

In-Line Heater Catalogue



power generation

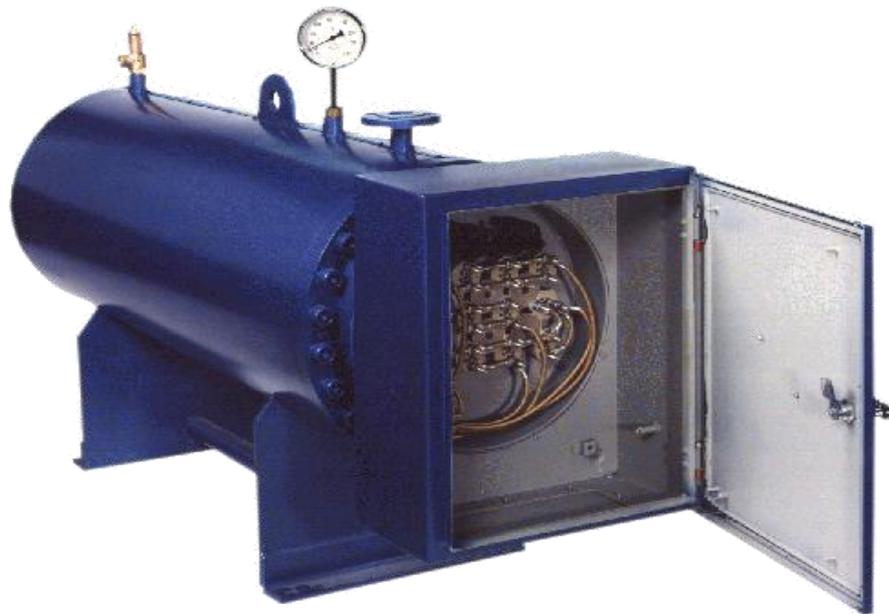
aggregate coating

whisky distilling

water treatment

space heating

For All Industrial Process Heating Systems



Electric In-Line Heater for Fuel Oils, Water, Chemicals etc.

Find us on the Internet
At

www.akwaugh.com

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Industrial Process Heating Equipment

Foreword

A.K. Waugh has supplied industry with heating equipment for Oils and for other process fluids for more than 80 years.

Fuel Oil Heating



We manufacture Oil Immersion, Oil Outflow and Oil In-Line Heaters. Heaters are individually manufactured to suit your application, and may use several heat sources, the most popular of which is electricity. Use of Steam, Hot Water or Thermal Oil as a primary or additional energy source can be incorporated. (Immersion and Outflow Heaters - see separate catalogues)

Other Fluids

When we are required to manufacture equipment for use with water, acid or alkali this is easily accommodated using different materials than those normally used for oil. Build and testing generally follow the same stringent procedures used for our oil heater products, thus ensuring reliability.

Pumping and Heating Units



We provide a complete and integrated Pumping and Heating service. Normally we do not advertise specific systems since most of our equipment is customised in some fashion or other for individual tasks. If this type of equipment is of interest please ask for further information. We will be pleased to help.

Control Panels



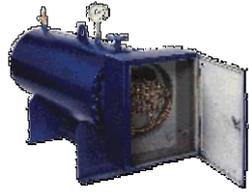
We provide a comprehensive range of custom-built panels to suit heaters and P&H sets. These are available with a wide range of options and can be supplied for heater outputs ranging from 3kW to over 350 kW, also manufactured for various climatic zones throughout the world. Detailed specifications are available upon request.

In General

We are here to give you technical assistance to let you choose the best heater or combination of heaters for your process. We will give you up to date advice on the fluid you wish to heat, and will work with you towards an effective and efficient solution for your heating needs. Our work is backed up where required by the design and testing services of organisations such as Lloyds Register or DNV.

We work to ISO9001.

Electric Line Heaters LHR Series



Mild Steel versions for Heavy Oil Stainless Steel versions for most other fluids Output Range 6 - 36 kW

Watts Ratings between 6 and 8 W/in² (0.9 and 1.2 W/cm²)
Standard W.P. up to 16 bar - higher pressures available.

(This range is not generally suitable for Reclaimed Oil or strong acids - contact us for information.)

