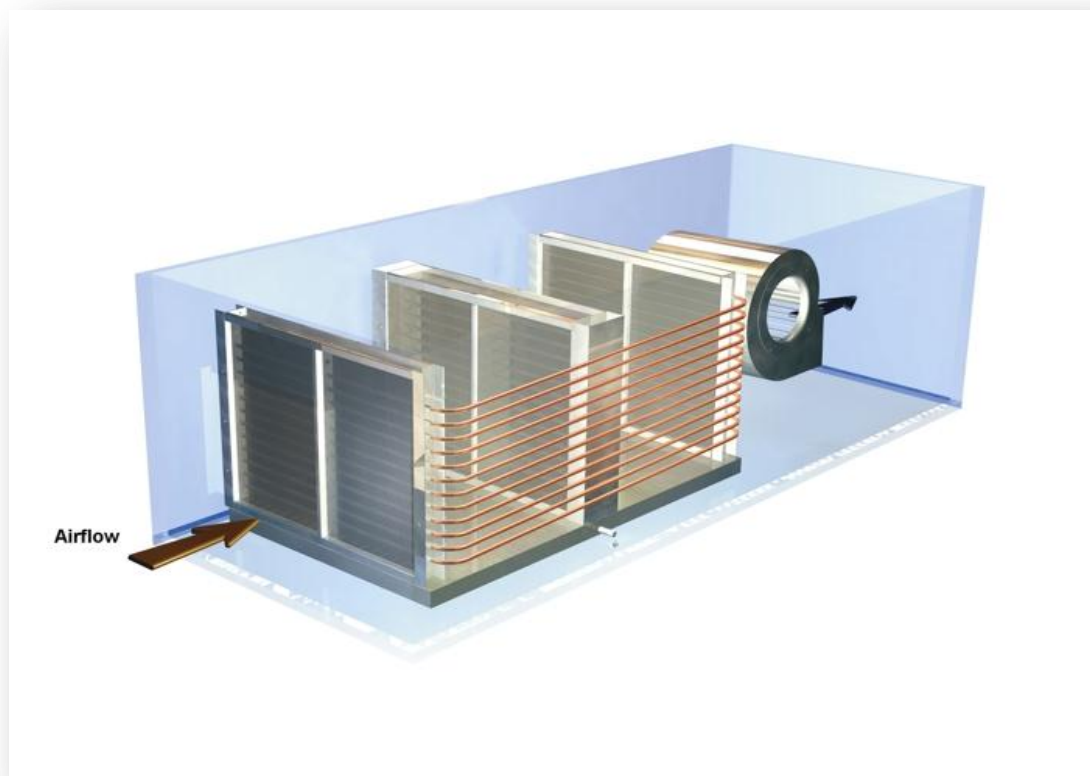


INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS



S&P COIL PRODUCTS LTD.
S P C HEAT PIPES FZC

HEAT PIPES

DEHUMIDIFICATION &
HEAT RECOVERY

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1 General Introduction

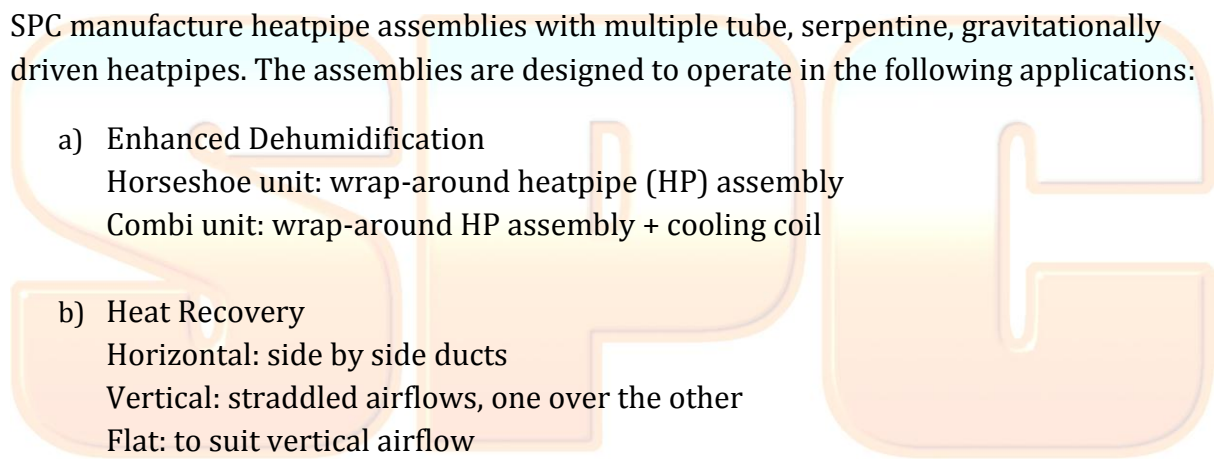
Heatpipe installations are generally used in either AHU or duct mounted applications. In the form in which they are manufactured by SPC they have a similar construction to conventional heat exchanger coils and the majority of installation and maintenance issues are identical to those for coils.

Operational aspects of heatpipe applications are different from normal heat exchangers and are briefly outlined below.

An individual heatpipe is an evacuated tube, charged with a working fluid designed to operate across the range of temperatures of interest. A temperature difference from one end to the other causes evaporation of the fluid, taking with it a quantity of latent heat.

The fluid condenses at a cooler portion of the heatpipe, giving up the latent heat. The condensed fluid is returned from whence it came under gravity.

SPC manufacture heatpipe assemblies with multiple tube, serpentine, gravitationally driven heatpipes. The assemblies are designed to operate in the following applications:

- 
- a) Enhanced Dehumidification
 - Horseshoe unit: wrap-around heatpipe (HP) assembly
 - Combi unit: wrap-around HP assembly + cooling coil
 - b) Heat Recovery
 - Horizontal: side by side ducts
 - Vertical: straddled airflows, one over the other
 - Flat: to suit vertical airflow

The heatpipe coils comprise one or more matrices of copper tubes supported in tube end plates and associated casing work. The tube matrix carries thin continuous fins, regularly spaced, at right angles to the tube matrix.

The fin arrays are designed to provide an enlarged airside surface and to optimise heat transfer for the design air conditions, whilst minimising the resultant airside pressure drop.

Should a chilled water cooling coil be included in a Combi type heatpipe then the cooling coil tubes are fed via a flow header which distributes the fluid in to a series of circuits designed to provide optimum in-tube fluid velocity. In this case a return header and connection collect the fluid after it has passed through the coil. If the cooling coil uses refrigerant, i.e. a DX evaporator, then the inlet to the coil is via a distributor assembly and capillary tubes to ensure proper liquid distribution.

Heatpipe blocks are vacuum tested, charged with a working fluid, and leak tested. DX coils are evacuated to remove any moisture prior to being sealed and filled with a holding charge of nitrogen.

