Electric Heater Batteries

Installation, Operation & Maintenance Manual

IOM 26 Issue 6

SPC

Contents

1. General

1.1 Description

SPC electric heater batteries are manufactured from either of the two designs detailed below. The first is most common and supplied by default, the latter by special arrangement.

- Incoloy (stainless steel alloy suited for high temperature operation) sheathed elements. The resistance wire is surrounded in a heat but not electricity conducting oxide powder surrounded in the Incoloy sheath. The oxide powder makes these elements electrically safe and they can be banked together to provide high rates of heat output.
- Spiral wire chromium resistance heaters. These are sets of resistance wire supported on ceramic formers and have very low thermal inertia providing rapid heat up and cool down responses.

All heater batteries are supplied with one or more safety thermal cut-out switches. The bulb of the thermostat is mounted above the elements and they are factory set at the appropriate temperature (150 to 175°C). Cut-outs can be either manual reset or auto-reset; manual resets are fitted with a reset button at the dial. The cut-outs must not be wired directly into the element power circuit but are intended to be wired into the control circuit in line with the operating coil of the contactor for the heating elements.

All heaters are built to order and order details need to be consulted in order to determine the rating, power supply and number of stages into which the battery is divided. When supplied with multiple stages the available capacity is split between them and the stages can be operated independently; they need not be equally rated.

Heaters are available to suit any power supply though higher rated batteries would inevitably be better suited to 3 phase supplies. The power supply information will be detailed on the order paperwork.

Electric heater batteries are only suitable for mounting internally unless specially designed and rated otherwise; they are available in rectangular or circular casings to suit the adjacent ductwork that they are being fitted into. Rectangular batteries have a welded steel casing with a plain flange all round finished in grey powder coat. Circular heater batteries are constructed from pre-galvanised steel sheet.

All heaters are tested prior to despatch. They undergo resistance tests, a 500V Megger test, a 2000 volt flash test and final inspection.

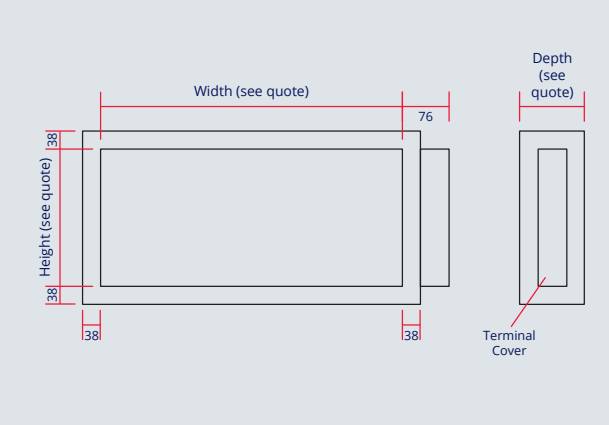


Figure 1. Rectangular Heater Battery

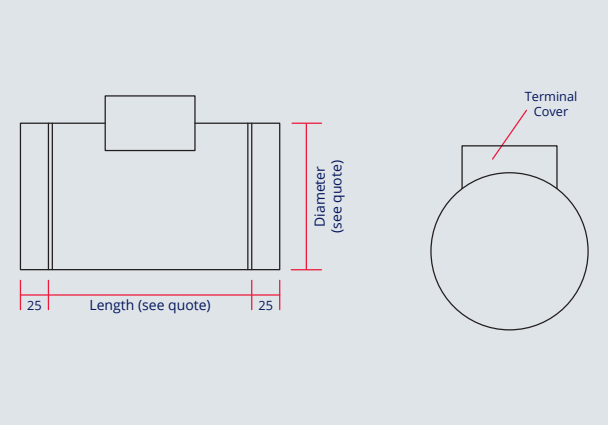


Figure 2. Circular Heater Battery

1.2 Receipt and preparation

On receipt check that all details are correct against the delivery schedule. Report any damage to the carrier and SPC immediately. It is recommended that any packaging is left in position until the heater batteries are ready to be fitted and that they are stored suitably so as to avoid the risk of damage. They must not be stored in areas where they may be subject to moisture or high humidity.

