WATER-COOLED HEAT REJECTION HEAT EXCHANGER

BACKGROUND OF THE INVENTION

[0001] The subject matter disclosed herein relates to a brazed plate water-cooled gas cooler/condenser.

[0002] Container customer demands dictate that container refrigeration units (CRUs) have the capability to reject heat to a water source and the capability to reject heat to the ambient air. This typically happens when the CRUs are on board a ship, where the water-cooled heat rejection heat exchanger is typically positioned in a refrigerant circuit downstream from an air-cooled heat rejection heat exchanger, with respect to a direction of refrigerant flow (although other configurations are also feasible). In these cases, when the unit uses the water-cooled heat rejection heat exchanger as the heat sink, the air-cooled heat rejection heat exchanger is typically rendered inoperable. This is achieved by turning the condenser fan off.

[0003] The currently known water-cooled heat rejection heat exchanger design is the shell-and-tube type, with the water on the tube side, and the refrigerant on the shell side. The heat exchanger shell for these units is typically made of carbon steel to contain refrigerant and cupronickel tubes to contain water. Cupronickel is chosen for its excellent resistance to corrosion when exposed to sea water, as sea water in the past has been used as the water source. It has to be understood, that although this configuration is preferred for a number of reasons, refrigerant can be flown inside the tubes and water contained on the shell side. Also, other liquid coolants, such as glycol solutions, can be utilized in place of water. The population of CRUs made with the water-cooled heat rejection heat exchangers is about 20% of the total production volume.

[0004] Typically, water-cooled heat rejection heat exchangers of CRUs operate as condensers, where refrigerant flown through the heat rejection heat exchanger is below the critical point and is condensing from vapor to liquid. However, for some refrigerants (such as carbon dioxide), a water-cooled heat rejection heat exchanger may operate as a condenser for a portion of the time, while operating as a gas cooler for another portion of the time. In the latter case, refrigerant flown through the heat rejection heat exchanger is above the critical point and, while cooled by water, is maintained in a single phase. Additionally, the high operating pressures induced by refrigerants such as carbon dioxide require special structural design considerations for the heat rejection heat exchangers. Lastly, other heat exchangers

BRAZED PLATE HEAT EXCHANGER FOR WATER-COOLED HEAT REJECTION IN A REFRIGERATION CYCLE

BACKGROUND OF THE INVENTION

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