2 Safety Issues

If work is to be carried out on site, before any operation or maintenance work is undertaken, the plant must be in a safe state for work to proceed and all operations must therefore be covered by local working regulations.

There is a duty upon employers to provide such information, instruction, training and supervision as is necessary to ensure, as far as is reasonably practicable, the health and safety at work of their employees.

There is also a duty upon every employee to co-operate with his/her employer on matters affecting health and safety and to take reasonable care for the health and safety of his/herself and others who may be affected by his/her acts or omissions at work.

Warnings

Before commencing work, obtain, read, and ensure you understand the relevant safety documentation.

Prior to commencing maintenance work, ensure that all electrical supplies are isolated and cannot be switched on by others. Where the maintenance work or test sequence necessitates live operation, particular care must be exercised.

Wear a safety harness when working in areas above ground where no handrails or similar safety provisions apply.

Warning notices are to be prominently displayed in the vicinity of operations when maintenance work is in progress. They should be displayed at other locations where inadvertent operation of equipment will place maintenance staff at risk.

3 Installation

3.1 General

When moving heatpipe assemblies to installation locations do not directly forklift if no pallet is present under the units, as shown in figure 1 below.

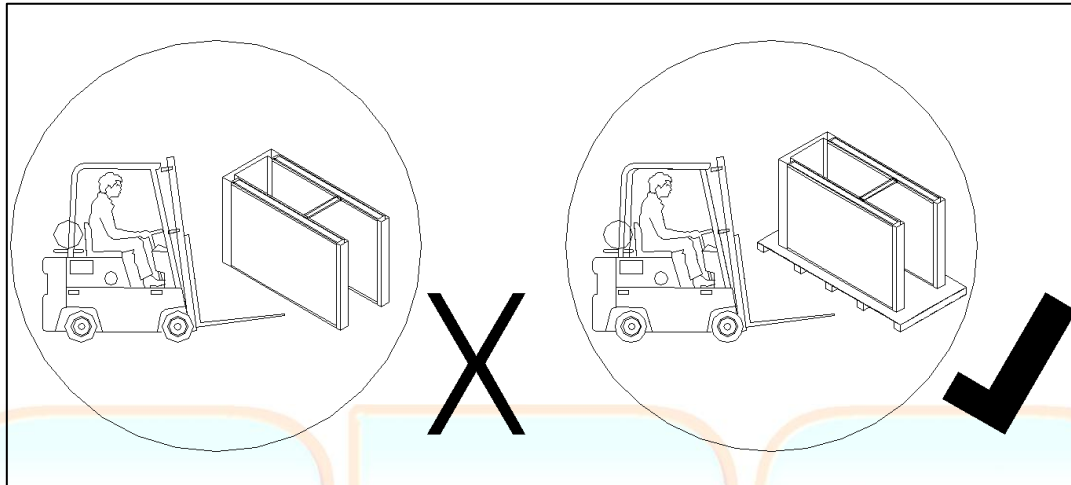


Figure 1: Incorrect & correct forklift usage

During installation, lift heatpipe assemblies by holding the casing and not headers or connections. Larger coils may have specific provision for eyebolts or similar lifting arrangements.

When lifting heatpipes as shown on figure 2 it may be necessary to drill the casing flanges in order to fit eye bolts etc. for lifting. It is imperative that these holes are drilled in the sideplates of the casing rather than in the endplates (the sideplates are the trays through which the heatpipe tubes do NOT penetrate.)

In order to prevent any possible damage to the tubes of the heatpipes all lifting must be via the sideplates as shown on the above; the sideplates have turned-in flanges for stiffness.

Horseshoe heatpipes are shipped with transit plates bolted between the sideplates. These plates are intended to maintain the separation between the two legs of the heatpipe and to stiffen/brace the assembly. The transit plates should be left in the casing until the final assembly procedure whereby the cooling coil is inserted between the heatpipe legs.

If holes are drilled in the heatpipe casing in order to assist in lifting/installation then these should be blanked off in order to prevent air bypass prior to commissioning.

Casework should be securely fixed prior to pipework flanges being made upon combined heatpipe/cooling coils.

