Project Profile

Project Description:	**Hyperbaric Chamber Cooling System**
Location:	Uddingston, North Lanarkshire
Client:	FMC Technologies Ltd
Project Value:	£60k
Project Duration:	January – December 2014
Sector:	Industrial

Callidus Design Limited was appointed by FMC Technologies to carry out the design of a cooling system for a new Hyperbaric Test chamber in their facility in Tannochside Park, Uddingston, North Lanarkshire.

FMC Technologies provide test facilities for equipment used in the process of oil exploration and extraction. Some of the equipment must operate at locations on the seabed and must be tested in the environmental conditions found in that location prior to being installed. In order to test the equipment, the conditions present on the sea-bed must be replicated on land so that the testing process represents the same conditions that will be experienced in the actual installation. To achieve this, the testing is carried out in a specially constructed Hyperbaric Test Chamber measuring approximately 1.5m in diameter and 4.5m in height.

The test conditions in the chamber require a temperature of 4 DegC and a pressure of 450Bar(g). These conditions closely resemble the environment the equipment will experience at the seabed. In order to test the equipment it must be put through a number of cycles of normal operation to check for reliability and repeatability. This is achieved by exercising any and all actuated parts of the equipment using hydraulic signals generated from outwith the chamber. The hydraulics and instrumentation signals must pass through the lid of the vessel via specially designed couplings which are rated to withstand the differential pressure between the inside of the chamber and the external atmosphere.

Exercising the equipment on test in the chamber using hydraulic signals generates heat in the process. If this heat is not removed at the same rate at which it is generated then the internal environment in the chamber will rise in temperature and no longer represent the conditions at the seabed. Removing the water from the chamber at 450Bar and returning the water to the chamber after cooling is impractical and hazardous since

it would require the pumping and routing of high pressure water outwith the chamber thus presenting a hazard. Therefore a heat exchange surface is required to convey the heat out of the chamber using a secondary fluid. As a result of the very high pressures involved, there are no proprietary heat exchangers available for this type of application. Therefore Callidus Design was required to design a heat exchanger from first principles. Additional challenges were presented by the low temperature to be maintained in the chamber which could not be supported by standard chiller outlet temperatures and the lack of available space between the equipment under test and the internal surfaces of the chamber.

In order to achieve the accuracy of temperature control within the test chamber a buffer vessel and 3-port mixing arrangement was introduced between the chamber and the chiller. The presence of the mixing valve and chamber dampened out the chiller switching hysteresis and thus permitted the required accuracy to be achieved.