2. Installation

2.1 Mounting

Heater batteries are intended for mounting into ductwork either rectangular or circular. The heater battery would normally be sized to suit the size of the ducting but on occasion there will be ductwork transformation pieces between the heater batteries and the ductwork so as to achieve a suitable velocity across the heater.

Rectangular heaters have a plain flange all round which can be drilled through to allow bolting to corresponding holes in the ductwork flange. Gasket seals should be used between mating flanges. The heater battery needs to be mounted in the correct orientation such that the bulb of the overheat cut-out is at the top rather than the bottom of the duct.

Circular heater batteries have male spigot connections suitable for joining to adjacent socket connections; the joint between circular battery and adjoining ducting should be sealed. The circular battery needs to be rotated into such a position that the bulb of the overheat cut-out is at the top of the ducting.

Whenever electric heater batteries are fitted in ducting they will need to be exposed to even air velocities. Uneven velocities mean some areas of the elements will be starved of air and will overheat. Ideally there should be 5 equivalent diameter of free ducting upstream or downstream of the battery but a minimum of 1m either side must be maintained prior to any bends.

If heater batteries are to be fitted inside air handling units then they will be of rectangular cross section. They will need to be supported inside the air handling unit so that they cannot move. The overall size of the heater battery will be less than the available size and the free area will need to be blanked off to prevent air bypass. Whenever components need to be installed very close to electric elements then they may need to be protected by a radiation shield to prevent damage. If electric heaters are installed in air handling units such that they are directly on the outlet of the fan then a mixing screen must be used to ensure that there is reasonably even airflow across the entire face. If areas are subject to very low airflows then they will overheat.

2.2 Wiring

SPC heater batteries just consist of the bare elements within a casing plus any overheat cut-outs attached to the casing. The latter are not wired in as they will form a part of the client's control circuit rather than the power wiring to the resistance elements. **SPC do not supply the controls themselves; they are always by others.**

Elements can be single phase or three phase and single stage or multiple stage depending on the order details. The elements should be operated by a contactor whose operating coil is in turn controlled by the components of the control circuit. If modulating control of the heating elements is required then they can be staged if this was requested at order placement;

alternatively a thyristor controller can be used to varying the effective supply in consequence of a 0-10V control signal received. Note again that thyristor controllers are beyond the scope of SPC's supply.

The wiring regimes shown below are examples of how various heater may be wired in. Note that the control circuits and contactors are always by others and are offered only as examples.

Control circuits would, as a minimum, contain at least one overheat cut-out, a flow proving switch and control thermostat. This would be mirrored for each stage of a multi-stage battery with the thermostats set to trigger at different temperature settings. The thermostat may be measuring room temperature, leaving air temperature or just be a sensor connected to a BMS or other system. The flow proving switch must open when the airflow drops below a set level or stops as in such a scenario the elements would quickly overheat. Minimum recommended air velocity is around 1.5m/s.

A fan run on facility should be incorporated into the control circuit whereby the airflow continues for a minimum of 1m after the element(s) are de-energised. This cools the elements and prevents any nuisance tripping of the over-heat cut-out switches.

The example wiring schematics are only intended as examples of how the elements may be controlled. The actual control circuit is beyond the design and supply scope of SPC; the frames marked SPC show the limit of the SPC supply which covers just the elements and any auxiliary overheat cut-outs that may be supplied.

The sketches show examples of a single phase, single stage arrangement and an example of a single phase twin stage application. The final two sketches are the corresponding arrangements in three phase. The three phase batteries are all wired in star (Y) formation and are shown with a neutral wire connected to the centre point. This neutral can be omitted if necessary.