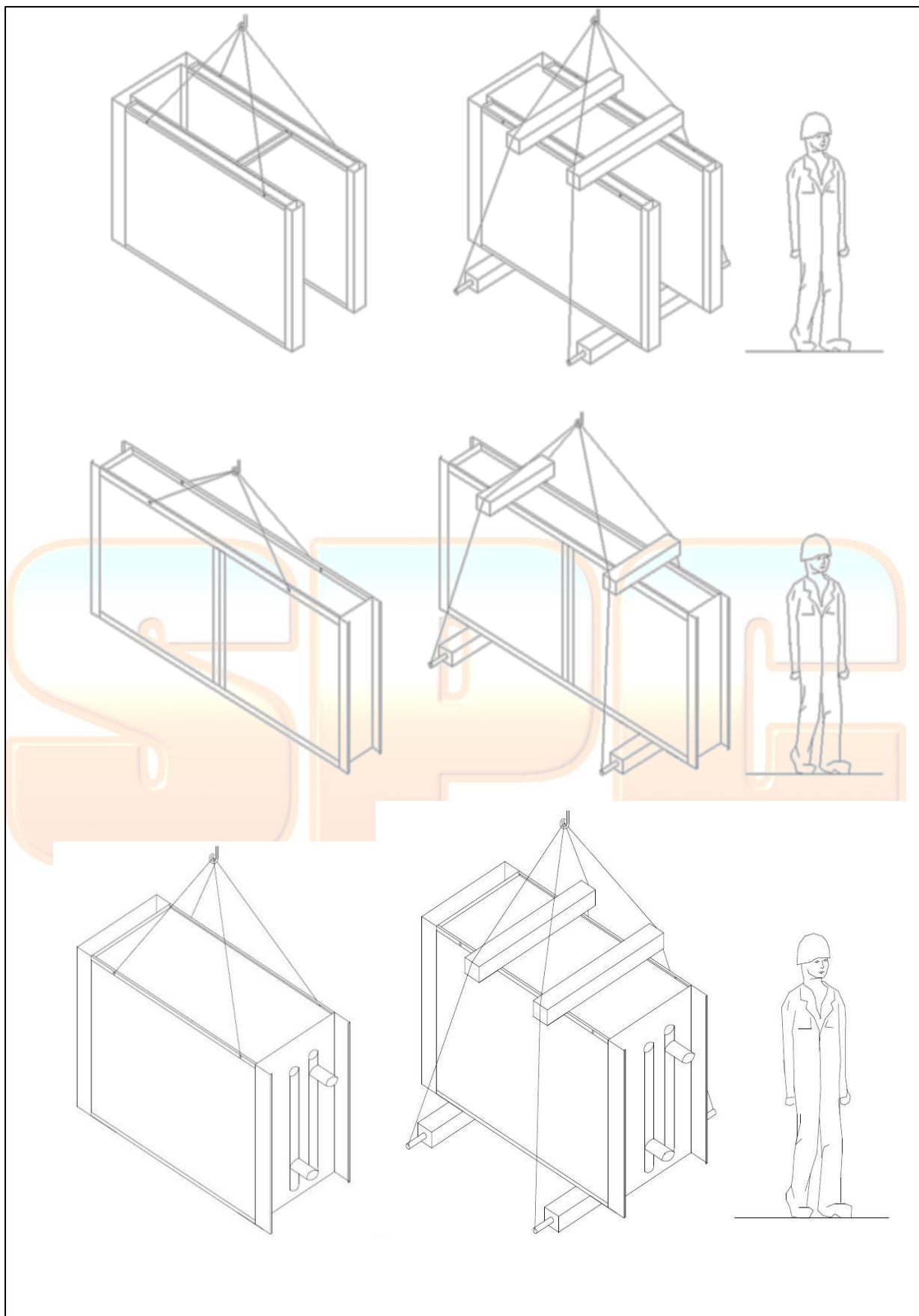


Figure 2: Examples of lifting techniques that should be employed when manoeuvring heatpipes

3.2 Enhanced Dehumidification

3.2.1 Horseshoe Unit

The assembly consists of 2 heat exchanger coil blocks mounted within a single sheet metal framework for ease of installation, either in retrofit or new build.

The assembly is U-shaped with identically sized front and rear coil blocks which constitute precool and reheat sections of the heatpipe assembly respectively. The separation between the coil blocks is sufficient to provide clearance on either side of the cooling coil, and is handed to suit the installation.

Normally baffle pieces to ensure sealing of the duct will be provisioned for by either installer or supplier, although it is the installer's responsibility to ensure that sealing is carried out correctly.

The heatpipe sections have interconnecting pipework linking them together on the opposite side of the coil from the cooling coil connections. These are encased in a rigid box to provide stiffness and to protect the pipework during installation.

The units are entirely passive and no supply or return pipework is required for installation and operation.

Bolting up of the framework should be carried out as required to ensure support and sealing. Sealing with mastic or similar is the responsibility of the installer. See Appendix 1 for more information

Retrofit: Access through the AHU casing for installation of the assembly around the cooling coil should be from the opposite end to the cooling coil connections. The horseshoe unit is introduced around the cooling coil. Upon installation the contractor must ensure no air bypass within the cabinet, and proper sealing and insulation to make good the installation.

New: The dimensions of the AHU must provide for inclusion of the Horseshoe Unit interconnecting and the pipework section around the cooling coil. Upon installation the manufacturer must ensure no air bypass within the cabinet, and proper sealing and insulation to make good the installation. All sealing/baffling (see Appendix 1 for details) should be undertaken with the intent that no air shall be allowed to bypass the heatpipe or cooling coil fin blocks. Unless the heatpipe and cooling coil are tight and sealed together this will entail blanking off of the heatpipe on both air entry and leaving faces.

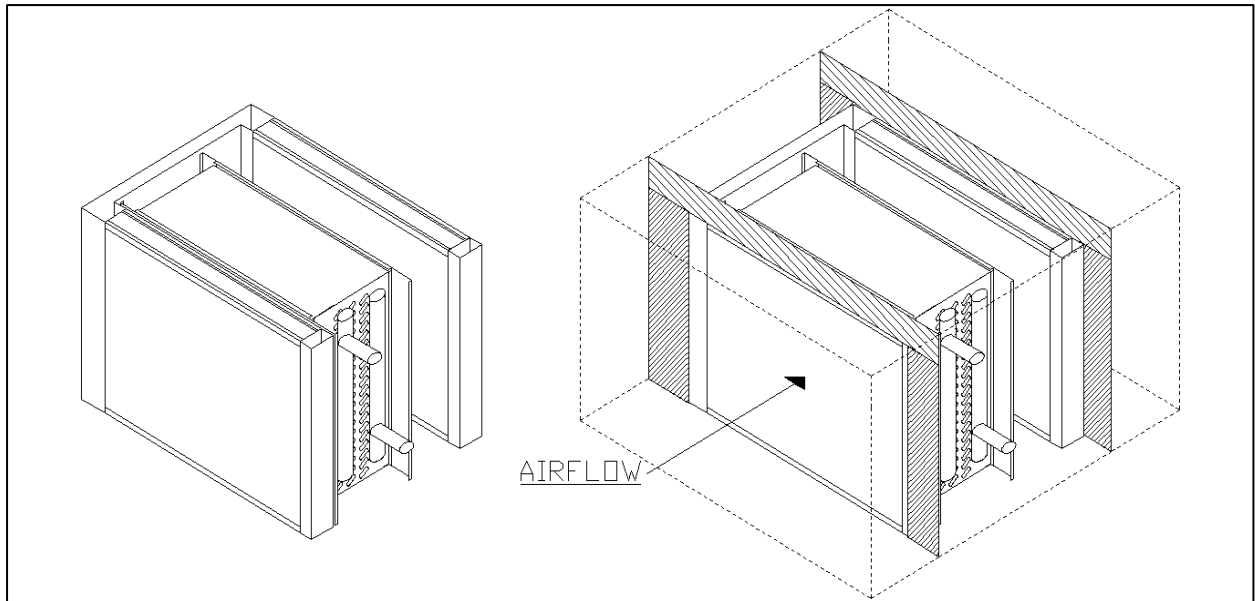


Figure 3: Horseshoe heatpipe shown before and after installation into an air handling unit

Figure 4 shows details of a horseshoe heatpipe split in two sections with the section mounted one top of the other.

The top and bottom trays of the heatpipe legs have turned-in flanges to allow easy stacking. Both sections must be secured to the panels or frame within the AHU unless the top section is physically connected to the bottom section. This is the responsibility of the installer but can be undertaken as shown using flat 'fishplates'. Sealing strip may be used at the joint to prevent any air bypass between the sections.

