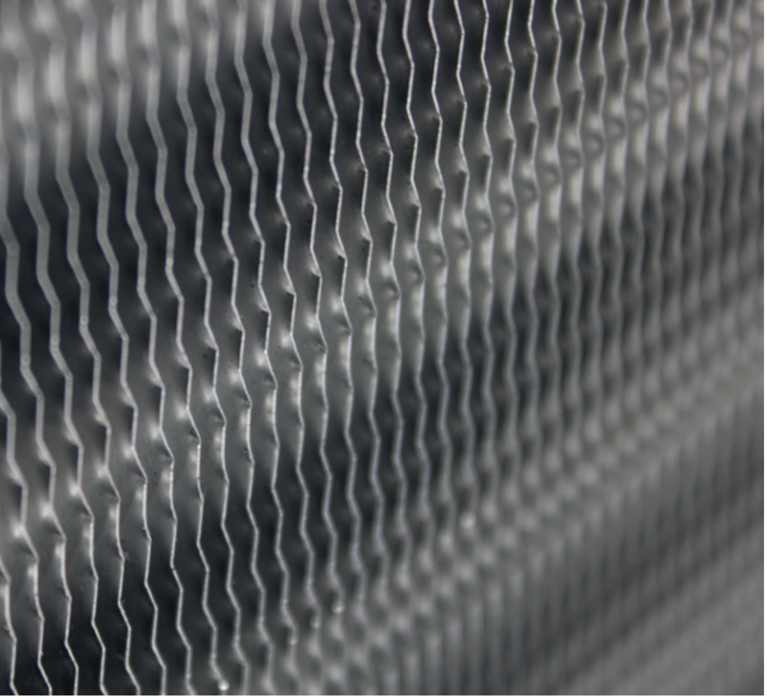

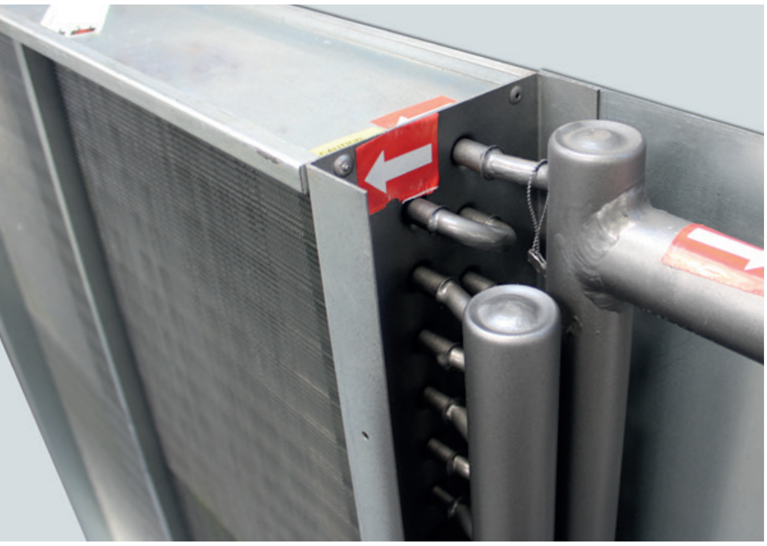

Coil Heat Exchangers

SPC

Contents

1 Coil Types

Water Coils

Water is the most common medium used on the tubeside of coils for heating or cooling a stream of air. For cooling applications it may also be appropriate to dehumidify the air by cooling it below its dewpoint temperature, though condensation is often just coincidental to the cooling process.

Hot water coils for heating air can use conventional boiler temperatures or lower hot water temperatures associated with high efficiency boilers and heat pumps. Coils for medium and high temperature hot water systems are manufactured with higher specification materials though tubes are always copper and a safe maximum, continuous working temperature of 160°C is recommended.

Chilled water cooling coils are available to reduce the temperature of an airstream or to simultaneously cool and dehumidify it. Coils can be sized to operate against typical chiller temperatures or elevated chilled water temperatures if it is important to remove the possibility of moisture condensing on the coil surface. If moisture may form then the cooling coil will be supplied with an integral drainpan.

