

Air Cooled heat exchanger

INSTALLATION - OPERATION - MAINTENANCE

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READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



contents

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

Warning

Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.

Caution

Indicates presence of a hazard which will or can cause personal injury or property damage if ignored.

Note

Indicates special instructions on installation, operation or maintenance which are important but not related to personal injury hazards.

Note

These instructions assist in obtaining efficient, long life from Marley heat exchangers. Direct questions concerning heat exchanger operation and maintenance to your SPX sales representative. Always include your product serial number when requesting information or ordering parts. Look for this number on the serial number nameplate.

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installation

Forward


This manual describes the components and a recommended method of installation, operation and maintenance of an Air Cooled Heat Exchanger (ACHE). Use of this manual is for providing assistance to the buyer/end-user to accomplish the Installation, Operation and Maintenance (IOM) of this equipment. The buyer/end-user is expected to have standard industry knowledge and requisite expertise working with ACHE units. This manual is not intended to be a substitute for common industry knowledge, nor is it intended to address all specific issues particular to the commercial consumer's operations. These operating instructions refer to standard operating conditions. Exercise special attention during extreme operating conditions.

As allowed with the contract documents, SPX retains all rights for these operating instruction including drawings, data sheets, and other information provided

Note

SPX shall not be responsible or liable under the contract or law for any and all direct or indirect damages of any nature resulting in whole or in part from the failure of the owner, its agents, or employees to follow the procedures, instruction and warnings contained in this manual. Any alterations or repairs that may become necessary during installation, testing, or operation must be made under SPX direction and in accordance with SPX procedures. Any unauthorized modification to the equipment will void any warranty.

Safety

1. Adhere to these instructions and included vendor information for installation, operation, maintenance, inspection and repair of the ACHE. Operate this ACHE only for the purpose for which it is designed. Maintain units with authorized and qualified personnel. Non-qualified personnel should not operate this ACHE equipment. Qualified erection personnel with ACHE experience shall construct the equipment in accordance with current local construction codes and best construction practices.
2. All operations and maintenance shall conform to applicable local, national, and international codes. Utilize proper lock-out/tag-out procedures for electrical components. Working inside the fan ring requires the screen guards be removed and the work is to be carried out from an external scaffolding platform/ladder. Walking on fan screen guards, fan ring, and the motor bridge may damage the equipment. 

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Caution

Operation and maintenance of individual components of the ACHE shall be in accordance with the manufacturer's instructions. Repairs of damage due to improper handling, storage and/or use of the equipment shall void any warranty and not be the cause for replacement, or repair.

SPX, their subcontractors, and/or supplier of any tier shall not be liable in event of any and all loss of anticipated profits, loss by reason of plant shutdown, non-operation or increase expense of operation of other equipment; any and all other incidental or consequential loss or damages of any nature, or negligence due to improper maintenance.

Warning

Violation of the safety instructions can result in risk of personal injury/death, ecological harm and/or plant equipment damage by electrical and mechanical means.

Description

ACHE—Air Cooled Heat Exchangers can be either forced draft or induced draft and are available in a range of materials and designs to meet your operational requirements.

PLENUM—The ACHE plenum consists of tube bundles mounted in a plenum chamber suspended from vertical columns. Lifting lugs are attached to the frame of the tube bundle for installation. Each plenum drive assembly contains a fan, motor, and drive system.

The steel components that form the frame of the tube bundle, and components of the steel structure are hot dip galvanized.

STRUCTURE—The steel structure may consist of lower beams, braces, pipe supports walkways, ladders and handrail. See contract drawings for specific details.

FAN—The fan blades are manually adjustable—see commissioning documentation and fan manufacturer documentation. The fan blades rotate by electric motors through a set of V-belts.

installation

Erection

IDENTIFICATION—All components are marked with a unique part number as listed on the drawings. Notify SPX immediately of any defects discovered or missing parts before you proceed with installation.

