

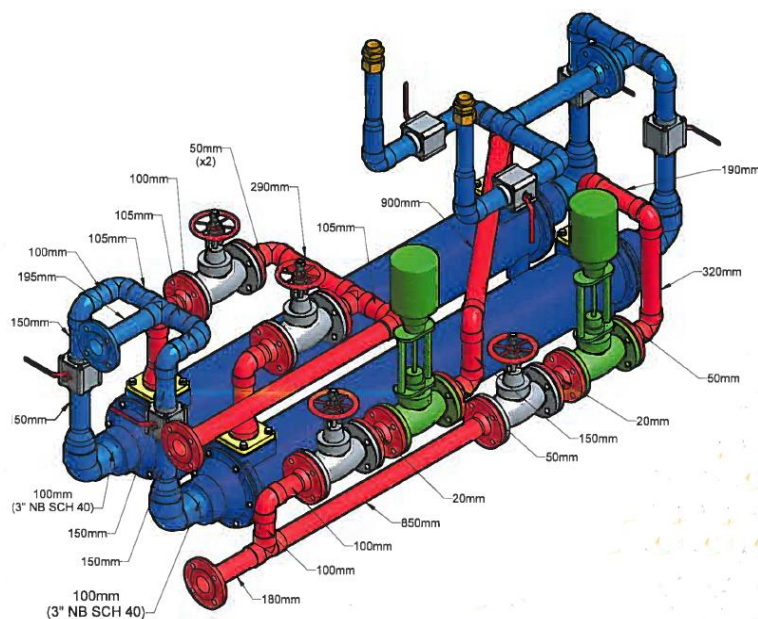
CASE STUDY 1

Replacement of the Diver's Emergency Hot Water Tank for Subsea 7's Diving Support Vessel, Rockwater 2

The divers' hot water system on the DSV Rockwater 2 utilises waste heat from the ships' cooling oil system. If a black out of vessel power occurred, then hot water was supplied to the divers via a diesel fed hot water unit. The pumps and diesel burner were fed from the emergency generator. Spares for this diesel unit have now become obsolete so a replacement system was warranted which has now been designed & installed.



OLD DIESEL HOT WATER UNIT



SHIPS OIL HEAT EXCHANGER

The diving system on the Rockwater 2 is certified by Lloyds. The upgrade of the emergency hot water system requires the certifying authority to be notified of the design change. This process requires the involvement of a Lloyd's surveyor onboard the vessel, with the certification process being the responsibility of the vessel operator / owner, but with Fathom systems providing assistance as required.

The new emergency system comprises four main components: the tank, control panel, remote control panel and the diverter valve (below left).



The tank is approximately 2.5m high with a diameter of 1.1m; it has a 1775L capacity but will only be filled to within 200mm from the top, this gives an air space for thermal expansion, leaving a volume of approximately 1500L

The tank is a ventilated via a 2" vent pipe from the top of the tank to a place where hot water can safely be discharged without the risk of scalding. The tank should be supplied from the ships fresh water that has been UV treated via the 3/4" solenoid valve. Heating the water is done via three 10kW immersion elements that are controlled either from dive control or locally from the control panel. Discharge from the tank is from the base, via a 2" isolation valve. This line is connected to the existing heat exchanger skid via the failsafe three way diverter valve. In the event of no power the valve will

automatically connect the tank to the LP side of the cat pumps. These pumps being fed from the emergency board can then deliver the stored hot water the bell.

The local control panel provides power, control & instrumentation for the tank. Power is fed to the heating elements via the main isolator, safety cut out contactor KM1, then via the dual solid state relay (SSR see right) V1. This SSR is controlled either by the local temperature controller S1 or the remote one in dive control. For redundancy each controller has its own temperature sensor.

The SSR controls the amount of power to three MCB's, Q1-3 (one for each element).



An energy meter (below right) displays information for technicians on voltage, current and power consumption. A mutable audible alarm will be made if there is a high or low temperature alarm, a SSR temperature trip or the tank's high, high set point has been reached. If any of these alarms are set, then power will be removed from the elements via KM1 and the "Heater Disabled" indicator will turn on.



The tank can be emptied locally by turning the "Tank Discharge Valve" switch from closed to open. This commands the three way valve to open; when it has fully opened, the "Start Pumps" indicator will be lit. The dive supervisor can then instruct the technicians to start the cat pumps.