For any water coil a selection can be made based on a percentage of antifreeze/glycol in the fluid to protect against freezing. Some form of frost protection should always be considered on water systems as stagnant water, exposed to sub-zero temperatures, will expand and readily split coil tubes. Glycol should be considered as a last resort as it has a deleterious effect on coil performance and fluid pressure drop.

If the conditions and fluids permit, a single coil can be designed to act as both heating and cooling coil in a changeover system which is cyclically fed by hot and chilled water as may be generated by a reversible air-water heat pump.

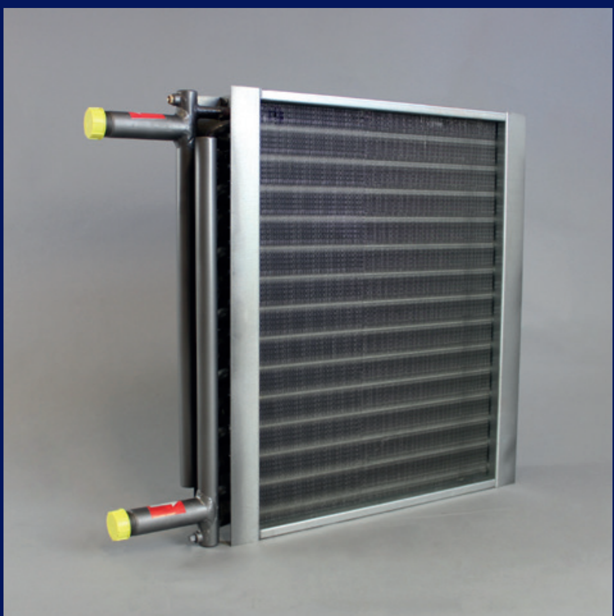

Figure 1. Hot water coil

Figure 2. Chilled water coil

Steam Coils

At one time a popular medium as a result of the high rate at which steam can transfer heat and its ready availability, steam is no longer the medium of choice due to the issues associated with generating the steam along with distributing it and collecting the condensate. There are, however, a number of legacy systems and limited new ones requiring steam coils for air heating. SPC offers a range of bespoke steam coils constructed from higher specification and thickness tube and braze materials. It is essential that steam coils are installed in well-engineered systems to ensure that condensate is removed from the coil as it is formed or differential thermal expansion will quickly lead to damage.

Figure 3. Steam coil

Refrigerant Coils

Air conditioning and refrigeration coils are components of direct vapour compression systems; refrigerant on the fluid side of the coil is used to directly cool (cool and dehumidify) air or heat it. In the former the coils are known as DX or evaporator coils as the refrigerant evaporates at a constant temperature within the coil tubes. In the latter, in which the refrigerant is used to heat the air, the coil is often termed a condenser or condensing coil as the high temperature refrigerant condenses to the liquid state within the tubes.

All common refrigerants except ammonia can be used inside copper tube coils, both pure and blended, and coils can be split into any number of sections (circuits) so that a single DX coil can be served by several condensing units (heat pumps). DX/evaporator coils are manufactured with proprietary brass distributors on the inlets to ensure proper mixing of the liquid and vapour entering the coil.

SPC can design and supply DX coils for use in reverse cycle applications. Such coils form a part of an air to air changeover heat pump system and can be sequentially used as either evaporators (air coolers) or condensers (air heaters).

