TUBULAR MEMBRANE HEAT EXCHANGER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/857,113, filed June 4, 2019, which is hereby incorporated herein in its entirety.

FIELD

[0002] This disclosure relates to heat exchangers and, more specifically, to heat exchangers having tubular membranes that facilitate heat transfer between two fluids.

BACKGROUND

[0003] Heat exchangers (HX) come in a wide variety of configurations and are used in a wide variety of applications. In one approach, referred to as tubular membrane HX, tubes are inserted in tube sheets and sealed to the tube sheet using a number of methods including welding, rolling, braising and gluing (for plastic tubular membrane HX). Another approach involves potting all of the tubes at once with a tube sheet rather than gluing tubes one by one. In yet another approach, tubes together are bundled and compressed mechanically to seal the assembly.

[0004] Sealing membrane tubes can be a challenge due to the small size and large number of tubes. Further, potting a membrane tube in a tube sheet can be a challenge due to poor adhesion of the potting to the tube. Additionally, with inconsistent and/or flexible tubes, uneven gaps between tubes and tube sheets can create leaks.

[0005] Additionally, water flow rates for tubular membrane HX may be limited by sealant issues resulting in lowering the heat and mass transfer properties for the tubular membrane HX. Membrane tube-to-tube sheet seal strength, not tube and tube sheet strength, may be the limiting factor in working pressure of the heat and mass exchangers for these types of applications which in turn limits the versatility and applicability of the tubular membrane HX.

SUMMARY OF INVENTION

[0005a] According to a first aspect of the present invention, there is provided a tubular membrane assembly for a heat exchanger, the tubular membrane assembly comprising:

a header including a header body;

a tubular membrane;

a fitting connecting the tubular membrane to the header body, the fitting configured to form a fluid tight connection between the fitting and the tubular membrane; and

potting of the header keeping the tubular membrane connected to the fitting.

[0005b] According to a second aspect of the present invention, there is provided a tubular membrane heat exchanger comprising:

an inlet header including an inlet header body;

an outlet header including an outlet header body;

a plurality of tubular membranes;

a plurality of inlet fittings connecting the tubular membranes to the inlet header body;

potting of the inlet header keeping the tubular membranes connected to the inlet fittings;

a plurality of outlet fittings connecting the tubular membranes to the outlet header body; and

potting of the outlet header keeping the tubular membranes connected to the outlet fittings.

[0005c] According to a third aspect of the present invention, there is provided a heat exchanger comprising:

at least one tubular membrane heat exchanger;

a fan assembly operable to generate airflow relative to the at least one tubular membrane heat exchanger;

a pump operable to pump fluid; and

the at least one tubular membrane heat exchanger is configured to receive the fluid, the at least one tubular membrane heat exchanger comprising:

an inlet header including an inlet header body;

an outlet header including an outlet header body;

a plurality of tubular membranes; and

fittings coupling the tubular membranes to the inlet and outlet header bodies.

[0005d] According to a fourth aspect of the present invention, there is provided a method of manufacturing a heat exchanger, the method comprising:

connecting inlet end portions of tubular membranes to inlet fittings associated with an inlet header so that the inlet end portions are adjacent an outer surface of a body of the inlet header;

applying first potting to the outer surface of the inlet header body and the inlet end portions of the tubular membranes;

connecting outlet end portions of the tubular membranes to outlet fittings associated with an outlet header so that the outlet end portions are adjacent an outer surface of a body of the outlet header; and

applying second potting to the outer surface of the outlet header body and the outlet end portions of the tubular membranes.

Brief Description Of The Drawings

[0006] FIG. 1 is a schematic view of a heat exchanger system including tubular