REFRIGERATED SEA WATER SYSTEM INSTALLATION IN A BOWPICKER

REPORT TO THE BOARD OF DIRECTORS

COPPER RIVER/PRINCE WILLIAM SOUND MARKETING ASSOCIATION

By Robert Beedle May 7, 2016

PROJECT HISTORY: Availability of ice is sometimes a problem among the fleet, and RSW systems are seen as an alternative method to chill fish that is very effective, and not dependent on ice. In 2014, the Marketing Association's Board of Directors, upon recommendation of the Quality Committee, approved funding for a contract with Robert Beedle to purchase and install a refrigerated seawater (RSW) system for the chilling of fish in the 33' bowpicker "Cedar Bay".

PURPOSE: The project goal was to promote the increased use of RSW systems among the Copper River/Prince William Sound gillnet fleet by determining the cost effectiveness of the chosen RSW system, and providing lessons learned and other information about the project to the membership. The RSW system chosen for the project is just one of many types of RSW systems available, with different drive methods, water circulation systems, installation requirements, etc. This report is not an endorsement or promotion of the Sea Frost system.

SYSTEM SPECIFICATIONS AND COST: The system purchased is manufactured by Sea Frost Refrigeration (www.seafrost.com), and is rated at 1-1/2 ton or 20,000 BTU. It uses type R-134A refrigerant. The Sea Frost system components have a total weight of less than 80 pounds. Cost of the system components is $3,350.

The Sea Frost system consists of the following:

Chiller: Shell-and-tube type. Shell is PVC plastic, internal refrigerant tubes are cupro-nickel. Shell dimensions – 19" length X 8" diameter. Seawater ports are 2"

Condenser: Constructed of cupro-nickel tubing. Dimensions are 12" wide X 8" deep X 11" high. Refrigerant fittings are swage-lock type. Sea water ports are 5/8"

Compressor: Swash plate type, which can operate at up to 6000 rpm. Compressor includes double v-belt pulley with electric clutch, refrigerant hose set (2), and base plate with belt tensioner. Dimensions are 9" wide X 6" deep X 6" high. Compressor requires about two horsepower under load.

Receiver/filter/dryer: comes mounted inside of condenser coil.

Parts needed in addition to Sea Frost system:

Circulation pump – Rule livewell pump 3800 gph. Cost – about $200.

Condenser pump – Jabsco Water Puppy 6.3 gpm. Cost – about $130.

Through hull fittings, valve, strainer and hose for condenser water (3/4")

Switches and wiring for pumps and compressor clutch

Mounts for compressor, chiller and condenser

Refrigeration hose (Weatherhead GH 134 Multi-Refrigerant with E-Z Clip System fittings). Cost of ½" hose – about $9 per foot.

Hose and fittings for circulation water plumbing between pump, chiller and hold

INSTALLATION:

Chiller mounted on hull under forward deck. Chiller water outlet goes to a tee then to multiple outlets into fish hold. Single suction in fish hold sump. Compressor and condenser mounted in engine room. Refrigerant lines routed through chase from engine room to chiller. Switches for pumps and compressor clutch mounted on dashboard. See attached photos.

Lessons learned in Installation: Planning the location and installation of the main components and plumbing is time consuming, but very important for issues of access, proper function, and limiting clutter. Proper securing of water, refrigerant lines and wiring is very important. Mount circulation pump as low as possible so it will prime and pump even when water level in hold is low.

ADVANTAGES OF THE SYSTEM:

Low weight. Low cost relative to other systems. No hydraulics used. Operates at all engine speeds. Ability to distribute components in different areas of the boat. Uses refrigerant hose instead of hard pipe for ease of installation and resistance to vibration.

DISADVANTAGES OF THE SYSTEM:

No temperature controller – system is manually regulated by checking water temperature and then operating switches. System is not "plug and play", so all plumbing of water and refrigerant, and all wiring is the burden of the owner. No

pressure gauges. About 10” deep water needed in hold for circulation pump to work.

RECOMMENDATIONS:

Refrigeration contractor or technician should advise on placement of components, then come back after components are mounted to install refrigerant lines, wiring, and charge system with refrigerant. Consider access to components for maintenance when choosing mounting locations.

If desired, the system could be converted to automatic operation by adding a 12 volt digital temperature controller ($100), dual pressure switch ($135), liquid line solenoid valve $50), and a packless line valve ($80). (prices are approximate)

Fish hold should have water tight divider(s), so less water is needed to chill and float smaller amounts of fish. Add more refrigerant valves to system to better isolate components for maintenance.

The author of this report makes no claims as to the effectiveness or outcome of these recommendations, if they are followed.