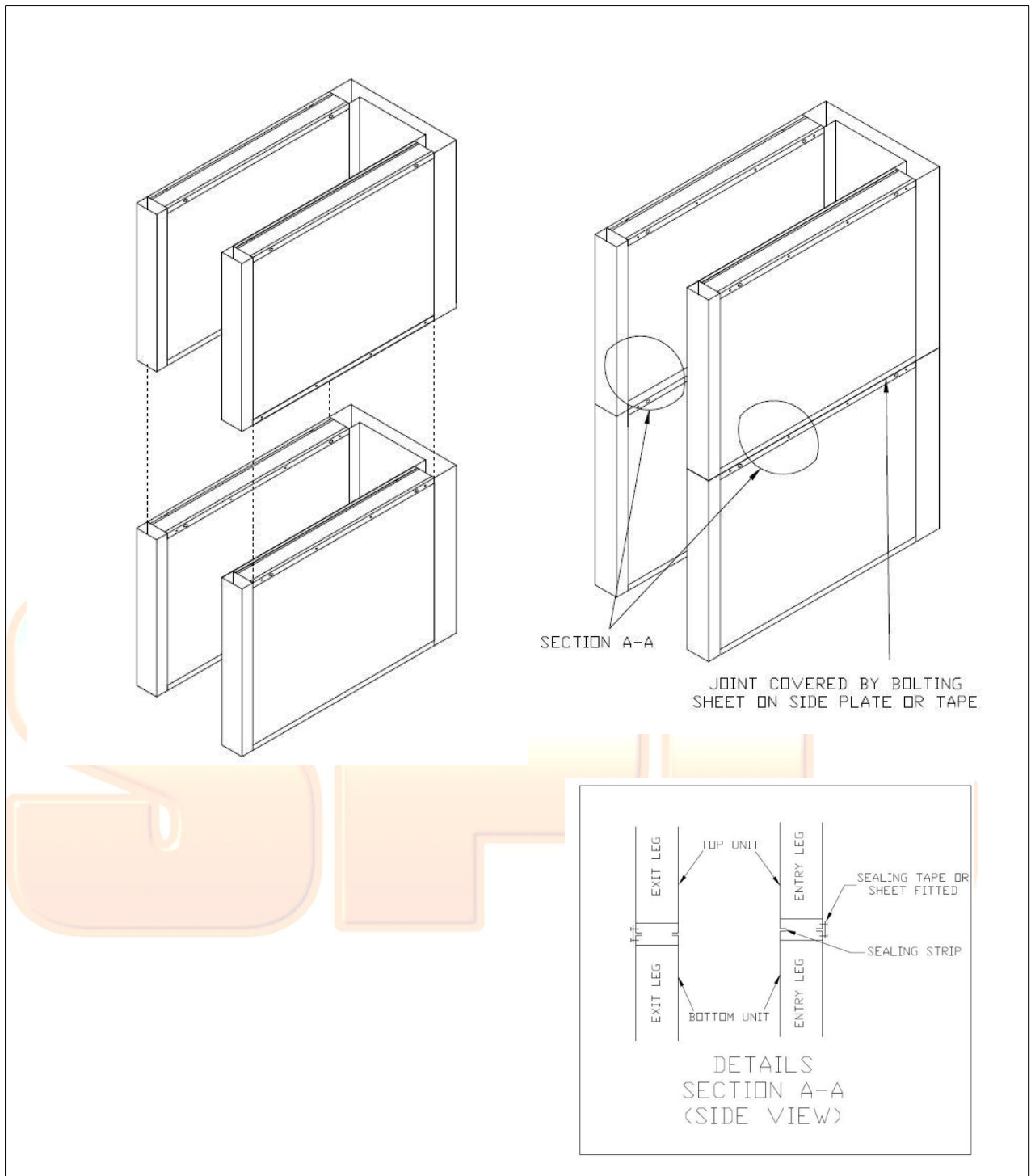


Figure 4: Installation of stacked horseshoe heatpipe

3.2.2 Heatpipe/cooling coil combi unit

The assembly consists of 3 heat exchanger coil blocks mounted within a single sheet metal framework for ease of installation.

The central block comprises the cooling coil, designed for operation with either refrigerant or chilled water according to specification. The cooling coil has connections that are handed to suit the installation.

The cooling coil block resides between the front and rear heatpipe blocks which constitute precool and reheat sections of the heatpipe assembly respectively.

The heatpipe sections have interconnecting pipework linking them together on the opposite side of the assembly from the cooling coil connections.

Bolting up of the framework should be carried out as required to ensure support and sealing.

Sealing with mastic or similar to suit the application is the responsibility of the installer.

Condensate drainage provision is the responsibility of the installer.

Retrofit: It is the responsibility of the installer to ensure that there is adequate room for installation of the assembly. Existing cooling equipment should be removed, making good as required. The Combi Unit can then be introduced in place of the original cooling coil. Upon installation the contractor must ensure no air bypass occurs within the AHU, and that the proper sealing is carried out to make good the installation.

New: The dimensions of the AHU shall provision for inclusion of the Combi Unit. Upon installation the manufacturer must ensure no air bypass within the cabinet and proper sealing and insulation to make good the installation.

See Appendix 2 for further details and sealing instructions.

Water coils: Water flow is into the bottom connection and return from the top, thus assisting in venting of the system. The coils are handed and should be connected in counter flow i.e. the water flow connection is at the leaving airside of the coil, and the return at the entering air side of the coil.

When making screwed connections for the coil, hold the header connection with grips or similar. The copper coil tubes may be bent or fractured if excessive strain is put on the headers.

Pipe flanges need bolt holes exactly aligned with those on coil flanges if supplied. Supply and return pipework should have adequate flexibility and support to avoid straining the coil.

Adequate provision shall be made for venting and draining of the cooling coil. Sockets for air venting may be supplied and are at the high point in the circuit to assist with air removal during set-up.

Drain plugs may be supplied and are located at low points to assist with drainage if coil removal is necessary. If vents and drains are not supplied all water coils will be capable of venting & draining through connection pipework.

Refrigerant coils: Evaporator coils are supplied with one or more liquid refrigerant distributors connected via capillary tubes to the coil circuitry – these are of equal length for correct refrigerant distribution; care should be taken to avoid kinking the tubes.

Refrigerant coils are generally supplied with sealed caps and the coil being positively charged with dry nitrogen – the connections should be cut or sweated off when ready for installation. Capillary or flare fittings should be fitted according to manufacturer's instructions. The handing convention used by SPC results in the outlet being at the lowest position on the suction header to assist the return of compressor oil, on the entering air face.

3.3 Heat Recovery

3.3.1 Horizontal Heat Recovery: side by side ducts

The assembly consists of two coil blocks of the same height and which may or may not be the same length or fin density. Care should therefore be exercised in ensuring that the unit is correctly handed during installation.

The blocks are adjacent to each other and separated by a central divider. Airflow across the two blocks should be in counter flow for optimal heat transfer. Heat will be transferred from side to side in the direction of decreasing air temperature.

Care must be taken to ensure that the unit is installed in the correct orientation – the warmer airstream must flow across the lower end of the heatpipe.

The units are entirely passive and no supply or return pipework is required for installation and operation.

Bolting up of the framework should be carried out as required to ensure support and sealing. Sealing with mastic or similar to suit the application is the responsibility of the installer. Condensate drainage provision is also the responsibility of the installer.

Figure 6 shows details of a horizontal heat recovery heatpipe split in two sections with the section mounted one top of the other.