Ratings based on fluid Inlet Temperature : 55°C / fluid Outlet Temperature : 90°C
Maximum allowable outlet temperature 150°C

List Number	Rating kW	FUEL OIL Litres / hr Raised 35°C	WATER Litres / hr Raised 35°C	No. & Rating of Elements (kW)	Length & Shell O.D.	Possible Electrical Stages
LHR 01	6	300	135	3 @ 2.0	1100 / 220	1
LHR 02	9	450	200	6 @ 1.5	1100 / 270	1
LHR 03	12	600	270	6 @ 2.0	1100 / 270	1
LHR 04	18	900	400	6 @ 3.0	1100 / 270	1
LHR 05	24	1200	540	12 @ 2.0	1100 / 320	2
LHR 06	30	1500	670	12 @ 2.5	1100 / 320	2
LHR 07	36	1800	805	12 @ 3.0	1200 / 320	2

Higher Kilowatt loadings available on request, built to special Order only.

The outputs shown are the best values obtainable for the particular heater at the stated temperature rise. Other temperature rises can be calculated on a pro-rata basis i.e.

For Fuel Oil, 900 lph @ 18 kW = 35°C rise
Therefore 450 lph @ 18 kW = 70°C rise and so on.

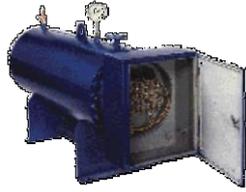
In certain units it is possible to divide the load into stages, but only in multiples of 3 elements, to ensure a balanced load. Please note that the o.d. shown is that of the Heater Shell, or body - not the overall o.d., or that of the Tube Plate. Tube Plate bolting may vary according to requirements.

Standard Equipment : Removable Core type Heating Elements
Controlling and Safety Thermostats as appropriate
Thermometer
Relief Valve - up to 6.9 bar (standard on Fuel Oil Heaters only)
Inlet / Outlet connections to suit.
IP 55 Terminal Box
External finish in Metallic Blue

Mountings are available in a variety of designs according to customer preference.

Extra Items are : Multiple Stage designs (Extra Thermostat(s) & Wiring etc.)
High Pressure Relief Valve - over 6.9 bar
Control Panel
Delivery UK

Electric Line Heaters EHL Series



Mild Steel versions for Heavy Fuel Oil Stainless Steel versions for most other fluids Output Range 36 - 144 kW

Watts Ratings between 8 and 9 W/in² (1.24 and 1.39 W/cm²)
Standard W.P. up to 30 bar - higher pressures available.

Ratings based on fluid Inlet Temperature : 55°C / fluid Outlet Temperature : 90°C
Maximum allowable outlet temperature 150°C

List Number	Rating kW	FUEL OIL Litres / hr Raised 35°C	WATER Litres / hr Raised 35°C	No. & Rating of Elements (kW)	Length / Shell O.D.	Possible Electrical Stages
EHL 12	36	1800	805	6 @ 6.00	1200 / 300	2
EHL 13	48	2400	1070	9 @ 5.33	1400 / 300	2
EHL 14	60	3000	1340	9 @ 6.66	1500 / 350	2
EHL 15	72	3600	1610	12 @ 6.00	1500 / 350	2
EHL 16	84	4200	1880	15 @ 5.60	1500 / 400	2
EHL 17	96	4800	2150	15 @ 6.40	1800 / 400	2
EHL 18	108	5400	2420	15 @ 7.20	1800 / 400	2
EHL 19	120	6000	2700	18 @ 6.66	1800 / 450	3
EHL 20	144	7200	3220	18 @ 8.00	1800 / 450	3

Intermediate or Higher kW loads available on request.

The outputs shown are the best values obtainable for the particular heater at the stated temperature rise. Other temperature rises can be calculated on a pro-rata basis i.e.

For Fuel Oil, 3000 lph @ 60 kW = 35°C rise
Therefore 1500 lph @ 60 kW = 70°C rise and so on.

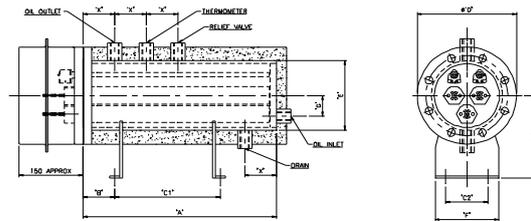
In certain units it is possible to divide the load into stages, but only in multiples of 3 elements, to ensure a balanced load. Please note that the o.d. shown is that of the Heater Shell, or body - not the overall o.d., or that of the Tube Plate. To assess the overall diameter check the sizes of the relevant PN16 blind flange.