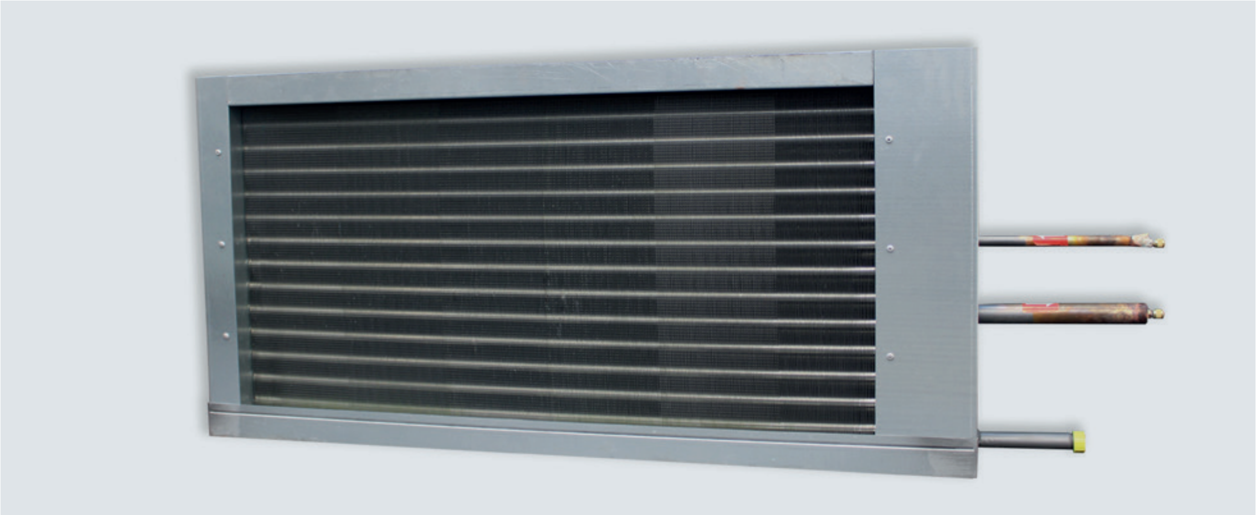

Figure 4. DX coil

2 Heat recovery

Runaround Coils

Runaround coils are air to air heat recovery devices employed in applications where competing technology cannot be used. Such applications involve scenarios where the supply and extract ducting/air handling units are not adjacent to one another and the airstreams remain distant. The only air to air device that will function with remote airstreams is the runaround coil.

Essentially, runaround coils are just a pair of coils; one operating in cooling mode and one in heating mode. The two coils are in a closed system coupled by the water circulating between the two. The water temperature finds a level between the two airstreams such that the extract (cooling coil) strips heat from the dirty extract air and adds it directly to the water circulating in the coil tubes. The circulating water then passes through the supply (heating) coil where it gives up heat to the air passing across it. The net effect is a transfer of heat from the extract air into the supply airstream.

Typical efficiencies for runaround coil systems are 50 to 60% where the efficiency measures the temperature rise on the supply air as a proportion of the difference in temperature between the extract and supply streams.

While a typical runaround coil system will feature just a single supply coil coupled to a single extract coil it is possible for several extract or supply coils to be used on the same loop.

A runaround system is normally sized for winter operation where available energy savings are greatest but the same system will automatically function in summer to cool supply air if there is a significant difference between warm outside air and extract air.

Pump Packs

SPC offer a range of pump packs to complement pairs of coils supplied for runaround applications. The two available pump packs are identical with the exception of the size/capacity of the circulating pump itself. The Reclaim 2L pack circulates a nominal 2 litres/s of fluid while the Reclaim 6L circulates a nominal 6 litres/s.

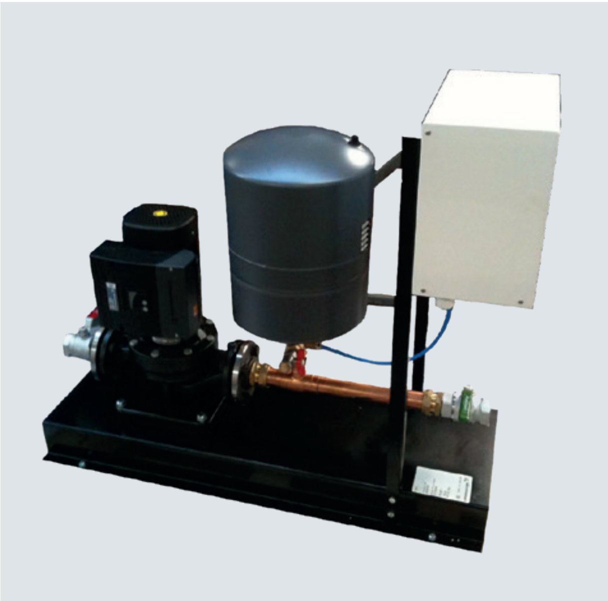

Figure 5. Pump pack

The pump packs incorporate the following features all mounted on a single skid.

