test **continuity** between terminals 1,2 in the control panel. The correct reading is open circuit. If closed circuit, check to see if a link has been added between 1,2 in the control panel, or X1, X2 in the water heater terminal box. If not, investigate water heater.

2. With the power on and CB3 on, measure **voltage** between terminal 1 and Earth. The correct reading is 230V. If 0V, test CB3.

3. With the power on, CB2 and CB3 on, confirm that the BFC water heater is on and healthy. If the BFC is off, measure **voltage** between 2L1 and Earth. The correct reading is 230V. If 0V, test CB2. If 230V, test BFC water heater (refer to SGE manual).

4. With the power on, CB2 and CB3 on and BFC healthy, trip BFC by turning off the gas isolation valve. When the BFC goes into fault and displays an error code on the screen, measure **voltage** between terminal 2 and Earth. The correct reading is 230V. If 0V, test BFC thermocontroller (refer to BFC Manual).

Part Name:	Timer Relay
Wiring Diagram Key:	K1T
Adveco Part Number:	E00TIM M/F
Function:	Timer relay used to create 5 minute delay after the error relay closes before the immersion heater switches on and sends a fault text message to reduce nuisance messages from minor self-resetting blocking codes.
Correct Operation:	When set to Op, 60s, and 5, the unit is set to close the relay after 5 minutes (five lots of 60 seconds).
Testing:	

1. With the power off, confirm the timer relay is set to Op, 5, 60s, set correctly if necessary.

2. With the power off, test **continuity** between terminal 15/18 of K1T. The correct reading is open circuit. If closed circuit, replace K1T.

3. With the power off, test **continuity** between A2 of K1T and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.

4. With the power on, CB2 on, and CB3 on, fault out the BFC water heater and measure the **voltage** between A1 and Earth, 15 and Earth, and Y1 and Earth. The correct reading is 230V. If 0V, test CB3, and Error Relay.

5. With the power on, CB2 on, CB3 on, and the BFC water heater having been at fault for at least 5 minutes, measure the **voltage** between 18 and Earth. The correct reading is 230V. If 0V, replace K1T.

EB0030

3. Troubleshooting

Part Name:	3 Phase Contactor
Wiring Diagram Key:	K1M
Adveco Part Number:	E00CONT18230
Manufacturer's Part Details:	Schneider
Function:	K1M switches Immersion Heater 9/12kW on when the coil is energised.
Specifics:	K1M Contactor should operate 5 minutes after the BFC water heater goes into fault mode.
Fault:	If K1M is faulty the backup immersion heater will not switch.
Testing:	

1. With the power off, test **continuity** between the terminals 1L1 and 2T1 of K1M. The correct reading is open circuit. Next, test **continuity** between terminals 1L1 and 2T1 while pressing the contactor test button. The correct reading is now closed circuit. Repeat this test for 3L2/4T2 and 5L3/6T3. If the continuity is not correct, does not change, or the test button is stuck, replace K1M.

2. With the power off, test **continuity** between A2 of K1M and the neutral of the isolator. The correct reading is closed circuit. If it is open circuit, investigate the wiring.

3. With the power on and CB1 on, measure the **voltage** between 1L1/E, 3L2/E, and 5L3/E. The correct reading is 230V. If 0V is measured, proceed to test CB1.

4. With the power on, CB2 on and CB3 on, fault out the SGE water heater and wait 5 minutes before measuring the **voltage** between A1 and Earth. The correct reading is 230V. If 0V is measured, proceed to test CB3, K1T, Error Relay, and Immersion Heater Control and Overheat stat between terminals 3/4.

5. With the power on, CB2 on, CB3 on, the water heater in fault and 230V on A1, measure the **voltage** between 2T1/E, 4T2/E, and 6T3/E. The correct reading is 230V. If 0V is measured, replace K1M.

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3. Troubleshooting

Part Name:	240V Relay
Wiring Diagram Key:	KA1
Adveco Part Number:	E004P REL 230
Function:	KA1 changes state when there is a fault. This causes the SMS device to send out fault notification. It also closes the BMS fault contacts.
Specifics:	Relay KA1 becomes energised 5 minutes after a BFC fault.
Testing:	

1. With the power off, test **continuity** between terminal 21 to 22 of KA1. The correct reading is closed circuit. If open circuit, replace KA1.
2. With the power off, test **continuity** between terminal 21 to 24 and 31 to 34 of KA1. The correct reading is open circuit. If closed circuit, replace KA1.
3. With the power off, test **continuity** between A2 of KA1 and the neutral of the isolator. The correct reading is closed circuit. If open circuit, investigate the wiring.
4. With the power on and CB5 on, measure the **voltage** between 31 and Earth. The correct reading is 230V. If 0V, test CB5.
5. With the power on, CB2 on, and CB3 on, fault out the BFC water heater, wait 5 minutes and test **voltage** between A1 and Earth. The correct reading is 230V. If 0V, test K1T.
6. With the power on, CB2 on, CB3 on and CB5 on, fault out the BFC water heater, wait 5 minutes and measure the **voltage** between 31 and Earth. The correct reading is 230V. If 0V, replace KA1.