Standard Equipment : Removable Core type Heating Elements
 Controlling and Safety Thermostats as appropriate
 Thermometer
 Relief Valve - up to 6.9 bar (standard on Fuel Oil Heaters only)
 Inlet / Outlet connections to suit.
 IP 55 Terminal Box
 External finish in Metallic Blue

Mountings are available in a variety of designs according to customer preference.

Extra Items are : Multiple Stage designs (Extra Thermostat(s) & Wiring etc.)
 High Pressure Relief Valve - over 6.9 bar
 Control Panel
 Delivery UK

Electric Line Heaters J Series for Light to Heavy Oil



Output Range 1 kW - 7 kW

Watts Ratings between 6 and 8 W/in² (0.9 and 1.2 W/cm²)
Standard W.P. up to 20 bar - higher pressures available.

(This range is not generally suitable for Reclaimed Oil - contact us for information.)

Ratings based on Temperature Rise of : 56°C
Maximum allowable outlet temperature 150°C

List Number	Rating kW	Litres / hr Raised 56°C	No. & Rating of Elements (kW)	Length & Shell O.D.	Possible Electrical Stages	Price (Ex. Works)	Element Price
J 1	1	30	3 @ 0.3	600 / 240	1		
J 2	2	60	3 @ 0.6	600 / 240	1		
J 3	3	90	3 @ 1.0	600 / 240	1		
J 4	4	125	3 @ 1.3	600 / 240	1		
J 5	5	155	3 @ 1.6	670 / 240	1		
J 6	6	185	3 @ 2.0	670 / 240	1		
J 7	7	215	3 @ 2.3	600/ 305	1		

Other Kilowatt loadings available on request, built to special Order only.

The outputs shown are the best values obtainable for the particular heater at the stated temperature rise. Other temperature rises can be calculated on a pro-rata basis i.e.

For Fuel Oil, 155 lph @ 5 kW = 56°C rise
Therefore 310 lph @ 5 kW = 28°C rise and so on.

In this heater unit there are 3 heating elements and this arrangement is generally made for single stage operation. On request we will advise on multiple stage operation. Please note that the o.d. shown is that of the Heater Shell, or body - not the overall o.d., or that of the Tube Plate. Tube Plate bolting may vary according to requirements.

Standard Equipment : Removable Core type Heating Elements
Controlling and Safety Thermostats as appropriate
Thermometer
Relief Valve - up to 6.9 bar
Inlet / Outlet connections to suit.
IP 55 Terminal Box
External finish in Metallic Blue

Mountings are available in a variety of designs according to customer preference.

Extra Items are : High Pressure Relief Valve - over 6.9 bar
Control Panel
Delivery UK

Steam / Electric Line Heaters

CES Series (NEW) for Heavy Oil / Reclaimed Oil

Output Range 20,000 - 200,000 Btu/hr



Watts Rating (on electrics) between 5 and 8 W/in² (0.77 and 1.22 W/cm²)

Standard W.P. up to 30 bar with Steam Pressure 14 bar maximum.

All units sized using 3.4 bar(g) steam

Oil Inlet Temperature : 55°C / Oil Outlet Temperature : 90°C – max. 150°C

List Number	Rating kW (30%)	Litres / hr Raised 35°C	No. & Rating of Elements (kW)	Steam Heating Surface Area
CES 300	3	300	1 @ 3.0	1.0m ²
CES 400	3	400	1 @ 3.0	1.3m ²
CES 500	6	500	3 @ 2.0	1.6m ²
CES 600	6	600	3 @ 3.0	1.9m ²
CES 700	6	700	3 @ 2.0	2.2m ²
CES 800	9	800	3 @ 3.0	2.6m ²
CES 900	9	900	3 @ 3.0	2.9m ²
CES 1000	9	1000	3 @ 3.0	3.2m ²
CES 1500	12	1500	3 @ 4.0	4.8m ²
CES 2000	18	2000	6 @ 3.0	6.4m ²
CES 2500	24	2500	6 @ 4.0	8.0m ²
CES 3000	27	3000	6 @ 4.5	9.6m ²

Other Kilowatt loadings / Surface Areas available on request, built to special Order only.

The outputs shown are the best values obtainable for the particular heater and a heater chosen from this list should perform adequately in the range 50 - 100% of full rated load.

It should be noted that the range above is completely interchangeable with our CCS and LHR ranges, such that the tube plate assemblies of the CES heaters will fit a dimensionally similar Steam Only or Electric Only unit. Our range of Hot Water Heaters is also interchangeable but advice must be sought as to performance prior to dismantling.

