
Case Study: Ace Glass 10L Jacketed Glass Reactor with JULABO LH 85

Environment: JULABO USA testing chambers (Allentown, PA). The testing chambers located at JULABO's Pennsylvania facility allow for controlled testing of the entire JULABO product line. Ambient temperature and humidity can be held constant in order to ensure consistent and reliable results. All testing performed at ambient conditions of 20°C and 50% relative humidity.

Equipment: JULABO LH 85 (9410185-13) refrigerated and heating circulator (230 V/60 Hz)

Temperature Range: -85 °C to +250 °C

Heating Capacity: 1.8 kW

Cooling Capacity: 1.5 kW @ +200 °C, 900 W @ -20 °C

Ace Glass 10L Jacketed Glass Reactor

Arrow 1750 Reactor Stirrer

Glass Shaft, Teflon Stirring Blade

JULABO 1m Triple Insulated Metal Tubing (8930210)

Associated adapters/fittings

JULABO HL 80 (8940120) Bath fluid (circulator fluid)

Ethanol (reactor fluid, low temperature testing)

JULABO H5S (8940106, reactor fluid, high temperature testing)

Procedure: It is important to note that all tests were performed so that there was zero overshoot observed during all temperature changes. All performance times can be drastically reduced by altering the control parameters so as to allow what is considered to be "acceptable" overshoot.

The first test performed was an ultimate deep temperature test using JULABO HL 80 bath fluid in the LH 85 and 10 liters of denatured alcohol (ethanol). The system was started from ambient conditions (about 24°C) and the setpoint of the LH 85 was set to -80°C. The Arrow stirrer was used to keep the ethanol mixed. As can be seen by Figure 1, the LH 85 was able to drop the temperature inside the reactor from about +24°C to -62°C in about 2.5 hours. In fact, both the internal temperature of the reactor and the circulator fluid were still dropping at this point. The testing was aborted at this temperature, however, in order to avoid reaching the -70°C limit of the glass reactor.

The second test performed was a -40°C to +20°C to -40°C step test. As can be seen in Figure 2, this test was accomplished in just about 4 hours. The purpose of this test is to show the performance of the system under real-world requirements. Again, the bath fluid of the LH 85 was HL 80 and the reactor fluid was denatured alcohol.

-95 ... +400°C

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The final test was to simulate a high temperature profile, much like the previous test. In this case, the profile was +100°C to -40°C to +100°C. As can be seen by Figure 3, this test took approximately 5 hours (not counting roughly 1 hour of dwell time at -40°C). For this test, HL 80 bath fluid was used for the internal bath fluid and Julabo Thermal H5S was used for the reactor fluid.

Conclusion: This testing has successfully shown that the JULABO Presto LH 85 can be used to control jacketed glass reactors as large as 10 liters in size. Of course, performance will vary depending on bath fluids and reactor fluids used, but these results can be used in order to estimate system performance.

Full fluid physical properties and equipment performance specifications are available for the apparatus used in these experiments from the Engineering Department at JULABO USA, Inc. This information can be used in conjunction with the experimental results shown in this case study to help predict other systems' performance.

Figure 1: Ace Glass 10L Reactor with LH 85 (HL 80 Bath Fluid, Ethanol Reactor Fluid)