- Single stage inline circulator with inverter speed control (230V single phase for Reclaim 2L, 400V three phase for Reclaim 6L). Speed can be set on the pump terminal plate
- Off line pressurisation set with diaphragm pump (2.4 bar rating), break tank, pressure switch, pressure gauge, mains and overflow connector. 230V single phase on both sizes of pump pack
- 24 litre expansion vessel on suction side of circulating pump
- Full bore shut of valves on inlet and outlet pipes
- Terminals available for remote enable/disable switching

Pump packs are intended for internal installation and can only be mounted externally if protected from the elements by a ventilated enclosure.

3 Materials

Tubes

All SPC coils are manufactured from seamless copper tubes either 12mm or 5/8” o/d. The standard wall thickness is 0.4mm, increased thicknesses of 0.7mm for 12mm tube and 0.9mm for 5/8” tube are available and typically used for steam, high temperature hot water and some condenser applications.

Fins

Standard fin material is plain aluminium but enhanced corrosion protection can be provided using precoated (vinyl coated) aluminium fin strip or postcoated protections such as Blygold. Precoated fins offer a cost effective solution that is good for mildly corrosive atmospheres - the thin vinyl coating provides a physical protection to the aluminium substrate though raw edges are exposed during the manufacturing process as the fins are punched/formed. Postcoatings are applied after completion of the coil manufacture and are spray processes that cover the fin block and all edges. Being applied after manufacture postcoatings are more effective though attract a price premium.

Copper fins can be used though they add to both the weight and cost of the coil. Heating coils for use in hospital applications often call for this construction as copper is considered antimicrobial. When copper fins are used on cooling coils they benefit from a similar metal joint with the tubes and give no opportunity for galvanic corrosion sites to form when covered in condensed moisture. Some older specifications call for copper fins to be electro-tinned after manufacture to add an additional protection to the underlying copper substrate but this process is rapidly being superseded by coated aluminium materials which can be more effective at much reduced prices and weights.

The fins for 5/8” tubes have a standard rippled profile, fins for 12mm tubes are available as standard ripple or with a louvred pattern superimposed. The ‘louvring’ increases the turbulence of the air flowing across the fins and increases the rate of heat transfer. It does, however, incur a high penalty in terms of airside resistance and is only used for special applications in which performance rather than power draw is tantamount.

Casings

Standard casing material is galvanised sheet steel and standard thickness is 1.5mm. Other casing materials are available for special applications, particularly stainless steel in either 304 or 316 grade which provides additional corrosion protection for cooling coils which actively condense moisture. Other materials; brass, copper, aluminium are available to special order but would not normally be considered for standard air conditioning applications.

Drainpans for collecting moisture are often integral to cooling coils and these could be specified in stainless steel while the remainder of the case was from galvanised sheet. Plastic moisture eliminator blades are available for fitting to cooling coils which operate against high air velocities and would otherwise suffer from moisture being carried over downstream of the coil.

Connections

Standard connections are from steel incorporating a tapered male BSP thread. Plain copper connections are also available along with a variety of flange types both screwed and welded.

4 Casings types/ applications

The standard casing designs are described below but please contact SPC for special requirements as bespoke casings are available.

Economy/Standard casing

This is the basic standard casing arrangement for heating coils which are intended to be bolted into ductwork. The casing consists of flanged trays all round to be used to bolt to adjoining ducting. Coils often need to be of a greater face area than the ducting necessitating the use of ductwork transformation pieces upstream and downstream. This casing style sees the return bends and manifolds outside the casing with the coil tubes free to expand and contract within the tubeplates. As a result some air leakage is inevitable.

The standard casing design can also be selected for duct-mounted cooling coils but drainpans only extend below the fin block so other arrangements would need to be made to collect any moisture forming under the ends or the whole assembly would need to be vapour sealed.