Standard Equipment : Removable Core type Heating Elements
 Controlling and Safety Thermostats as appropriate
 Thermometer
 Relief Valve - up to 6.9 bar
 Inlet / Outlet connections to suit.
 Fittings are provided for Sarco or alternative steam / HW control equipment
 IP 55 Terminal Box
 External finish in Metallic Blue

Mountings are available in a variety of designs according to customer preference.

Extra Items are : Spirax Sarco Steam Regulator & suitable Control Valve
 Steam Trap Set / Sight glasses, isolating valves etc.
 High Pressure Relief Valve - over 6.9 bar
 Delivery UK

Steam Line Heaters

CCS Series for Heavy Oil / Reclaimed Oil

Output Range 20,000 - 200,000 Btu/hr

Standard W.P. up to 30 bar with Steam Pressure 14 bar maximum.

All units sized using 3.4 bar(g) steam

Oil Inlet Temperature : 55°C / Oil Outlet Temperature : 90°C

Maximum allowable outlet temperature 150°C

List Number	Output in BTU's / hr	Litres / hr Raised 35°C	Steam Heating Surface Area
CCS 01	20,000	230	0.9m ²
CCS 02	40,000	455	1.9m ²
CCS 03	60,000	680	2.8m ²
CCS 04	80,000	910	3.7m ²
CCS 05	100,000	1140	4.6m ²
CCS 06	120,000	1360	5.6m ²
CCS 07	140,000	1600	6.5m ²
CCS 08	160,000	1820	7.4m ²
CCS 09	180,000	2050	8.4m ²
CCS 10	200,000	2300	9.3m ²

Greater Surface Areas / loadings available on request, built to special Order only.

The outputs shown are the best values obtainable for the particular heater and a heater chosen from this list should perform adequately in the range 50 - 100% of full rated load, dependent upon the control system in use.

The range above has been rationalised with respect to available loadings and body shell / rating combinations. Interchangeability of minor parts is a feature and will be useful for those customers with a number of similar heaters on one site. Intermediate loadings will usually be available, but will be treated as non - standard items.

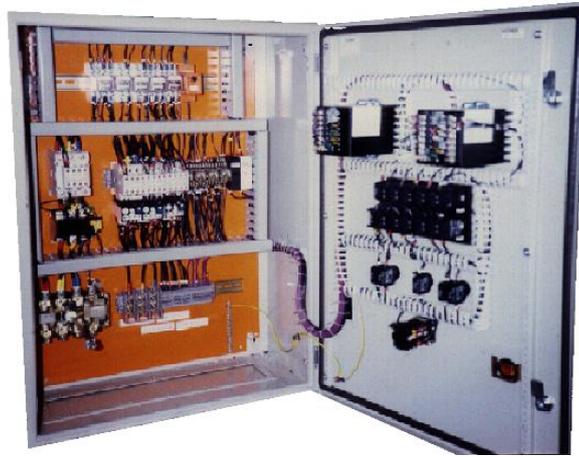
It should be noted that the range above is completely interchangeable with our CES and LHR ranges, such that the tube plate assemblies of the CCS heaters will fit a dimensionally similar Steam / Electric or Electric Only unit. Our range of Hot Water Heaters is also interchangeable but advice must be sought as to performance prior to dismantling.

Standard Equipment : Thermometer
 Relief Valve
 Inlet / Outlet connections to suit.
 Fittings provided for Sarco or alternative steam / HW control equipment
 External finish in Metallic Blue

Mountings are available in a variety of designs according to customer preference.

Extra Items are : Spirax Sarco Steam Regulator & suitable Control Valve
 Steam Trap Set / Sight Glasses, Isolating Valves etc.
 High Pressure Relief Valve - over 6.9 bar
 Delivery

Control Panels For Electric Heaters, Steam / Electric Heaters and Pumping & Heating Units



We manufacture a variety of control panels to suit our heater range. These can be simple, with only warning lights and a main isolator, or complex with digital controls incorporated.