PERFORMANCE TEST DATA:

Engine speed: 1200 rpm, Refrigerant Charge: 3 pounds R-134A

System pressures: suction – 0 psi, discharge – 50 psi

Beginning water temp. – 47.5 degrees F. Temperature after 10 minutes – 44 degrees. Temp after 20 minutes – 41 degrees. Temp after 45 minutes – 38 degrees

Slow cooling times are attributed to inadequate RSW circulation flow (causing chiller icing) using Rule 1500 gph pump. Pump size since been increased to 3800 gph.

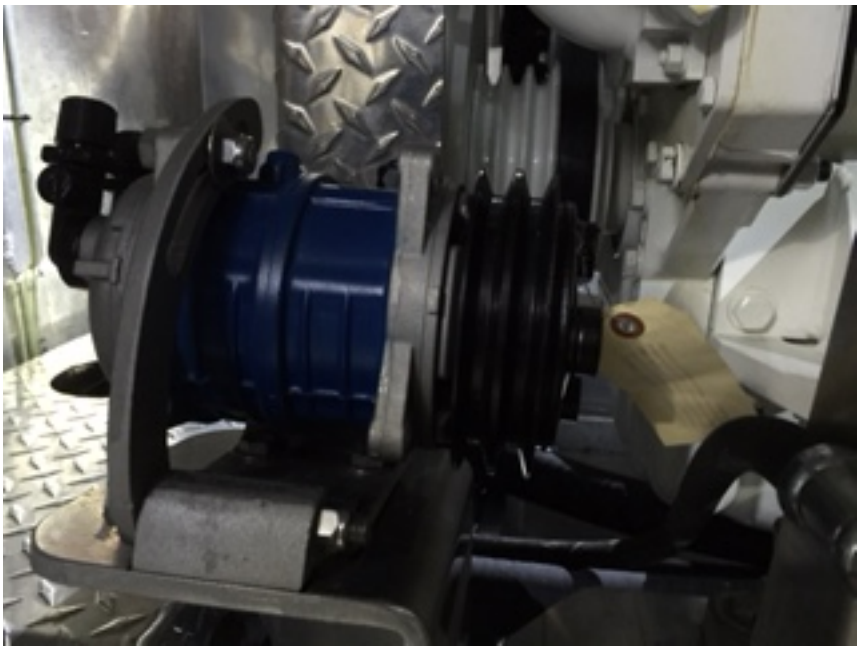
EXHIBIT A

Refrigerant hoses going from engine room through duct to chiller forward of fish hold.

EXHIBIT B

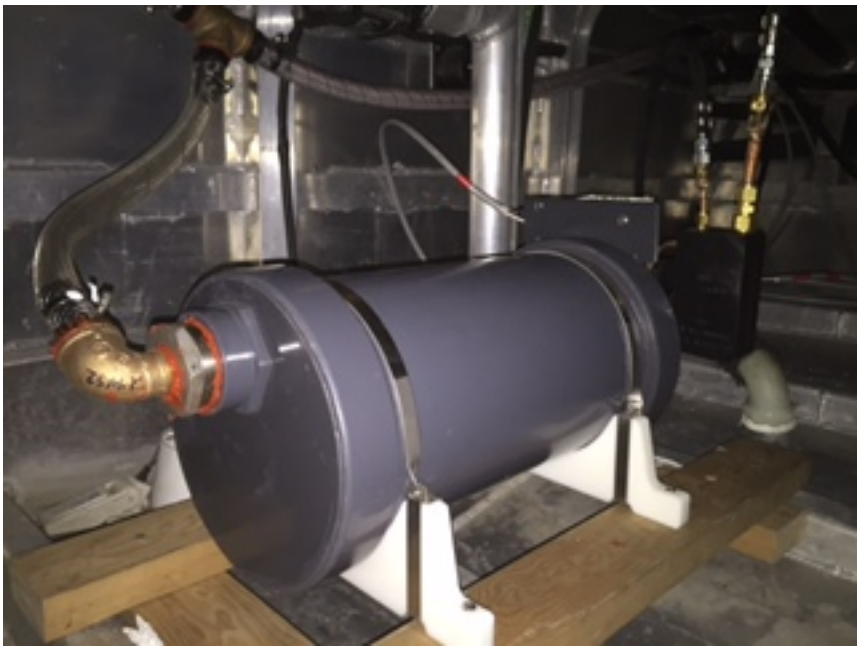
Condenser and receiver mounted in engine room

EXHIBIT C



Compressor on mounting bracket at front of engine

EXHIBIT D



Chiller mounted under forward deck

EXHIBIT E

Side view of chiller and circulation pump

EXHIBIT F

View of chiller and hoses looking aft