IOM USER MANUALS—This User Manual as well as those offered separately on motors, fans, vibration switch, drive belts, fan shaft bearings, etc., are intended to assure that this ACHE serves you properly for the maximum possible time. Since product warrantability may well depend upon your actions, please read this user manual thoroughly prior to operation.

Note

During shipment some fasteners may have loosened. These require checking and retightening prior to installation.

Assembly of walkway, handrails and ladders (if applicable)

- Place the ACHE (steel structure with support columns) on the foundation (by others) anchor bolts
- All field connections shall be A325 bolts and washers as called out on the erection documentation
- Mount the walkway beams
- Install the walkways with grating
- Mount the handrails and the ladders
- Check the tightness of all connections after commissioning the ACHE

Assembly of inlet and outlet piping (if applicable)

Warning

A pressure gauge on the header nozzle indicates the vessel is filled with nitrogen gas. Nitrogen is colorless and odorless and can cause suffocation. Caution is to be exercised when loosening the plug, or cover, because the tubes are pressurized.

The nitrogen in an ACHE is purged by loosening a plug or nozzle cover at the low point and allowing any condensate to escape from each side of the header. Reduce the pressure slowly by letting the nitrogen out to atmosphere.

- Install respective components to the inlet and outlet flanges of tube bundles allowing for the expansion joint, valves and gaskets.



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- Measure all pipes for correct length (straight spool pieces have 6" additional length to allow for field erection tolerances)
- Trim field weld locations and weld adjoining pieces.
- Clean-up any debris before welding
- Install pipe supports.
- See P&ID drawing and instrument location drawing for valves and instrument locations

Lubrication—Check lubrication of rotating parts and bearings including motors, fan drive, fan shaft components, and grease as required with the proper lubrication to manufacturer's recommended level. Grease all bearings with the proper grease if unit came from storage. Read and follow the manufacturer's instructions.

Before startup—The coil bundle was shipped purged of contaminants and filled with nitrogen under pressure. Once the nitrogen has been slowly purged from the coils, it is the responsibility of the installer to only fill the coils with the appropriate glycol mixture to avoid freezing of the coils. SPX is not responsible for the coil condition after the coils have been purged of nitrogen.

- Check all joints for proper fit, tightness and installation of protective guards.
- Remove objects under or in proximity of the cooler which can be drawn into the plenum when the fan is operating.
- Ensure all fan bearings are properly lubricated prior to start up. If grease lines are used, be sure to purge the lines of air. Rotate the shaft and inject grease per the manufacturer's instructions.
- Ensure the fan and associated fan drive components rotate freely, remove or unlock any fan hub or fan motor anti-rotation devices if present
- Unlock anti-rotation device (if included) and check the direction of rotation for the fan and fan motors by briefly energizing the motors.
- Ensure that there is clearance between the fixed and rotating components. The clearance between the fan blade tip and the fan ring shall be minimum 1/4".
- Check the belts to ensure their proper seating and alignment, and verify their tension—adjust if necessary as per the manufacturer's recommendation.
- Check the connection and condition of the electric motor.
- Check tightness of bolts and protective grate connection.

Each tube bundle has been individually hydrostatic pressure tested or oil leak tested when applicable. It is advisable to complete a leak test / hydrostatic

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test on the tube bundle, piping, and valves prior to start-up of the cooler. It is the responsibility of the owner to ensure the coil is protected from freezing, scaling, corrosion or other contamination prior to being placed in service. It is advisable to exclude the tube bundles when flushing the remainder of the piping system.

Commissioning– Warm up the ACHE slowly to minimize thermal shock of the tube bundle. Prevent overcooling during low ambient temperature condition and low heat load operation. The vents should be kept open during initial fill to eliminate air pockets. Vents shall be closed after initial fill. Prevent individual tubes from being heated differently due to sudden changes in temperature during initial small startup flows. This could cause excessive stress in the tubes and lead to tube-to-tube sheet joint failure.

Complete all inspections/tests after a couple of hours of operation. These include tensioning of belts, fastener tightness and movement/sound in the fan operation. Refer to the commissioning check sheets.