There are three float switches on the tank, top, middle and bottom. As well as indicating the water level, the top is used to control the auto fill function (if auto is selected). To avoid over filling at sea, it is recommended to keep the tank fill switch in the off position. The bottom switch is also used to provide volt free contacts to shut down the cat pumps (only if the "Tank Discharge Valve" switch is in the open position).

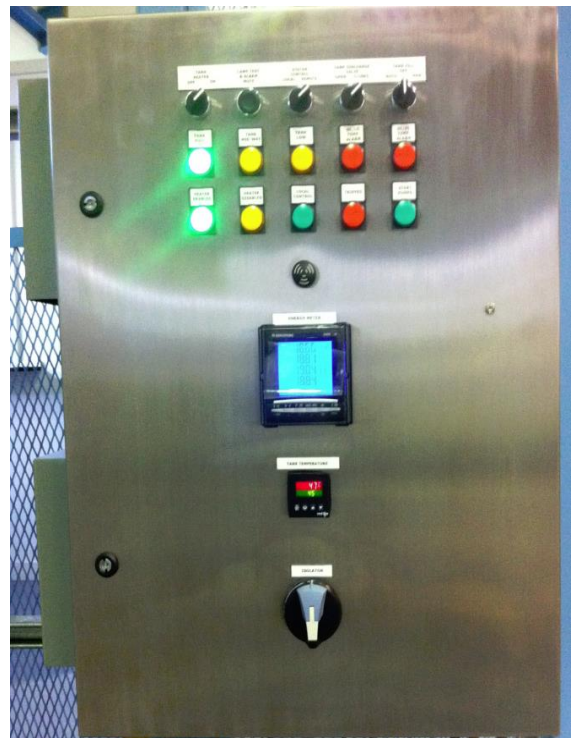
Local or remote control is set by the "System Control" switch; this would normally be set to remote, for the dive supervisor to control.

The remote control panel is located in dive control and gives the dive supervisor control of the tank temperature and control to discharge the tank. There are indication of the following; "Heater on", " Start Pumps", "Tank low", "Control Available" and "Hi/Lo temperature alarm with a mutable audible alarm.

The system was pre-commissioned at Fathom Systems premises in Badentoy, Aberdeen prior to shipping to the vessel and as all the electronic instruments have internal memories no setup should be required for these.

All elements should be IR checked before power up of the panel. These were checked in Aberdeen but it is possible for water ingress to occur during transit.

The tank and pipe work should be flushed until clean and checked for leaks. Most of the system works and ambient pressure, so no pressure testing is require except the three way diverter valve that sees the supply pressure of the cat pumps. The diverter valve can be programmed to fail open or closed. After power up and charging the failsafe batteries the failsafe function should be checked. Refer to the manufactures (J+J) manual if this function needs to be reversed.



System Start-Up Procedure

With the tank empty and the UV fresh water connected, switch on power from vessel, switch on main isolator. Cancel the audible alarm with the mute button. Check with the use of the energy meter that 440V 3 phase is present. Set the "Tank Discharge" switch

is in the closed position, the "System Control" switch is in the local position then switch the "Tank Fill" switch to auto, and fresh water should start to fill the tank. When the water is approximately 8" from the top the "Tank Full" indicator should light up and the fresh water solenoid should stop the water supply. The Temperature controller will display the actual temperature and the set point temperature. Adjust the setting by pushing the up / down arrows on the controller. Minimum temperature is 45°C and the maximum is 65°C. Switch on "Tank Heater" switch (no heating will be allowed until the tank full condition is achieved). The "Heater Enabled" indicator should light and if the tank temperature is lower than the set point, the current drawn will be shown on the energy meter. As the temperature nears the setting the SSR will control the current in short bursts of on & off. There may be a slight over shoot of the set point bay a degree or two. If it's higher than this, the controller has an autotune function that can be enabled, see the Red Lion manual for details. This automatically set up the PID parameters based on the cycle of the temperature at start up. The controller is set up to have a band alarm of 5°C, so the alarm will go off 2.5°C below or above the set point.



Emptying the Tank

Stop the cat pumps 1 or 2 and isolate the ships seawater supply, set the "Tank Discharge" switch to open. The diverter valve should open and the "Start Pumps" indicator should light. Start the cat pump and the tank will empty. When the "Tank low" indicator is lit, the cat pump will stop. Return system to normal and fill tank.



Emergency Hot Water Control Panel

On the local panel, set the "System Control" switch to remote and turn on the "Tank Heater" switch. In dive control the "Control available" & "Heater On" indicators should be lit. The "Tank Discharge" switch should be closed and the temperature controller should be indicating the tank temperature and its set point.