The top and bottom trays of the heatpipe recovery unit have turned-in flanges to allow easy stacking. Both sections must be secured to the panels or frame within the AHU unless the top section is physically connected to the bottom section. This is the responsibility of the installer but can be undertaken as shown using flat 'fishplates'. Sealing strip may be used at the joint to prevent any air bypass between the sections.

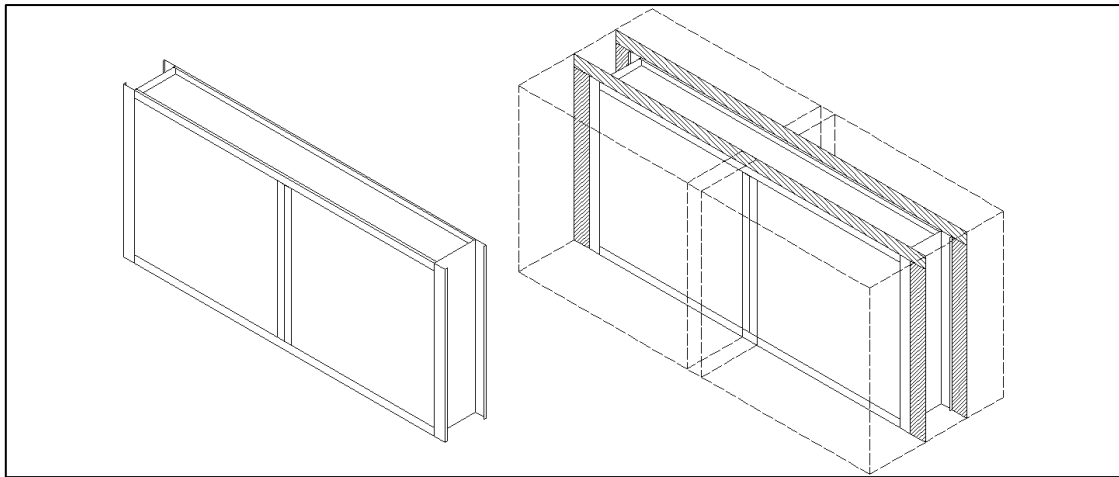


Figure 5: Horizontal heat recovery shown before and after installation into an air handling unit.

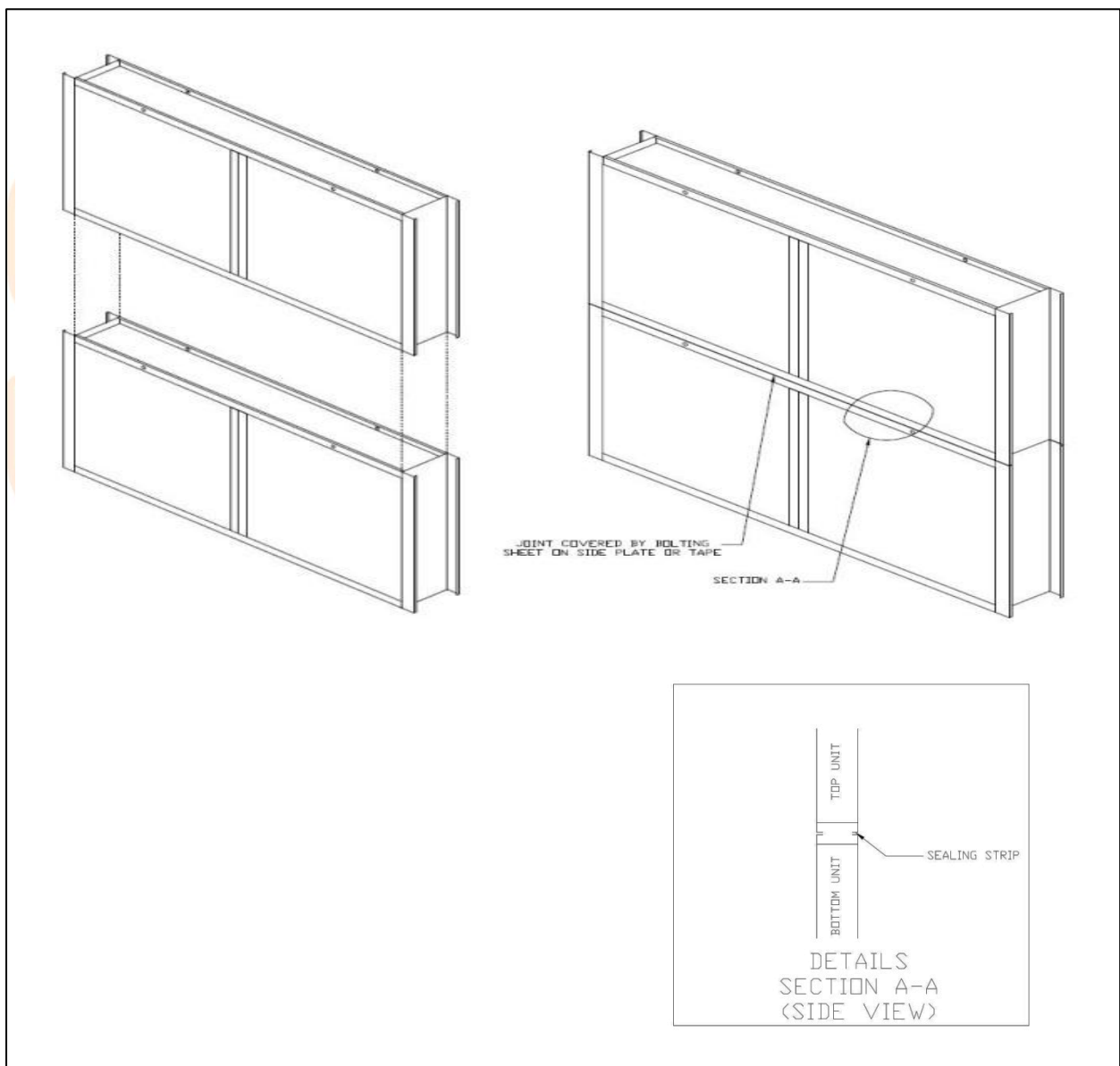


Figure 6: Installation details of stacked horizontal HPHR

3.3.2 Vertical heat recovery: top/bottom horizontal airflow

The assembly consists of two heatpipe blocks of the same width and which may or may not be the same height. The blocks are adjacent to each other and separated by a central divider - airflow across the two blocks should be in counter flow for optimal heat transfer. Heat will only be transferred from the bottom to the top section and supply and exhaust should be arranged accordingly. A drain pan and eliminator section may be incorporated on the bottom section if latent cooling, condensation, and carryover are anticipated.

The units are entirely passive and no supply or return pipework is required for installation and operation.

Bolting up of the framework should be carried out as required to ensure support and sealing. Sealing with mastic or similar to suit the application is the responsibility of the installer. Condensate drainage provision is also the responsibility of the installer.

