

Cambridge Viscosity Supplies ViscoPro 2100 Viscometers with 372 Sensors for a Customized Lubrication Test Apparatus



APPLICATION

Refrigeration Lubricant

OVERVIEW

CPI Fluid Engineering, founded in Midland, Michigan 50 years ago, is a division of the Lubrizol Corporation (a Berkshire Hathaway company). Specializing in compression and heat transfer fluid technology, CPI has a strong focus on developing optimum solutions applying experience and applying state-of-the-art testing, quality control, and data validation.

Since 2006, CPI has used Cambridge Viscosity ViscoPro 1600 viscometers as an important research tool in their testing. Recently, they built a new testing apparatus with expanded measurement capabilities.

CHALLENGE

CPI commissioned a project to engineer, design, and build new testing equipment to increase their compressor lubrication testing capability and capacity. To complete the work, they leveraged their parent company's resources by working with the Lubrizol headquarters Wickliffe, Ohio Test Cell Engineering team. A benchtop temperature cycling chamber measuring 19" x 15" x 24" was ordered before the apparatus was designed, so the engineers faced their first challenge to engineer test equipment that fit into a very tight compartment.

The second challenge came in the form of accommodating a wide testing range at potentially high pressures. As part of refrigerant lubricant testing, CPI routinely measures pressure, viscosity, temperature, and flow. Because lubricants can be exposed to a wide range of temperatures, testing procedures typically cycle between 130 and -20 °C, with the new capability allowing a -70 to 180 °C range.



The ViscoPro 1600s, installed in 2006, are still being used in the CPI labs.

With the range of refrigerants including potentially volatile gases like methane, for example, the equipment has to safely handle a large range of pressures from vacuum to thousands of psi.

“ We asked for a lot - 2500 psi, welding, leak testing. It’s great to work with a vendor like Cambridge Viscosity who will work with us to customize the instrument. These sensors are highly refined, measuring below half a centipoise. And they delivered it welded with the fitting in it. It’s rare to find a vendor who will work with you at that level. ”

– Nick Virostko, Test Development Engineer, Lubrizol

CPI specifically examines fluid’s resistance to motion under force and its ability to flow. When fluid is heated, it flows much easier and faster. CPI needed to be able to characterize these samples over the vast range of research and development conditions. Whether it’s in engines, transmissions, axles, compressors, or another application, the layer of lubricant must provide proper lubricity to optimize performance and avoid viscosity breakdown that leads to operational failure. However, if the lubricant is too thick for the job, the efficiency can be adversely affected leading to higher than necessary energy utilization and potentially more greenhouse gases. To optimize the lubricant for the application, the viscosity must be right to provide the right amount of protection and the right efficiency.

SOLUTION

Because of their history with Cambridge Viscosity’s ViscoPro 1600s, CPI wanted to incorporate the ViscoPro 2100 for their viscosity testing requirements in the new apparatus.

Cambridge Viscosity supplied three ViscoPro 2100s with 372 sensors, configured for three different ranges for each customized testing apparatus. The small-footprint 372 sensors can be used up to 5000 psi, so they can easily be used in high-pressure applications. By incorporating three sensors together, the test apparatus can accommodate samples that have vastly different viscosities over the potential 250 °C testing chamber range and will provide accurate characterization of the fluid properties.

Through experience CPI realized potential leaks posed another challenge in the new enhanced capability equipment. The pressure gets high—potentially above 2000 psi—in the beginning of the



The new ViscoPro 2100 viscometers are enclosed in a mobile benchtop temperature cycling chamber.

test cycle. The sensors were tested for 2500+ psi, so that is not a problem. However, the samples, which typically consist of multi-phase refrigerant mixed with liquid lubricant, have small molecules that will try to escape during periods of high pressure.

To ensure leaks did not happen, Cambridge Viscosity custom-welded special fittings in the ports on either side of the sensor. This isn't done in normal applications, but by welding the ports, Cambridge allowed the use of a metal face-sealed fitting that is very unlikely to leak in extreme conditions and temperature cycling. Additionally, Cambridge performed hydrostatic testing above 2500 psi to ensure leaks were not present before shipment to CPI.

CONCLUSION

When CPI Fluid Engineering began to design a new test apparatus to simulate a variety of operating conditions, they partnered with Cambridge Viscosity for the viscometers. Cambridge helped CPI determine which sensors best fit the test equipment requirements, and they customized the viscometer solution to meet the requirements of the application.

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