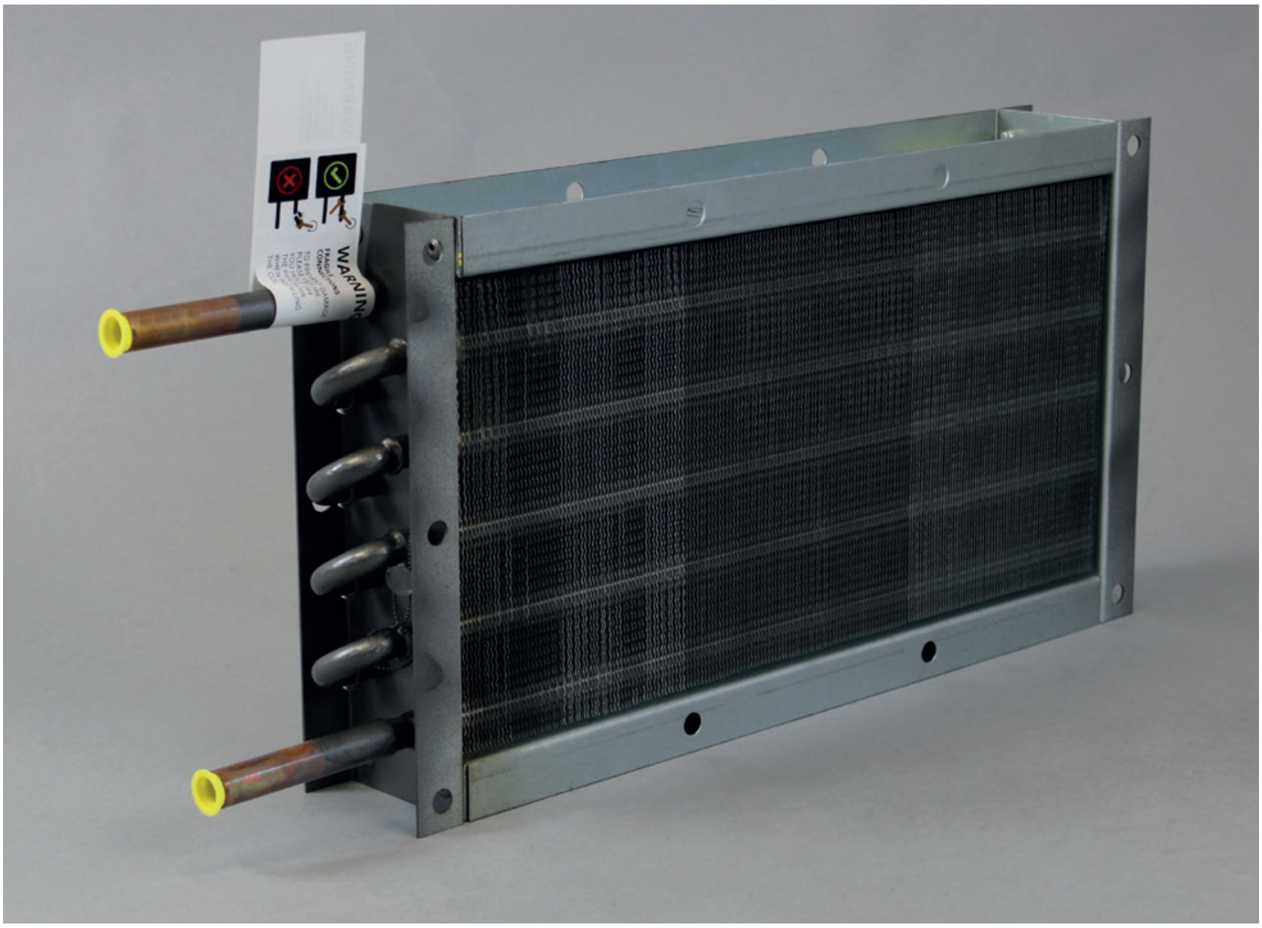

Figure 6. Economy heating coil

Enclosed casing

The enclosed casing is also intended for use with duct-mounted coils but this premium casing style incorporates sealed coverboxes over the ends, covering the return bends and manifolds.