Standard panels are wired to BS 6231, and have the following incorporated :

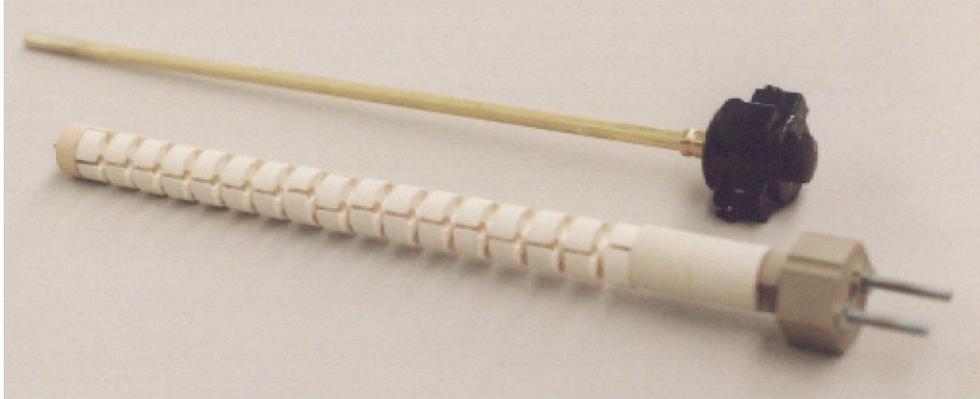
*IP66 rating
Door legends as appropriate
Door interlocked On-Load isolating switch rated above working load
Main load Contactor or Contactors as appropriate
Load and Control circuit fuses
Transformer operated warning lights
Rail mounted outgoing control circuit and load terminals*

The lower limit for the application of sophisticated control is around 3.0 kW, although we can accommodate any rating. Higher loadings are more popular since the cost of the control system is more easily justified against a more expensive heater, which may have many features worthy of incorporation in a panel.

Should there be a requirement to incorporate other controls e.g. Pump Starters, Interlock Relays and associated functions we only require your specifications to be able to incorporate these within our standard design.

Note that all heaters contain (as standard) Control and Safety thermostats which are easily incorporated into the control circuit of any simple and cost effective control panel. However, note that these thermostats are capable of direct heater operation up to 3 kW without a contactor or other mains switching device.

Heating elements & Thermostats



We manufacture our own heating elements, giving us the following advantages :

Quality Control
Flexibility
Rapid Manufacture

For urgent spares requirements we are flexible enough to move production to that requirement and complete it within whatever timescale is desired.

We do not manufacture thermostats or relief valves as these are precision items of equipment available from other specialist manufacturers.

We purchase these items as required from a selected number of long term suppliers. All heaters we manufacture, past and present, have one or both of these components and we are able to provide spares to suit.

Heavy Oil / Reclaimed Oil Line Heaters (All types)

Information

We pride ourselves in giving a sound technical service. Our knowledge is based upon over 80 years of experience in manufacturing, supplying and servicing heaters.

Our policy is to supply as complete a package as possible.

Except where indicated, everything is Standard issue and in some cases there are sub-options within the Standard at no extra cost.

- a) Heater Shell : Comprising Basic **Seamless** Steel Shell & Tube Plate Assembly
- b) Inlet & Outlet : Connection Sizes to choice - up to 4" (100mm) bore, BS4504
- c) Other Fittings : For Thermometer, Relief Valve, Drain (plugged)
- d) Instrumentation : Thermometer range to suit application (typically 100mm dial type)
- e) Valving : Relief Valve to suit application (to 150 psi - extra above this)
- f) Heating Elements : Removable Core Type with high quality Nickel Chrome wire.
- g) Thermostats : Control and Safety (Manual Reset) to suit application
- h) Terminal Box : Up to IP 65, with "Klippon" type terminations
- i) Mountings : As required, plate supports, side horns etc.
- j) Lagging / Cladding : Heaters are lagged with Rockwool & Clad in sheet M.S.
- k) Painting : Generally Primer & Hammer Blue.

We can, within reason, accommodate variations to our standard equipment such as additional fittings or specific colour schemes to RAL specifications.

For Steam or Hot Water Heaters, we supply as standard certain fittings for steam temperature control, whether or not you specify these from us. Generally this will be a BSP connection on the Tube Plate for a Steam Regulator. If you have a particular system in mind we would be happy to advise.

Our Standard Guarantee (with the exception of Waste / Recycled oil heaters) is 12 months from the date of purchase, regardless of when the equipment is put into use. We do aim to be flexible and may consider claims outwith this period on their merits. We have an optional plan which extends certain aspects of our guarantee - please enquire.

Waste or recycled oil heaters have to endure special working conditions which mean that the standard guarantee is not suitable. We therefore base any claim for assistance solely on the information we can acquire regarding the process involved.