Note

The material used in manufacturing the fin tube bundles conforms to the design conditions for operational temperature and pressure–no special instructions are required for start-up or shut down. However, do not make changes to the operation haphazardly.

operation - maintenance

Operation

Steel structure—Verify the overall mechanical condition of the units through periodic inspections. These inspections shall include but not be limited to:

Preventive Maintenance Inspections—Conduct preventive inspections on a regular basis at a minimum at least as often as required by the various components of the ACHE.

Conduct a thorough inspection immediately upon any defect discovered during preventative maintenance that may cause a more serious issue.

If a defect jeopardizing safe operations or personnel safety has been detected it shall be immediately corrected to eliminate danger of failure of the structure, components or joints. The galvanization of the steel is for protection against corrosion. The coating shall be inspected, repaired and restored as required to maintain the structural components.

Annual Comprehensive Inspections—Annual inspections shall establish the overall physical condition of the structure, joints, anchor bolts, shape of members and condition of surface finish protection. The inspection shall identify unusual distortion, or vibration resulting from dynamic effects or occurrence of cracks because of material fatigue.

Every inspection and repair is to be recorded noting the condition and any modifications as they occur.

Unless specified otherwise by other regulations, the complete rebuilding of the steel structure is to be performed by the original manufacturer.

Tube bundle—Ensure the tube bundles operating parameters remain within the design data specified on the factory nameplate. The working mode shall comply with applicable regulations. Make sure the proper glycol mixture is being used.

Note

Please refer to the equipment data sheet to understand the number of rows and pass arrangement to properly service the system. In some physical arrangements the tube bundle is not readily drainable.

Allow for slow steady temperature and pressure changes during start-up and shutdown. The following operations are prohibited:

- Temperature surges
- Unrepaired leaks

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Checks for leakages at the bundle body and flanged joints, condition of bolted joints and surface protection.

Ensure no debris (such as paper, leaves, etc.) are present near the cooler, which could be sucked into the finned tubes by the fans. Check for fouling and contamination of the fins that could reduce cooling performance.

Cleaning the fins shall be allowed only when the fan is stopped and power to the fan motor is properly locked out/tagged out.

Fan Motor—Before start-up check the belts for proper seating, alignment and setting, correct if necessary. The guard should be fitted to prevent accidental contact.

Fan—Monitor the overall operation of the fans—if vibrations or noise increases, cease operations until the cause is corrected.

Lubricate the bearings as required per the manufacturer's instructions included. Conduct a comprehensive inspection of the fan at least once a year. This inspection shall include a thorough examination of the fan per the manufacturer's instructions included.

Cleaning and Maintenance

Regular cleaning of the fin tubes and other components will ensure the longevity of these units. For cleaning and maintenance of ACHE components (e.g. motor, belt, fans) see the specific manufacturer instructions.

Fan and Electric Motor—Maintenance is to comply with the guidelines and instructions in the manufacturer's manuals enclosed. Lubricate the bearings after any cleaning.

Belts and Pulleys—Operation that adversely affects the safety of the belt drive is prohibited. Inform maintenance immediately of any incident that may negatively affect the belt. Operate only when it is in good working condition. Ensure effectiveness of the belt drive by regular inspection and cleaning. Unauthorized modifications to the belt drives are not permitted. Work on the belt drive only when it is stationary.

Fitting the output drive pulley should be done with suitable equipment to avoid damaging the shaft bearings due to the axial joining force. The shaft center



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distance should be reduced so that the belts can be placed in the pulley grooves without force. Forcible assembly using levers, screwdrivers etc. is not permissible, as this will damage the limited extension strands and / or the fabric cladding of the belts.

If the belts are dirty, they must be cleaned before fitting onto the pulleys. This can be done with a mixture of glycerin and spirit in a ratio of 1:10. Benzene, benzoyl turpentine and similar substances may not be used. Sharp edged objects, wire brushes, emery paper, etc., may not be used, as they will cause mechanical damage to the belts.