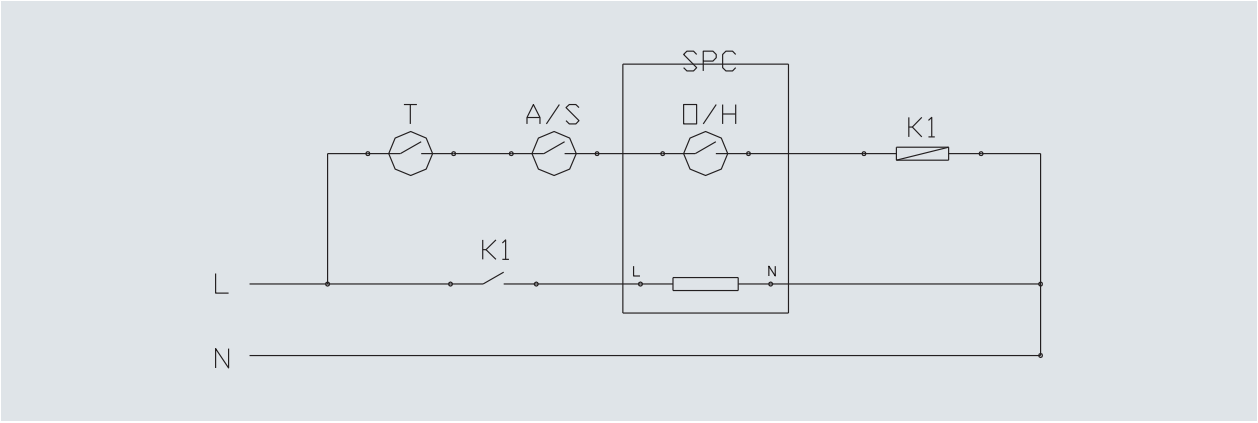


Figure 3. Single phase, single stage heater

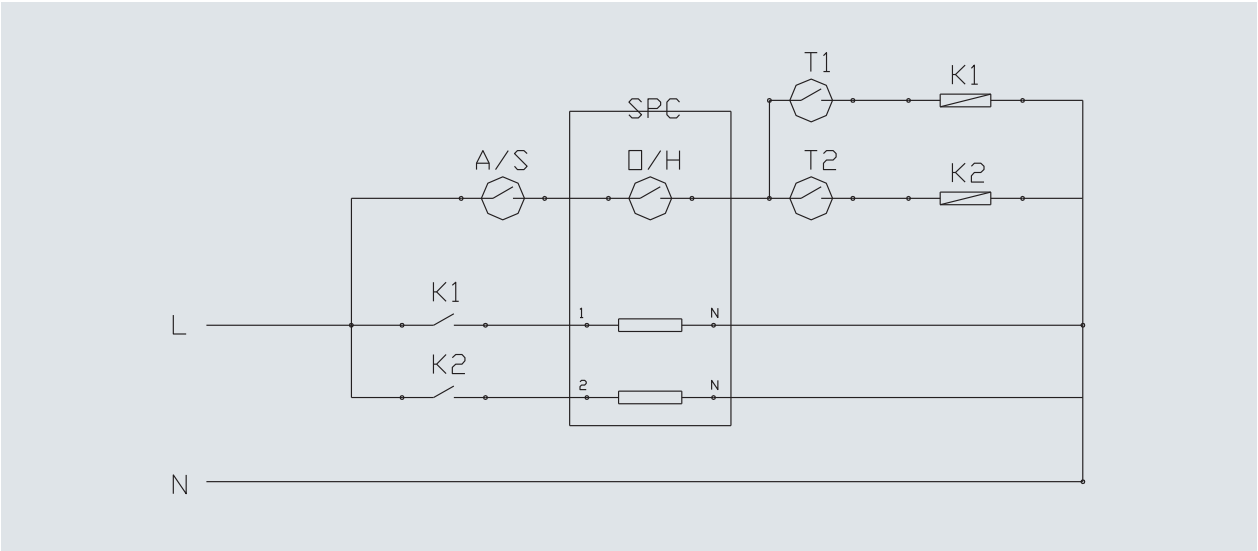


Figure 4. Single phase, twin stage heater

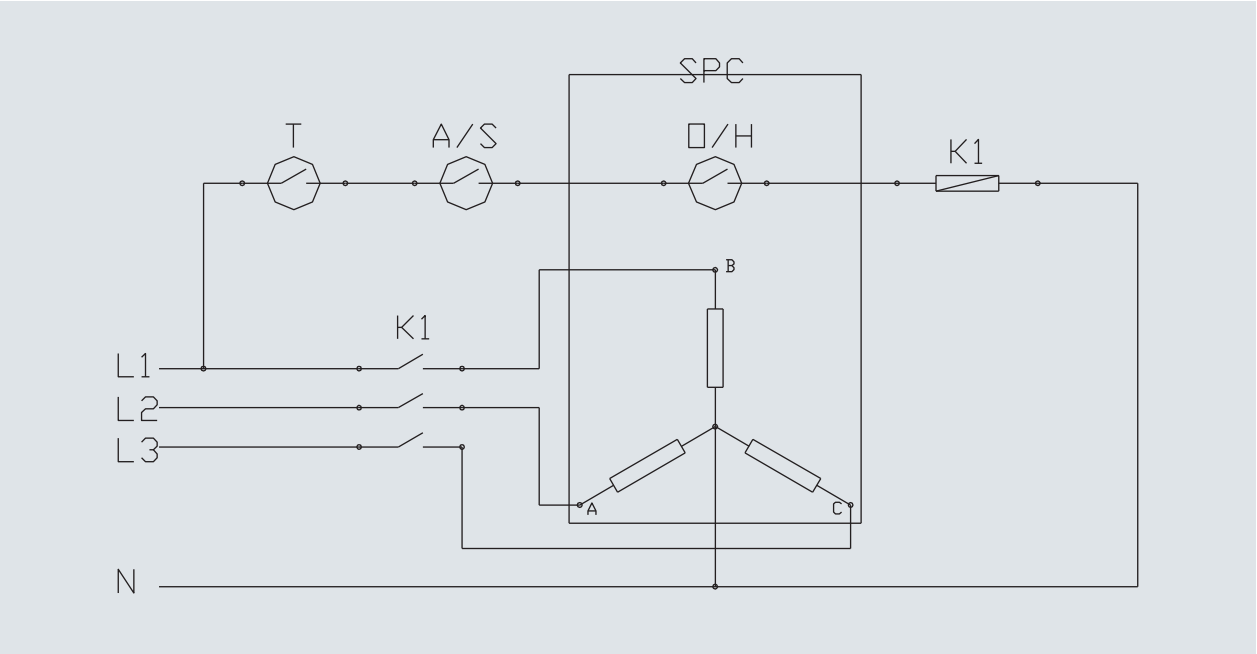


Figure 5. Three phase, single stage heater

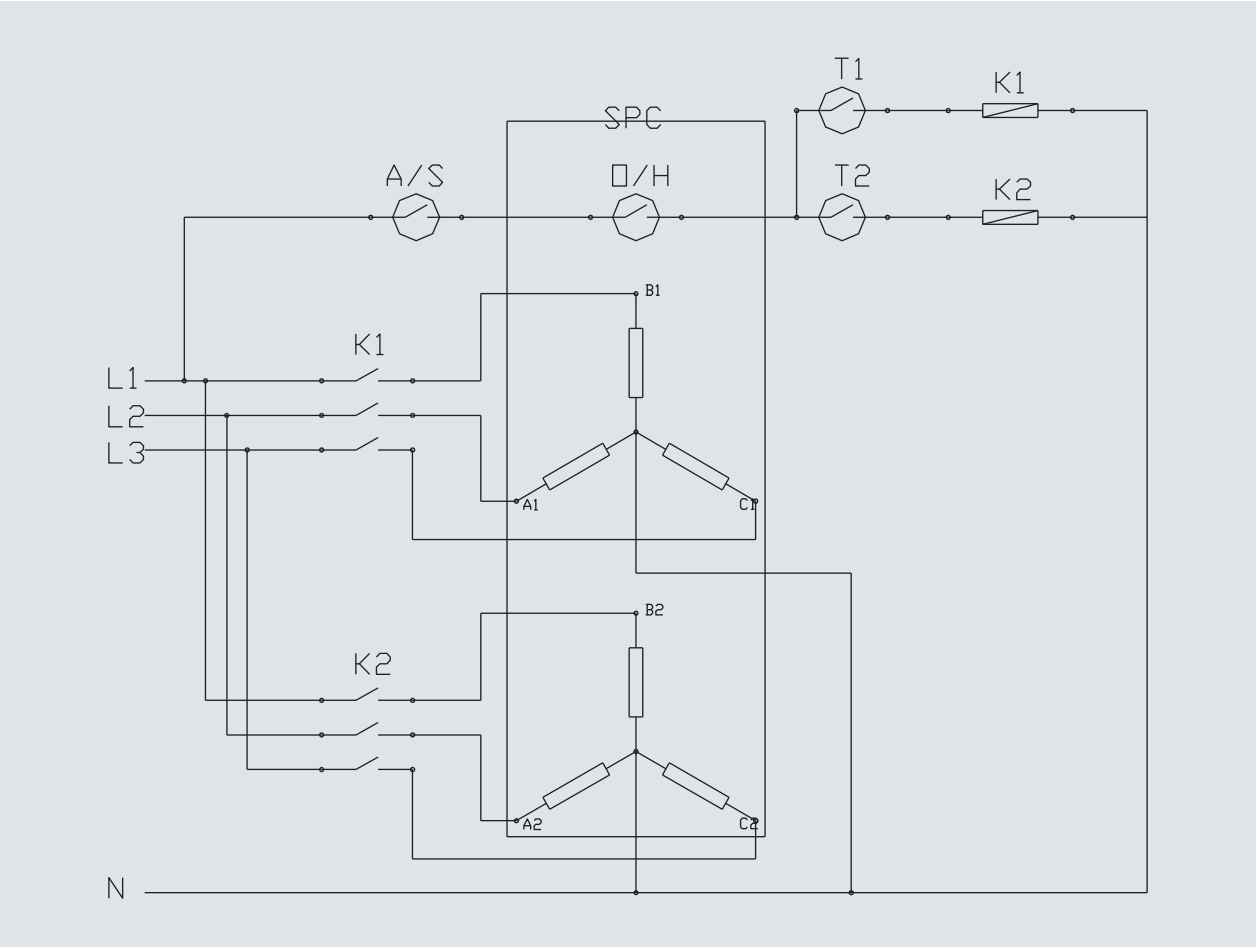


Figure 6. Three phase, twin stage heater

The following legend applies to the sketches:

T - thermostat **A/S** - air proving switch **O/H** - safety overheat cut-out **K** - contactor

3. Maintenance

The heater battery casing and heating elements may collect dust/debris over time and this should be cleaned/removed to ensure safe and optimal operation. The heater batteries must only be cleaned with dry cloths or compressed air/vacuum; liquids must not be used. The heater battery must be electrically isolated and the elements allowed to cool close to room temperature prior to cleaning.

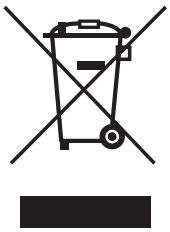
If filters are fitted upstream of heater batteries then they must be regularly cleaned. Dirty filters will partially block the airflow leading to overheating and tripping of the elements.

4. Fault finding

While it is not impossible for heating elements to fail if problems occur then these are almost invariably associated with the control of the heater batteries rather than attributable to the batteries themselves. The control circuit is beyond the scope of SPC's supply but a check on all the elements in the control circuit needs to be made; for instance a thermostat or airflow switch may be preventing the elements from energising or a manual reset safety overheat may have tripped and need resetting. Note that if overheats are tripping regularly this is a sign that there are safety issues and the cause(s) should be established before bringing the system back into service.

5. Disposal

Electric heat batteries are constructed from various metals and plastics. It is not recommended that they be disposed of with household waste but should be recycled as far as possible.



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