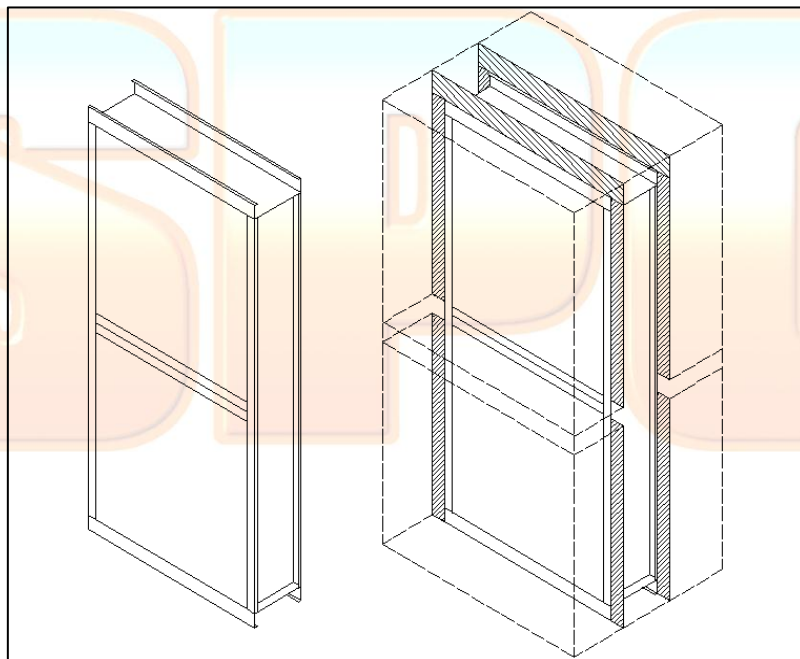


Figure 7: Vertical heat recovery shown before and after installation into an air handling unit

Figure 8 shows details of vertical heat recovery heatpipe split into two sections with the sections mounted side by side. Both sections must be secured to panels or frames in the AHU. Sealing strip and/or 'fishplates' can be used to seal the point at which the sections butt together.

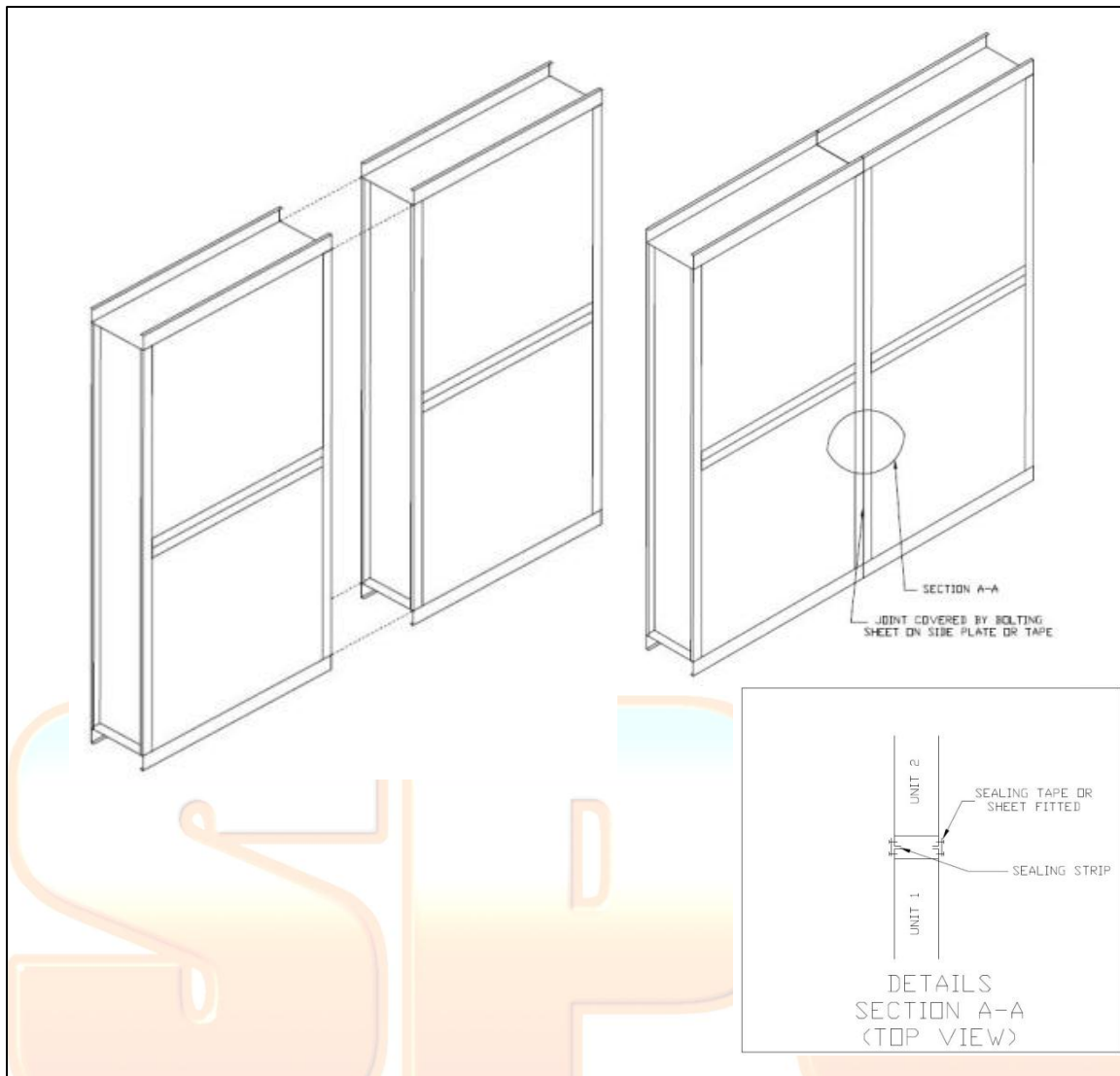


Figure 8: Installation detail of stacked vertical HPHR

3.3.3 Flat heat recovery: vertical airflow

The assembly consists of two heatpipe blocks of the same width which may or may not be the same length. The blocks are adjacent to each other and separated by a central divider. Airflows across the two blocks will be vertical and in counter flow. The block will slope in the depth and the warmer air will flow over the lower section of the heatpipe.

The units are entirely passive and no supply or return pipework is required for installation and operation.

Bolting up of the framework should be carried out as required to ensure support and sealing. Sealing with mastic or similar to suit the application is the responsibility of the installer. Condensate drainage provision is also the responsibility of the installer.

4 Operation

4.1 Enhanced dehumidification

4.1.1 Horseshoe/Combi unit

The cooling coil under operation provides a temperature differential enabling the heatpipe assembly to transfer sensible heat from upstream to downstream of the cooling coil, thus enhancing the capacity of the cooling coil to dehumidify, and saving energy in terms of cooling capacity and reheat requirements.