After fitting the belts check shaft center distance and adjust if necessary. The belt pulleys must be axially parallel and in alignment with one other. Deviation from axial parallelism may not exceed 1° (one degree).

Check alignment by placing a straight edge on the pulley rim. Check at several points. Under certain circumstances, it may be necessary to move the motor pulley again to obtain proper accuracy of alignment.

Before restarting check that safety devices are in place.

Belts are to be inspected in accordance with the manufacturer's recommendation, but at least four times a year. This includes checking the belt tension and correcting as necessary.

After initial installation, check the tension of the belt after running approximately 50-70 minutes. Readjust belt if necessary using a tensioning tool.

If the unit is not in operations for one week, the fan must be hand turned to ensure the belt is maintained in optimum condition.

Abnormal heating, excessive vibrations of the belt drive and noises could indicate insufficient belt tension. Insufficient tension can also result in slipping and early failure.

Do not change out individual belts in multi-groove belt drives. Change all belts at the same time. Belts of different makers may not be combined to make a set. Matched sets of equal length should be used.

Note

Before installation on the shaft ends, belt pulleys and taper lock bushings are to be cleaned.

Interior Cleaning of Fin Tubes—There are three methods used for the cleaning of the inside of ACHE tubes.

- Mechanical cleaning (If no tube inserts are present)

This cleaning consists of drills or wire brushes fitted to long power rotating rods. This is normally completed with a water rinse or a blowing out. It is not an advised method for the removal of tarry deposits.

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- Chemical cleaning

This cleaning entails circulating hot chemical solution through the tubes. Such solutions contain inhibitors against tube wall corrosion.

It is recommended to contact a specialist with a sample of the fouling deposit for the best chemical solution. Each tube-bundle has to be fitted with inlet and outlet pipe fittings to facilitate input of the solution. A circulating pump and a topping-up tank should also be available.

This method is preferred as it reduces downtime and avoids disassembling the unit. It will not work where tube are completely blocked.

- High-pressure flushing equipment (If the process application permits)

The use of high-pressure wash has become widespread in the USA and Europe. Tube cleaning can be accomplished by means of portable high pressure pumps. These pumps have a capacity of 30 gpm (110 l/min). with discharge pressures as high as 620 bar. The sprinkler head is fitted at the end of a long tube, similar to that used for mechanical cleaning, and it is introduced into each tube individually. The best pressure is found by trial and error. Typically, the softer the deposit is the lower the water pressure required.

Note

High pressure flushing not suitable for blocked tubes. Blocked tubes have to be mechanically cleaned.

Outside Cleaning of Fin Tubes—Inspect the fin tubes monthly for contamination and fouling with dirt or larger debris. Reduction in cooling performance may occur with excessive contamination. Fouling of the fin surfaces varies on the location of the unit, type of process, ground surface conditions, foliage or other environmental factors. Some sources of fouling are:

- Dirt or dust. This accumulates over and between fins as a fine powder and after being damp it forms a crusty deposit.
- Lint, leaves, grass clippings, etc.
- Insects
- Mixtures of dust with oil and corrosive substances. With oil, it can produce a mixture having the consistency of putty.

Clean fins only during shutdown. Dismantling any components for inspection, cleaning or repair is permitted only after the tube bundles have been depressurized and have reached ambient temperature.

If necessary, repair any damaged coatings. Care shall be exercised to avoid damage or bending of tube fins. Any fins bent shall be re-straightened by use of simple tools taking great care not to damage the core tube.



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A preliminary examination should first be made to determine which type of cleaning would be best. Usually only the two or three lower fin-tube rows will be fouled. This indicates that the cleaning should be undertaken from the top downwards with the fan at standstill and shut-off valves closed.

- **Air nozzle**

An air jet under a pressure of 30 psi (2.2 bar), will normally remove dust powder and dry debris. Ensure that the air jet is within the plane of the fins to avoid bending them.

- **Water nozzle**

A cold-water jet, under a pressure of 30 psi (2.2 bar) will normally remove dust and other debris. The jet should always lie within the fin plane, to avoid damaging the fin.