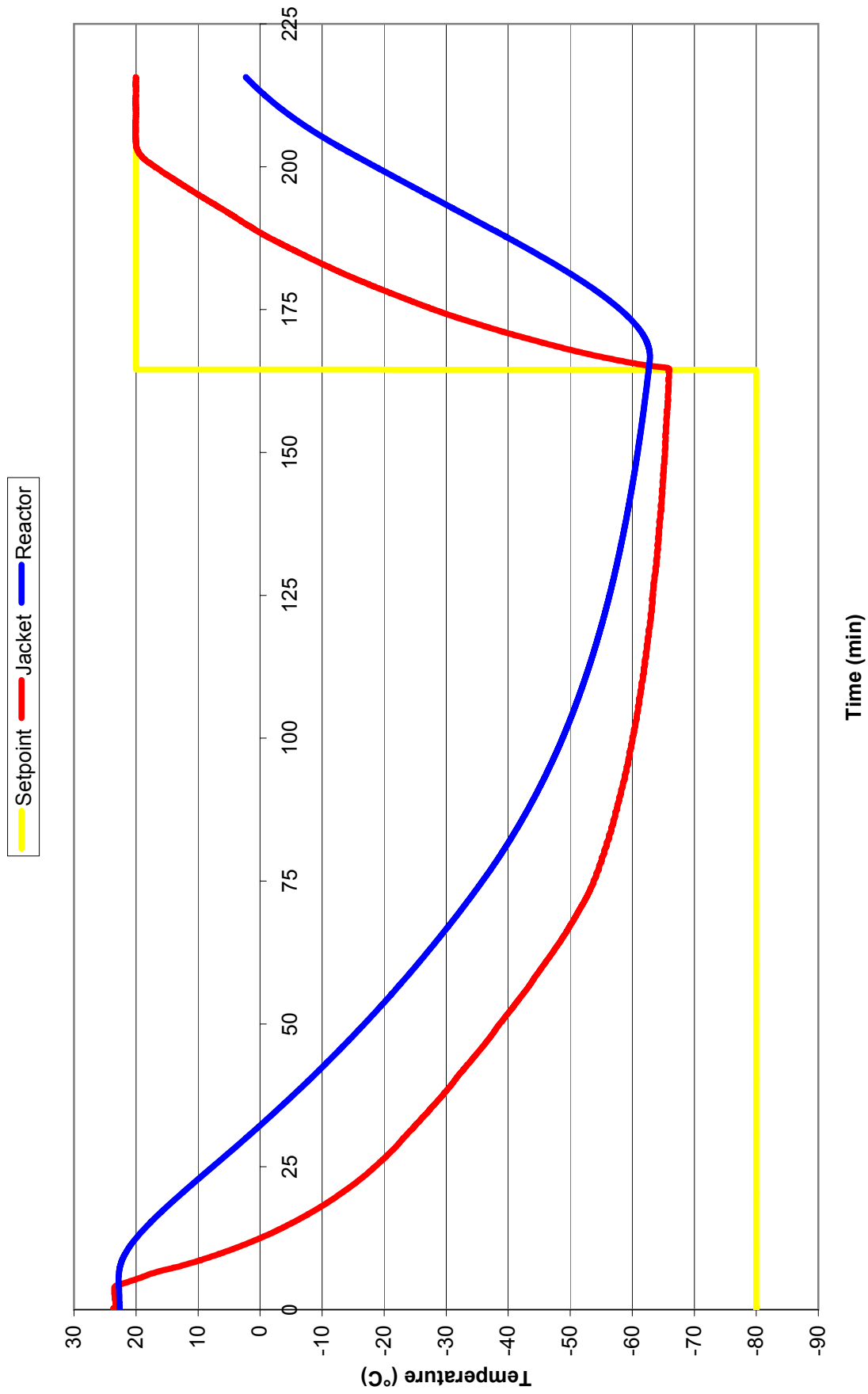


Figure 2: Ace Glass 10L Reactor with LH 85 (HL 80 Bath Fluid, Ethanol Reactor Fluid)

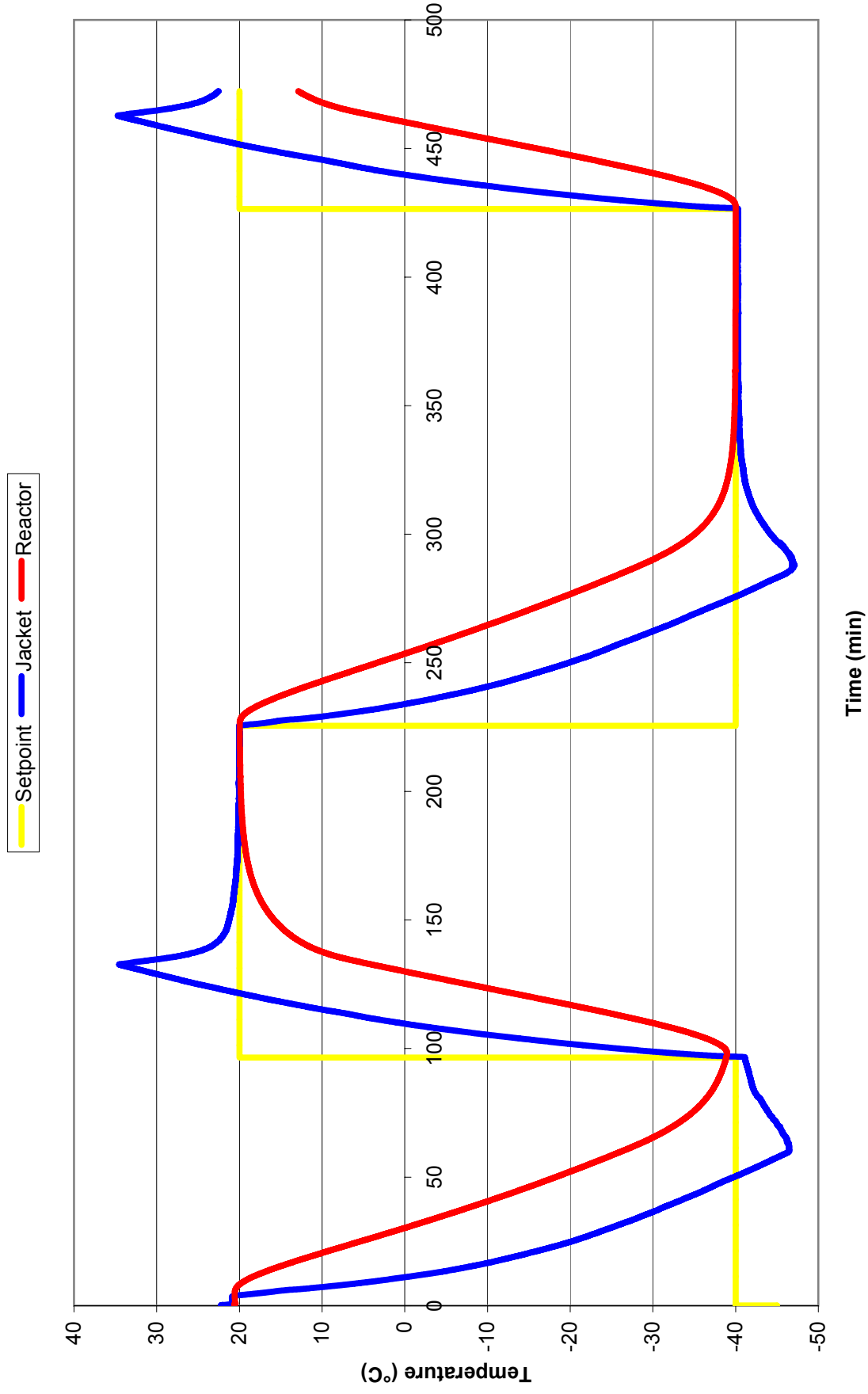


Figure 3: Ace Glass 10L Reactor with LH 85 (HL 80 Bath Fluid, H5S Reactor Fluid)