Part Name:	SMS Module
Adveco Part Number:	E0012
Manufacturer's Part Details:	Enfora MT1200, MT2500 or MT4000
Function:	To send a text message to a prearranged number when a system fault occurs which is turned into an email and sent to the store and other places.
Specifics:	Systems sold before January 2016 are likely to contain MT2500 models. From January 2016 onwards, systems are likely to contain MT4000 models. Newer systems may contain the MT1200. Operation and maintenance is the same in both cases.
Testing:	

1. With the power on and CB3 on, confirm there are two green LED's on the SMS device. If there are none, test Power Supply. If there is only one, the SMS device has no mobile service.
2. With the power on, CB3 and CB2 on, put the BFC/SGE into fault and ask the store manager if a fault email is received within 10 minutes. If not, pull the connector cable from the SMS device and see if the store receives an email within 10 minutes. If an email is received, test KA1. If an email is not received, call AO Smith to check if a text message has been received and take advice from there.

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3. Troubleshooting

Part Name:	Destrat Pump
Adveco Part Number:	MB0001
Function:	To aid in thermal disinfection of the tank periodically, and to mix the contents when operating on the backup element.
Specifics:	The bottom half of the tank is held at temperatures between 20°C and 40°C for much of the operation of the system. The destrat pump is used to heat the entire tank twice per week. It is also used when the standby immersion heater is operating to create a mixing effect in the tank to overcome inaccuracies of flange mounted stats.
Testing:	

1. With the power on, CB2 on, CB3 on, and CB5 on, and the BFC in fault for more than 5 minutes, confirm that the pump is operating. If not, measure voltage between 4L2 and Earth. The correct reading is 230V. If 0V, test KA1 and CB5. If 230V but pump does not run, check pump and replace if necessary. Once pump is confirmed to operate, test Timeclock.

Part Name:	Timeclock
Wiring Diagram Key:	TC1
Adveco Part Number:	E00TC1
Function:	To run the destrat pump twice a week for 2 hours.
Testing:	

1. With the power on, confirm the timeclock is set to the correct day and time, that the timeclock is set to run the program, and that the program includes two on periods per week, 3-4 days apart, for at least 2 hours but for no more than 4 hours.

2. With the power on, put the timeclock into Hand (manual) operation and confirm the pump runs. If not, test CB5 and pump, then replace timeclock.

3. With the power on, add a run period to the program for the day and time you are there and confirm that the pump runs.

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3. Troubleshooting

Part Name:	Circuit Breakers
Wiring Diagram Key:	CB1 through CB
Manufacturer's Part Details:	Schneider
Function:	Circuit breakers protect the circuits from over current. They come in single phase or three phase blocks. They are rated in Amps based on the load they supply.
Testing:	

1. With the power on and the circuit breaker switched to off, measure the voltage between the top terminals of the breaker (terminal 1, plus terminals 3 and 5 for three phase breakers) and Earth, and then the bottom terminal (terminal 2, plus terminals 4 and 6 for three phase breakers) and Earth. The correct readings are 230V on the live side 1,3,5; and 0V on the load side 2,4,6. If 0V on the live side, test Main Isolator. If 230V on load side replace circuit breaker.

2. With the power on and the circuit breaker switched to on, measure the voltage between the load terminal (terminal 2) of the breaker and Earth, repeat for terminals 4,6 for three phase breakers. The correct reading is 230V. If 0V replace Circuit Breaker

3. Put a load on the breaker by switching on the immersion heater or other downstream component. If the breaker trips investigate the components and the wiring for a short. Swap two equal rated breakers if no fault can be found to test for breaker fault or system fault.

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3. Troubleshooting

Part Name:	Power Supply Unit
Wiring Diagram Key:	PSU
Adveco Part Number:	E00PSU230/12
Function:	To provide 12V DC to the SMS device.
Testing:	

1. With the power on and CB3 on, measure the voltage to the power supply at terminals L, N. The correct reading is 230V. If 0V, test CB3.