- **Special Cleaning**

Typically, these two methods will clean the fins. When the composition of the fouling is such that it cannot be cleaned using a different method the use of a specialized cleaning process is required. Contact SPX for information regarding specialized cleaning.

Tube Replacement—For replacement of tubes or other parts, contact SPX.

New tubing of tube bundle—New tubing can be accomplished at the SPX factory. The tube bundle should be transported to our facility in a clean condition, free from flammable, toxic or caustic residues.

Long-term Storage Protection

For additional information on long-term storage of an ACHE, contact SPX Cooling Technologies.

Storage of ACHE parts—Steel structural parts, ladders, walkways, guards and piping may be stored in an open storage area. Fans, belts, bearings, motors, electrical parts, instruments and gauges should be stored in an enclosed area.

Protection of non-operating equipment for more than three months

If the ACHE units are not fully operational for three months after initial installation or after years of service the following actions shall be taken.

Turn the fan shaft by hand several rotations each week. Inject a small amount of grease into ball /roller bearings of fan shaft and drive components per the

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manufacturer's recommendation. Ensure no tools, equipment, or other materials are placed on the fin tubes, fan housing, or structure.

General protective requirements for ACHE—Where the unit is not equipped with control louvers, a canvas or plastic cover should be laid over the top of the tube-bundle to prevent the fins from becoming fouled by dirt or other deposits. If the unit is equipped with control louvers, the blades of the louvers should be kept in closed position.

All of the inlet and outlet nozzles and connections should be sealed off with blind flanges, one of each tube-bundle on the outlet side should be fitted with a valve, pressure gage and blocking plug.

For units not already commissioned, connect a nitrogen supply line to the blind flange with the valve. Loosen the bolts at one of the inlet nozzle blind flanges to allow air to escape. Inject inert gas into the tube-bundle to cause nitrogen flushing for about 10 minutes to expel air out of the unit.

For commissioned units, consult with the system designer/EPC engineering team to ensure proper drainage and protection of the system.

Tighten the inlet nozzle blind flange bolts and let nitrogen pressure build up to 7 PSIG inside the tube-bundle. Disconnect the nitrogen line and plug the isolation valve to avoid any pressure drop in case of valve leak.

Electric motors—Electric drive motors should be removed and stored indoors. At least monthly during storage, turn motor shafts that will allow distribution of lubricant to the bearing parts. Connect any electrical heaters if so equipped.

Fan and drive shafts—Clean all machined or exposed surfaces, then coat with an anti-rust compound. Turn the fan shaft and rotate by hand on a weekly basis to distribute grease evenly over the bearing parts. Then, every three months, inject grease to prevent any blocking of the lubrication lines possibly due to grease hardening.

Belts—Properly stored belts will retain their properties unchanged for several years. Do not store belts longer than 3 months in an open, uncontrolled environment.

Store belts stress free, without tension or distortion that could cause permanent deformation or failure due to fatigue and cracking. If belts are stored horizontally on top of one other, the stack height should not exceed 12". If they are stored suspended, the diameter of the bar from which they are suspended must be



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equal to at least 10 times the height of the belt.

The storage area must be dry and dust free. Belts may not be kept together with chemicals, solvents, fuels, lubricants, or acids.

Shield belts away from heat sources. The distance between heat sources and belts must be at least 10 feet.

Protect belts from direct sunlight and strong artificial light with high ultraviolet content such as fluorescent tubes in open fixtures. Room lighting should be normal incandescent bulbs.

To counteract the damaging effect of ozone, the storage areas may not contain any form of ozone generating equipment, such as fluorescent light sources, mercury vapor lamps or electrical high voltage devices. Combustion gases and vapors must be avoided or removed because they may lead to ozone formation. Ensure no condensation occurs on the belts. The relative humidity should be below 65%.

Note

For extended long-term storage, contact SPX for complete requirements and details.

Spare part procurement—To order spare parts, please contact SPX Sales Department.

Air Cooled heat exchanger

USER MANUAL

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