For chilled water Combi units the use of a proprietary corrosion inhibitor should be considered in the water, remembering that the coils are primarily made of copper on the fluid side.

4.2 Heat recovery

4.2.1 Horizontal heat recovery: side by side ducts

Airflow across the two blocks must be in counter flow for optimal heat transfer. Heat is transferred from side to side in the direction of the temperature gradient i.e. from the warmer airstream to the cooler.

4.2.2 Vertical heat recovery: top/bottom horizontal airflow

Airflow across the two blocks must be in counter flow for optimal heat transfer. Heat will only be transferred from the bottom to the top section and supply and exhaust should be arranged accordingly.

4.2.3 Flat heat recovery: vertical airflow

Airflow across the two blocks must be in counter flow for optimal heat transfer. Heat will only be transferred from the lower to the upper section and supply and exhaust should be arranged accordingly.

5 Maintenance

Water coil combi units may incorporate sockets for air venting at the high point in the circuit to assist with air removal during set-up and if necessary during maintenance.

Drain plugs may be located at low points to assist with drainage if coil removal is necessary. Otherwise all water coils should be capable of venting and draining through connecting pipework.

Preventative maintenance is generally required to ensure that the blocks are maintained in a clean condition. This has three purposes:

- a) Ensures that there is no marked increase in airside pressure drop
- b) Ensures that there is no significant impairment in airside heat transfer capability.
- c) Ensures that drainage from wet coils is not impaired over time.

Coils are virtually maintenance free but in the event of a build-up of atmospheric dust or fluff on the fin surface, these can be removed by vacuum or air blast, taking care that all loosened debris is removed and not carried into the distribution ductwork. In the event of fins being pressed in, relieve with a thin blade or fin comb. Minor fin damage has little or no effect on coil performance.

For combi units with integral drainpans free flow of condensate must be regularly checked. It is normal when checking for drainage to ensure that this occurs when the system is running, in addition to static tests.

5.1 Maintenance schedule

Description	Frequency
Visual inspection of headers and tube joints	During commissioning
Visual inspection of coil faces	Quarterly
Air blast/vacuuming of fin face	If required after visual inspection
Visual inspection of cooling coil drainage arrangements	During commissioning
Drain pan cleansing	Quarterly

5.2 Recovery

In the event of significant failure the complete heatpipe should be removed for maintenance purposes.

Whilst failures are rare, the most common type of failure to occur is a tube leak. Whilst it is sometimes practical to carry out repairs on site, removal of the complete coil is recommended in order to ensure subsequent integrity if repaired, or for replacement.

In the event of removal being necessary, the following procedure should be followed:

Water coil (if included) should be isolated by means of in-line isolating valves and drained down.

Refrigerant coil (if included) should be pumped down.

Disconnect any coil connections.

Support heatpipe as required for subsequent dismantling and unbolt casework flanges.

Remove heatpipe.

5.3 Decommissioning

Should heatpipes need to be taken out of service the working fluid (refrigerant) should first be reclaimed. The type of refrigerant will be clearly marked on an indelible label attached to each heatpipe.

It is recommended that each heatpipe circuit is recovered by using a line tap fitting to puncture the tube adjacent to each of the small bore charging tubes. Each circuit should be evacuated to at least 1 bar using a purpose built recovery set, and the recovered refrigerant returned to a suitable cylinder. The refrigerant should then be recycled in line with local regulations.

5.4 Corrective maintenance

Copper coil tubes in cooling coils between coil block and headers may be bent or fractured if excessive strain is put on headers.

During installation or removal, combi units should be lifted by means of the casing and not the headers or connections.

Screwed pipe connections should be tightened or undone whilst holding the header connections with grips to avoid undue stressing of coil tubing. Pipe flanges should be fitted using a proprietary jointing compound.

Casework should be securely fixed prior to pipework flanges being made up.

On chilled water coil combi units, sockets for air venting may be fitted at the high point in the circuit to assist with air removal during set-up or subsequently thereafter. Drain plugs may be located at low points to assist with drainage if coil removal is necessary, otherwise all cooling coils should be capable of venting and draining through connecting pipework.

In order for work to be carried out on the water side of the cooling coils, the coil should be isolated by means of isolating valves located in the service supply and return to the coil.

In order for work to be carried out on the airside faces of the heat pipe or within the ductwork, the system fan should be isolated.

5.5 Spares list

Not applicable.

Full replacement if applicable.

S P A R E S

6 Appendices

6.1 Appendix 1

It is recommended that sealing strip be fitted to the outer coverplate on the wraparound section and to the baffle plates on the end of the two legs. The sealing strip should compress against the AHU panels to prevent bypass.