2. With the power on and CB3 on, measure the voltage from the power supply between terminal +V and –V. The correct reading is 12V DC. If outside of range of 12 ± 4V, then replace power supply.

Part Name:	Heat Recovery System – HR001
Adveco Part Number:	HR001
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the heat recovery box. The heat recovery box includes the controls and pumps necessary to run the heat recovery system.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery box between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.
2. With Voltage at terminal 3L1, the heat recovery system should operate. If not, tests must be carried out within the HR001 on the controllers and pumps. Ensure there is fluid in the system.

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3. Troubleshooting

Part Name:	Heat Recovery System – Fosters/Scutts
Manufacturer's Part Details:	Scutt's Condender Units
Function:	To reclaim heat from the fridge and freezer condenser units.
Specifics:	The control panel provides a permanent 230V supply to the condenser. When the compressor runs, it is wired to pull in a relay. This will cause the motorised zone valve to open. When fully open the microswitch within the motorised valve will close providing a switched live back to the control panel. This switched live will operate the pump station PS1.
Testing:	

1. With the power on and CB4 on, measure the voltage for the permanent live supply to the heat recovery system between control panel terminal 3L1 and Earth. The correct reading is 230V. If 0V, test CB4.

2. With the power on and CB4 on, and both Fosters condenser units isolated (off on both isolators), measure the voltage for the switched live between terminal 9 and Earth. The correct reading is 0V. If 230V is present, check the state of the motorised valve: If indicator is perpendicular with the pipe then replace the motorised valve. If the indicator is in line with the pipe then further checks are necessary to see if the valve orientation is wrong (valve moves opposite to the way it should), or if the valve is faulty (will not move).

3. With the power on, CB4 on, and one Fosters unit powered on and running, measure the voltage between terminal 9 and Earth. The correct reading is 230V. If 0V, test relay and motorised valve in condenser unit.

4. With the power off, test continuity between terminals 6 and 7. The correct reading is closed circuit. If open circuit, check dual stat over heat has not tripped, and tank temperature is below set point. Replace Dual Stat if faulty.

5. With the power on, CB4 on, the fridge or freezer on, and 230V at terminal 9, measure the voltage between terminal 8 and Earth. The correct reading is 230V. If 0V, further tests on the Dual Stat are necessary.

6. With Voltage at terminal 8 the pump station should run. If not, test the pump, also ensure system has fluid in it.

Components & Terminology

Normally Open and Normally Closed

This refers to the switches within the electrical switchgear. The designation of NO/NC is always given with the component in its de-energised or *off* state. This can make reading electrical schematics difficult because components that are *usually* closed are shown open. A circuit breaker is a switch that is normally open (off) but *usually* open when the system is operating. To properly troubleshoot and understand the drawings, this must be understood.

Circuit Breaker

Circuit breakers provide over-current protection for the components of the hot water system. They can be single breakers for single-phase components, or in blocks of three for three-phase components. The ratings of the included circuit breakers have been chosen to provide the correct level of protection.

Circuit Breaker Auxiliary

An auxiliary is an electrical switch mechanically fastened to the circuit breaker. It has a normally open and normally closed switch. When the circuit breaker trips the auxiliary changes state.

Contactor

A contactor is a three-phase high current switch which is activated by an electromagnet. When a low voltage / low current is provided to the coil of the contactor between A1/A2 the current in the coil creates an electromagnet which changes the state of the switch. This is how a small, single-phase thermostat can turn on a large three-phase immersion heater. The main contacts can be NO or NC and auxiliaries can be included to switch multiple signals. There is a test button in the centre of the contactor to test the contacts.

Relay

A relay is effectively a single-phase contactor. It has a coil to create an electromagnet to switch the state of the device, as well as a series of NO/NC contacts that can be used independently of each other. It is used to switch a component on/off without the voltage and current of the component passing through the switching device; it is also used for out of sequence switching (when the controlling device turns off, the component turns on).

Contact and Warranty Information

The EB0025/EB0028/EB0030 Control Panel, this manual and all information contained within are supplied by Adveco Ltd.

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Adveco Ltd. are the point of contact for all warranty claims and queries through the above address.

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- Off-site manufacturing of skids and plant rooms
- Controls systems
- Packaged plate heat exchangers
- Solar thermal systems
- Gas fired heating systems
- Combined heat & power cogeneration systems