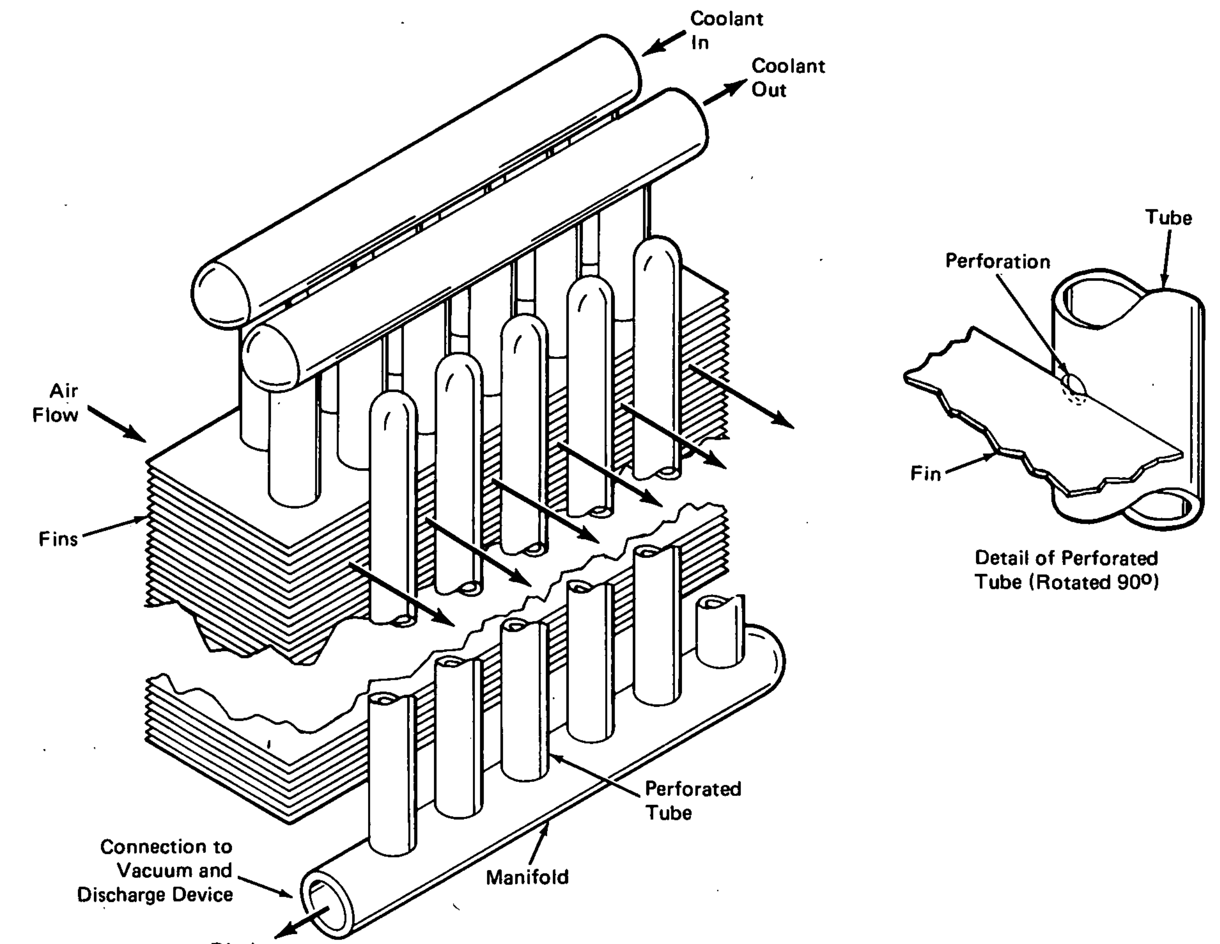
NASA TECH BRIEF

Lyndon B. Johnson Space Center

Condensate-Removal Device for Heat Exchangers

The problem:

Condensing heat exchangers often require an effective system for removal of condensate. Failure to remove the condensate often leads to poor control of air humidity. In addition, moisture may collect on the air-output side of the heat exchanger and mix with the outgoing air-stream, increasing the humidity and partially coming out as droplets falling on surrounding surfaces. The result is that the humidity of the surrounding environment may reach undesirably high levels, and the droplets may cause corrosion and dangerously slippery surfaces. Previous condensate-removal methods have been inefficient and expensive.



Condensate-Removal Device with Heat Exchanger

(continued overleaf)

The solution:

An effective condensate-removal device has been developed for heat exchangers.

How it's done:

The condensate-removal device (see figure) comprises an array of perforated tubes manifolded together and connected to a vacuum suction device. Vacuum applied to these tubes pulls a mixture of condensate and the effluent gas through the perforations and along the length of the tubes to a discharge device. In life-support systems, such as manned space vehicles, the discharge device may be a separator which separates water vapor from the effluent air and allows recirculation of both of them.

At least one condensate-removal tube extends transversely to each airpath of the heat exchanger, either directly in the path or adjacent to it. Each tube is also in contact with the parts of the heat exchanger on which condensate is formed, whether these be plates or fins. The perforations in the condensate-removal tubes are positioned so that a part of the effluent air is sucked into them, together with droplets of condensate flowing to the perforations, by a combination of surface effects and the pushing of the air stream. The condensate-removal tubes are incorporated in the core of the heat exchanger near the air-outlet side, so that the tubes contact and are surrounded by the heat exchanger fins, with the perforations facing the airflow. The perforations may be longitudinal slots or a series of holes spaced along the lengths of the tubes. When holes are used, they must be located between the fins to promote ready inspection and cleaning.

In an alternate configuration, where the heat exchanger includes fins extending out of its core, the fins must partially penetrate the perforations in the tubes, whether these be spaced-apart holes or extended slots. In either form, the width of the holes or slots is kept relatively small, to ensure a sizeable pressure drop from the outside of the tube to its vacuumed interior. This width, however, cannot be too small; otherwise, the condensate droplets will lodge in and block the openings. In practice, it was found that the width of the holes or slots should be in the range of 0.010 to 0.100 in. (0.25 to 2.5 mm). The smallness of these openings also prevents too large a fraction of the effluent air from passing through the tubes.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Houston, Texas 77058
Reference: TSP73-10429

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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