If you are a new customer, you are invited to supply as much information as possible to allow us to build a heater which suits your process.

General Information – Fuel Oil Preheating

Oil Burners, depending upon the type used, usually require the viscosity of the oil to be as indicated below. The type of heater and thermostat ranges are generally dependent upon the oil burning plant, grade of fuel and to suit a particular make and type of burner. Please Note : these comments do not apply to Waste / Reclaimed Oil.

Specifications are in line with BS2869:1988

Oil Type (Description)	: Grade	: Viscosity @ Temperature	Preheater Temperatures for :	
			Pressure Jet Burners	Rotary Cup Burners
Light Fuel Oil	: Class E	: 8.2 cSt @ 100 C	: 60 - 70 C	: 25 - 33 C
Medium Fuel Oil	: Class F	: 20.0 cSt @ 100 C	: 90 - 105 C	: 40 - 50 C
Heavy Fuel Oil	: Class G	: 40.0 cSt @ 100 C	: 110 - 130 C	: 70 - 82 C

Industrial Oil burning plant using pressure jet burners should be designed to allow for a temperature rise of 70 C for Class E and 85 C for Class F fuel oils. Plants requiring multi-fuel capability should be designed for Class G oil.

The temperature of the oil exiting the Line Heater is controlled by a thermostatic device.

In an electric heater this control is achieved by an electro-mechanical thermostat or other device mounted on the tubeplate, with the sensor directly in the path of oil flowing from the heater. The Control thermostat or sensor is set at or near the oil burning temperature, depending upon site conditions and the required Safety thermostat is set approximately 20 C higher to compensate for the differentials between the two thermostats. Should the Control thermostat or sensor fail to operate, the Safety thermostat acts as a master cut-out and switches the heater off. When the fault has been rectified the reset button on the safety thermostat is depressed and the circuit is re-established.

We are obliged to provide a minimum of one Safety thermostat - even if the heater has been specified with a sophisticated electronic control system. British Standards require a Safety device. Please also note that putting a control device in a pipeline EXTERNAL to the heater, however near to the actual heater shell, will ALWAYS give a false reading on emergency shutdown since it relies purely on the flow of oil past the sensor. We consider this unsafe.

Basic Electronic control via sensor and relay is achievable using standard components. For heaters with substantial outputs there is a wide range of sophisticated products available. However, money spent on close control is not always good value unless the rest of the system is similarly sophisticated. Thyristor control is particularly suitable for large electric heaters, this mode providing a stepless variation in input load as commanded by a temperature sensor or sensors.

Split loads are available on standard controls, generally using heating elements linked in groups of 3 (star connection) to provide a balanced load.

For Steam or HPHW heaters a Sarco thermostatic regulator and Steam Control valve are available as options for fully automatic control. An electronic version of this system is available, however it is often preferable to have the mechanical system since this does not rely on the presence of electrical power. It should be noted that where such heaters are used it is advisable to have the control device situated inside the heater shell in the same manner as for electric heaters to ensure a steady oil temperature under flow and standby conditions. Where the controls are sited away from the heater, say in a branch pipe, while this can give good results under flow conditions, it does not react well to damaging residual heat build up on uncontrolled shut-down.

In an Electric Heater one should particularly appreciate the mass of the heating unit and therefore the thermal inertia inherent in the design. We have gone to great lengths to provide the greatest flexibility within our ranges to prevent the possibility of oil carbonisation even under extreme circumstances.

It is our recommendation that pumping systems must be interlinked to the heater with timers for both start up and shut down, this arrangement giving flow at the times of greatest thermal stress on the oil. This simple and inexpensive addition to the electrical system will greatly extend the life of your plant.

For the purposes of standardisation of outputs, all heaters are shown with an inlet oil temperature of 55 C, the recommended handling temperature for Class G oil.

Please consult our web site for any additional information you might need.
We try to update this as frequently as possible.

Our main email is : sales@akwaugh.com

We check our email regularly and aim to reply within 24 hours. However, as with any system of this nature please do not assume safe receipt of your message. If you do not hear from us within 48 hours, please get in touch again.

You can always phone us on :

Telephone : +44 (0) 141 440 5775 (best for outwith the UK)
Mobile : +44 (0) 780 167 6794

Working days : Monday to Thursday
Working hours: 0700 to 1630

If there is no-one available to talk to you, please leave a message on our answering system.

Please note : We moved factory in 2018 to :

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Dennistoun
Glasgow
G31 3EL
Scotland