The coverboxes minimise the rate of air leakage from or into the casing and are usually specified for hospital applications and other critical areas where leakage needs to be minimised. Note that coils do not comply with the strictures of ductwork leakage standards as they cannot be measured against a leakage rate per unit area.

The regulations advise that coils and other similar components are isolated when duct pressure testing.

Duct-mounted cooling coils are normally selected with enclosed casings as the coverbox design allows for the drainpan to extend below the return bends and manifolds and to allow overall condense catchment. Enclosed cased cooling coils are optionally available with removable drainpans to facilitate cleaning.

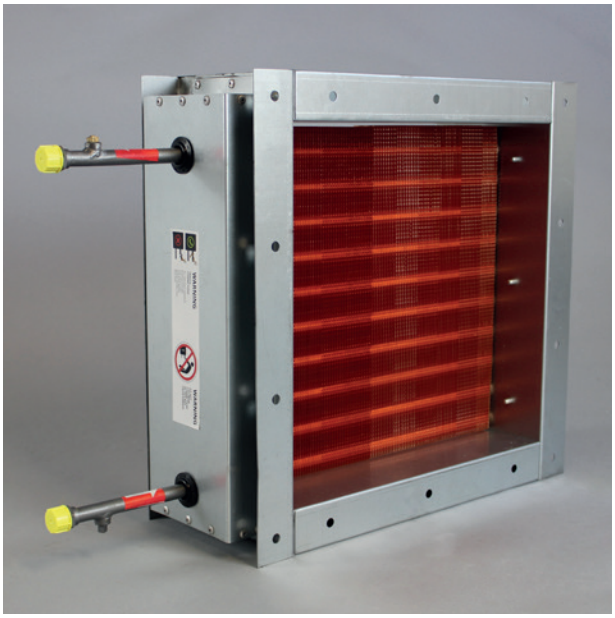

Figure 7. Enclosed heating coil

Figure 8. Enclosed cooling coil

Unitary casing

Unitary cased coils are designed to sit inside air handling units (AHU) rather than be bolted into ductwork. They are sized such that the overall casing size is close to covering the open area of the inside of the AHU. Coils are offered with baffle plates masking the return bends and manifolds so as to prevent air bypass around the sides of the coil.

AHUs normally feature drainpans in the bases of their cooling coil sections allowing moisture formed on the surfaces of the cooling coil to drip into them. Cooling coils can be supplied with perforated bases to enhance drainage or, if there is no drainpan in the base of the AHU, an integral drainpan can be fitted to the coil covering fin block, return bends and manifolds.

Figure 9. Unitary cased heating coil

5 Connection pipe handings

For coils with multiple rows of tubes in the direction of air flow it is important that the internal fluid flows generally in the opposite direction to the air. This optimises the rate of heat transfer and will match the quoted performance. Such multi-row coils can have the pipe connections on either the LHS or RHS when looking in the direction of airflow but SPC will need to know which option is required prior to manufacture. The sketch below identifies how to specify the required connection handing.

