



BY JOHNSON CONTROLS

Service Information

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Equipment Affected:		Large Tonnage Chillers	
Tube Extraction Procedure			

GENERAL

This document outlines the procedures to be conducted for extraction of tubes from heat exchangers. No procedure can be totally comprehensive of all operations, procedures, safe work practices and or steps in removing isolated or small groups of tubes from existing heat exchangers. The following statement and procedures are to be used as a primary guideline but may require field modifications as required to ensure the successful removal of the required tubes.

DEFINITIONS

The following terms will be used in the body of this statement:

OD: Outside Diameter

ID: Inside Diameter

Exchanger Tube or Tube: The term exchanger tube or tube refers to the heat exchanger tube or tubes that are installed in a heat exchanger that allows heat transfer between a secondary medium and a primary medium.

Tube Sheet: The tube sheet is metal plate with multiple holes that allow for a mechanical interface sealing joint for the tubes the tubes and a sealing plate for the heat exchanger vessel

Tube Spear: A tube spear is steel tool that has a tapered thread rod extension with a non typical thread pitch approximately 7" long and a threaded extension that is a standard thread with standard thread pitch, approximately 1.5" long on the other end of the tool. The spear is manufactured as a cataloged item by numerous manufacturers that produce tube removal equipment. It is designed so that the tapered threaded end is inserted into the heat exchanger tube that is to be removed. As the tube spear is rotated into the exchanger tube it captivates the tube for extraction.

Tube Extraction Device: The tube extraction devise is a motive force device that will create required axial force to remove the tube from the interface of the tube sheet and internal supports if the tube has been internally expanded. This motive device can use many different motive forces like hydraulic rams, manual slide hammer (weight), air and mechanical inclined threaded screws, etc. to generate the required axial forces to remove the tube from the tube sheet.

Work on this equipment should only be done by properly trained personnel who are qualified to work on this type of equipment. Failure to comply with this requirement could expose the worker, the equipment and the building and its inhabitants to the risk of injury or property damage.

The instructions on this service bulletin are written assuming the individual who will perform this work is a fully trained HVAC & R journeyman or equivalent, certified in refrigerant handling and recovery techniques, and knowledgeable with regard to electrical lock out/tag out procedures. The individual performing this work should be aware of and comply with all Johnson Controls, national, state and local safety and environmental regulations while carrying out this work. Before attempting to work on any equipment, the individual should be thoroughly familiar with the equipment by reading and understanding the associated service literature applicable to the equipment. If you do not have this literature, you may obtain it by contacting a Johnson Controls Service Office.

Should there be any question concerning any aspect of the tasks outlined in this bulletin, please consult a Johnson Controls Service Office prior to attempting the work. Please be aware that this information may be time sensitive and that Johnson Controls reserves the right to revise this information at any time. Be certain you are working with the latest information.

Internal Tube Cutter: An internal tube cutter is a device that can be inserted into the ID of the tube and score the tube ID when the tube cutter is rotated in continuous 360 degree rotations. The motive force for the internal tube cutter can be an electric drill, air drill or manual mechanical tooling.

Tube Stub: The tube stub refers to the short tube section that had been scored and that will be left remaining in the tube sheet after removal of the tube.

Internal Tube Support: This term refers to a metal plate with multiple holes. The internal supports are evenly spaced inside the heat exchanger and are designed to support the tube over its entire length.

OPERATION, SPECIFICATIONS AND METHOD DESCRIPTION

1. Preparation: Prepare all tooling required.
2. Lock-out Tag Out: Lock Out / tag out any sources of power, hydraulics or other motive forces/energy sources that are not to be utilized in the removal procedures.
3. Safety Procedures: Refer to JCI printed safety programs and site specific requirements as directed by the contractor or customer/end user.
4. Safety Walk Down:
 - A. Walk around the exchanger and look for any safety issues.
 - B. Identify/notify other personnel or work groups that may be affected by the tube removal/extraction works.
 - C. Verify that there is no pressure on the internals of the heat exchanger and that all refrigerant mediums have been removed. If refrigerant has to be removed from the chiller, remove and store refrigerant in accordance with industry refrigerant pump out procedures and local governing laws.
 - D. Arrange safety tape or barriers as required to securely isolate a work area 6 feet long by 8 feet wide on the non pulling end. Isolate an area 8 feet wide and 3 feet longer than the nominal tube length on the pulling end.
 - E. Assure that all motive forces required for the tube extraction works are available and safely energized.
 - F. Assure that all personnel have the appropriate personal protection equipment (PPE) for the defined task and that all have been thoroughly briefed on the works to be completed.
 - G. Notify all appropriate project supervision, safety personnel and or other work forces in the area that works are commencing and confirm they are in agreement with the work scope and work plan.
5. Tube removal
 - A. Identify the tube to be removed.
 - B. Set internal tube cutter penetration depth to an amount that will score the internal tube wall without fully penetrating OD wall of tube.
 - C. Set the length of the tube cutting surface so that it extends beyond the thickness of the tube sheet. Example: Tube sheet is 2” thick. Set insertion length stop on cutting tool so that cutter head is greater than 2” from stop on tube cutter.
 - D. Insert the internal tube cutter in the tube on the non pulling end of the vessel.
 - E. Use available motive driver to rotate the tube cutter until the tube has been scored a full 360 degrees.
 - F. Move to the tube pulling end of shell and insert the tube spear into the tube that is to be removed and rotate in a clockwise rotation until the spear is firmly inserted into the tube.

- G. Install the extraction tool onto the spear.
- H. Apply the motive force required to break the tube free from the tube stub and the tube from the tube sheet.
- I. The tube can now be pulled from heat exchanger. As tube is removed from shell the skipped fin area on the tube may come in contact with the internal tube support. If that happens, there may be some added force required to clear the skip area of tube from tube support. Continue pulling tube until full length has been removed from vessel.
- J. Move pulling tools to the tube stub end.
- K. Insert the tube spear into the identified tube stub and rotate in a clockwise rotation until the spear is firmly inserted into the stub to be extracted.
- L. Install the extraction tool onto the spear.
- M. Apply the motive force required to remove the tube stub from the tube sheet.
- N. Remove the motive force extractor.
- O. Remove tube stub from tube spear.
- P. Repeat above procedure until all tubes identified to be removed have been pulled.