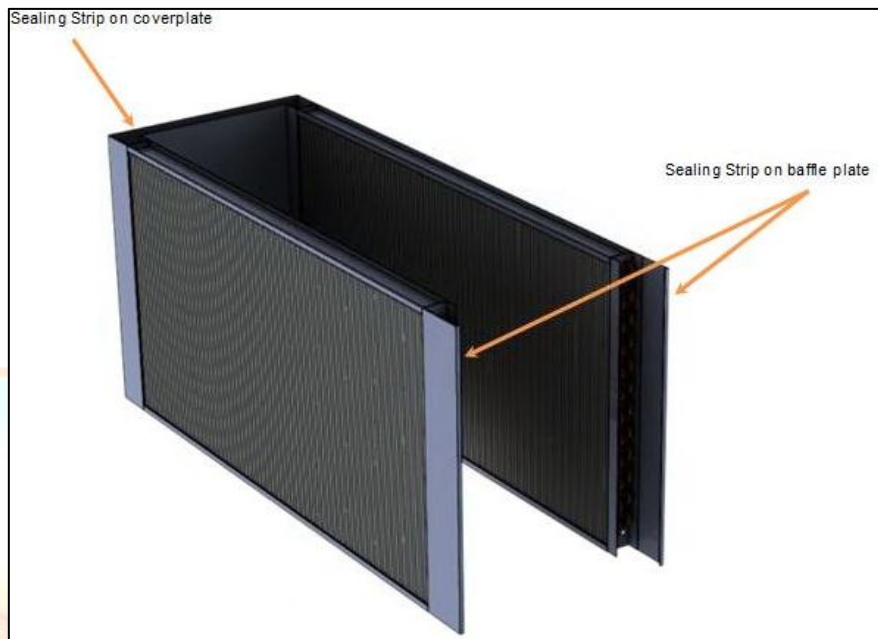


Figure 9: Sealing details for Wraparound heatpipe

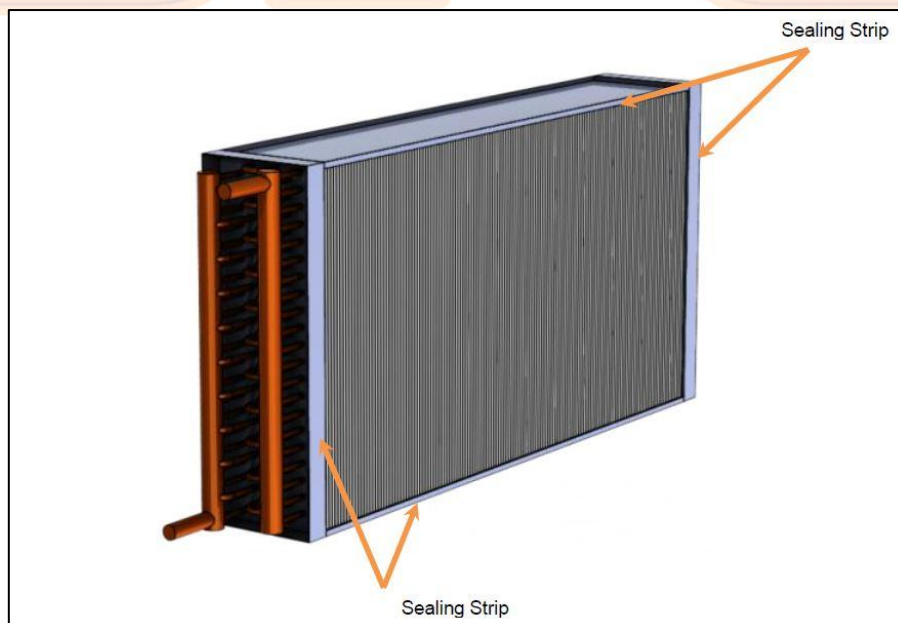


Figure 10: Sealing detail for Cooling coil

It is recommended that sealing strip is fitted to the casing of the cooling coil on the side in contact with the heat pipe to provide a reasonable air seal between the two.

6.2 Appendix 2

Additional installation details for combined heat pipe/cooling coils with integral draintrays.

This appendix note only applies to the above type of unit whereby the cooling coil and wraparound heat pipe are supplied in a common case and the base of the casing is formed into a drainpan. This guidance is intended for AHU manufacturers and installers and does not apply to units installed into ductwork.

The diagram below shows a typical 'combi' unit (combined heat pipe/cooling coil) with air flowing from left to right. It is imperative, when installing such units in AHUs, that there is no possibility of air leakage around the sides of the casing on either the air entering or leaving face. Note that this is not the case for coils which do not have integral drain trays (tray part of the base of the AHU) which are often only blanked off on the air entry face; the sealing requirement arises only if the draintray forms the base of the combi unit.

If air is allowed to bypass the fin block it can form a high velocity jet capable of picking up moisture sitting in the draintray and depositing it downstream beyond the draintray. If the unit is not blanked and sealed off on the air leaving face then some air can be drawn underneath the fin block and out through the ends of the draintray with the same effect i.e. moisture deposited downstream.

The diagram shows the possible air leakage paths which should be sealed to both ensure rated performance and prevent moisture being deposited downstream of the draintray.

The drain connection from the combined unit must be adequately trapped to prevent outside air being drawn into the draintray. This would cause flooding of the tray with moisture being dragged over the lip of the tray on the leaving air face. These units are often installed on the suction side of the fan at the point where negative pressures are at a maximum. Good engineering practice must be followed when sizing drain traps and condensate lines taking into account greater negative pressures than may normally be found due to the increased depth of the combined heat pipe/cooling coil and the effect of dirty filters etc.

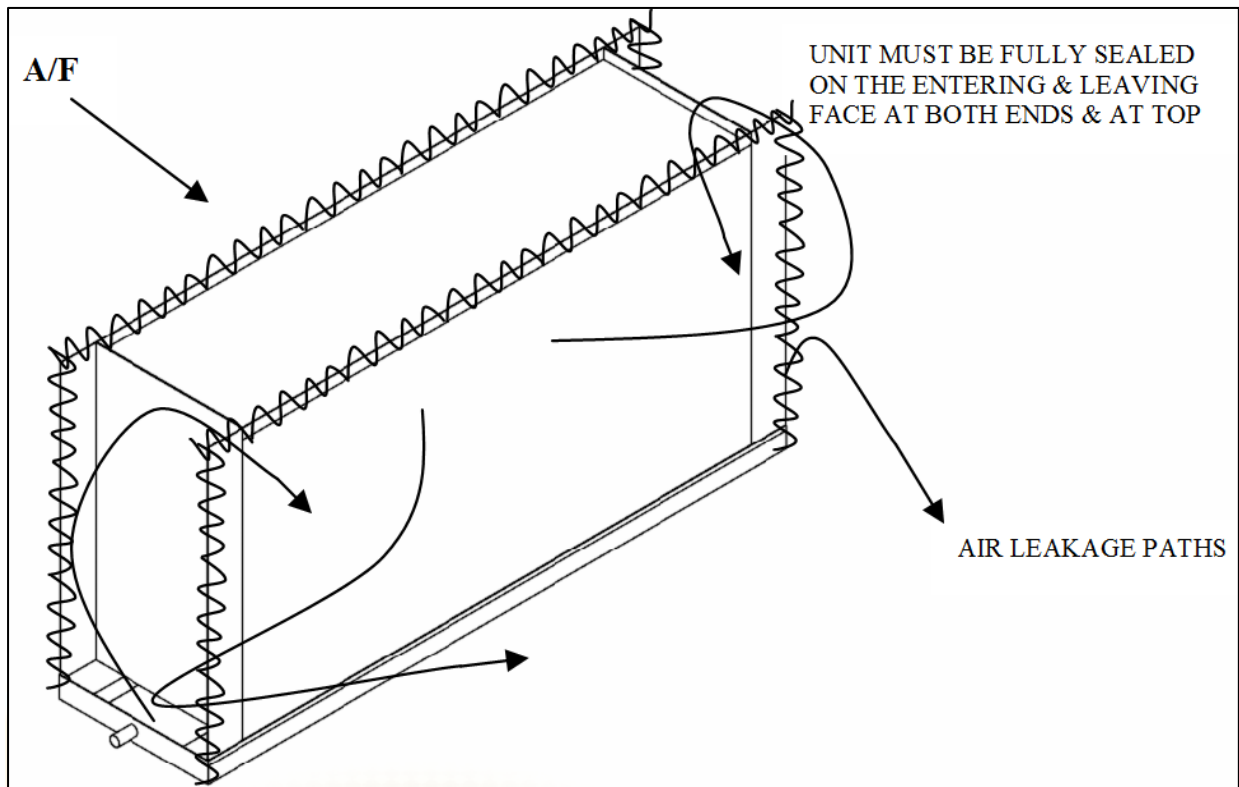


Figure 11: Sealing detail for Combi Coil with integral draintray



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