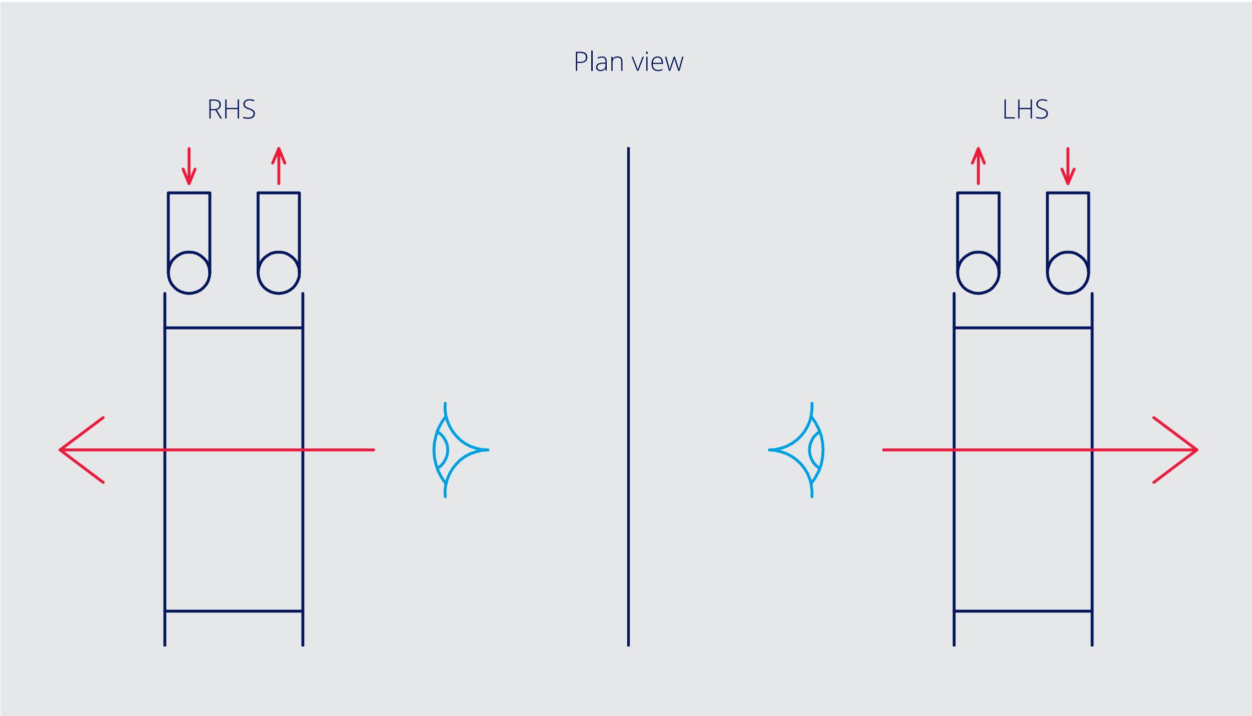

Figure 10. Handing convention

6 Quality and testing

Coil design and manufacture is undertaken in line with the company ISO accredited quality system and in line with the requirements of article 3 of the pressure equipment directive. The latter stipulates that coils be manufactured in line with sound engineering practice but that they cannot bear the CE or UKCA mark.

All water and steam coils are pressure tested to 22 barg, air under water. Higher test pressures can be specified and refrigerant coils are typically tested up to 45 barg. Maximum safe working pressure for water coils is 15 barg and for steam coils 6 barg.

Refrigerant coils, additionally, shall be vacuum dehydrated and supplied with a holding charge of nitrogen.

7 Software

SPC offer an online coil self-selection tool. Please visit the website for more details and to watch tutorials.

8 Electric Heater Batteries Specification

SPC offers a comprehensive range of electric heater batteries. Units are available to suit either rectangular or circular duct mounting. Batteries can also be designed such that they fit inside air handling units (some blanking off of the airway will be required). Rectangular models are from a fully welded steel construction with a grey powder coated paint finish. Circular heaters are constructed from rolled galvanised sheet steel. Features of the range of units are highlighted below:

- Heaters use 8mm Incoloy heating elements with resistance wire isolated electrically from the outer Incoloy sheath. These 'safe' elements are in compliance with BS7351. Elements can be manufactured from resistance wire and ceramic formers by special request
- Elements are designed to operate with surface temperatures below 400°C
- Minimum capacity 0.5kW up to 400kW in a single section
- Heaters can be supplied to suit single or three phase supplies
- The basic heater supplied is single stage but multiple stage heaters are available to suit the application
- All heaters are supplied with one or both of a manual reset and auto reset overheat cut-out. These are not part of the heater power circuit but must be wired into the control circuit of the heater(s) by the installer
- Heating elements are supplied without controls (by others). They are suitable for 0-10V thyristor control to provide exceptional close control
- Standard supply has the electrical box at one side or on the circumference of circular units. They are intended for internal installation though IP rated electrical boxes are available by special request
- All heaters are safety tested before delivery (2000V flash test and 500V Megger test)

Figure 11. Rectangular heater battery for duct-mounting

Figure 12. Circular heater battery for duct-mounting

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