Temperature Control of Ace Glass 1 Liter Jacketed Reactor with Presto LH 85

The Objective:

Ace Glass Inc. has developed a new 1L glass reactor. Julabo USA wanted to test the performance of this jacketed reactor with our Presto LH 85 Heating and Refrigerated Circulator. We decided to run several tests to observe the combined performance of the circulator and reactor.

The Motivation:

As is common in almost every area of business, it is desirable to complete projects in the shortest amount of time to maximize the productivity of equipment and employees. Because of this, Julabo USA (and Julabo Labortechnik GmbH) has developed the Presto series of heating and refrigerated circulators. With their powerful heating and cooling capacities, strong pumps, and minimal bath volumes, the Presto series of circulators can cut temperature-controlled experiment times almost in half, depending on the unit used and the application, in comparison to standard open bath circulators.

It is only natural to put the Ace Glass 1L glass reactor and the Presto LH85 together to test their performance.

The Solution:

Testing will be performed on the following system:

- Julabo Presto LH 85 Heating and Refrigerated Circulator (9 410 185)
- Ace Glass Inc. 1 liter jacketed glass reactor
- Arrow electronic stirrer
- Julabo 1 meter triple insulated flexible metal tubing (8 930 210)
- Julabo HL80 heat transfer fluid (range: -85°C to 170°C) (8 940 120)
- Julabo H5S heat transfer fluid (range: -50°C to 105°C) (8 940 106)
- Ethanol
- Pt100 external temperature sensor (8 891 018)
- Necessary fittings

Three simple tests will be performed in order to learn the behavior of the system.
The first test is a simple low temperature test to determine the lowest achievable reactor temperature.

The second test is a low temperature profile in which the reactor is heated from -40°C up to 20°C and then cooled back down to -40°C. The time necessary to achieve these temperature changes will be recorded to demonstrate the rapid dynamics of the circulator-reactor combination.

The final test is a high temperature profile in which the reactor is cooled from 100°C down to -40°C and then heated back up to 100°C. Again, the time necessary to achieve these temperature changes will be recorded.

Test Goal:
The goal of the tests is to determine:

- The lowest reactor temperature the combined system can attain
- The amount of time required to reach this minimum temperature
- The amount of time required to complete the low temperature profile
- The amount of time required to complete the high temperature profile

Test Results:
Note: All tests were performed with the Arrow electronic stirrer operating at 200 rpm. The bath fluid in all tests is Julabo HL80 heat transfer fluid.

In the first test, ethanol was used in the reactor. The initial reactor temperature was 20°C. The set point for the reactor was then changed to -65°C. Figure 1 below shows the response of the system while cooling down to -65°. The test was ended when the reactor reached -60°C in order to protect the glassware from excessively deep temperature.

In the second test, ethanol was used in the reactor. The response of the system during the low temperature profile can be seen in Figure 2 below. The system heated the reactor fluid from -40°C to 20°C in 51 minutes. The system then cooled the reactor back down to -40°C in 53 minutes.

In the final test, Julabo H5S heat transfer fluid was used in the reactor. The response of the system during the high temperature profile can be seen in Figure 3 below. The system cooled the reactor from 100°C to
-40°C in 54 minutes. The system then heated the reactor back up to 100°C in 79 minutes.

Note: The recorded times are the times for the system to reach the set point temperature with ±0.1°C stability.

Conclusions:

- Lowest achievable temperature with LH 85 and 1 liter jacketed reactor: -60°C
- Time to cycle from -40°C to 20°C to -40°C: 104 minutes
- Time to cycle from 100°C to -40°C to 100°C: 133 minutes

Figure 1: Ace Glass 1L Reactor with Presto LH85 (HL80 Bath Fluid, Ethanol Reactor Fluid)

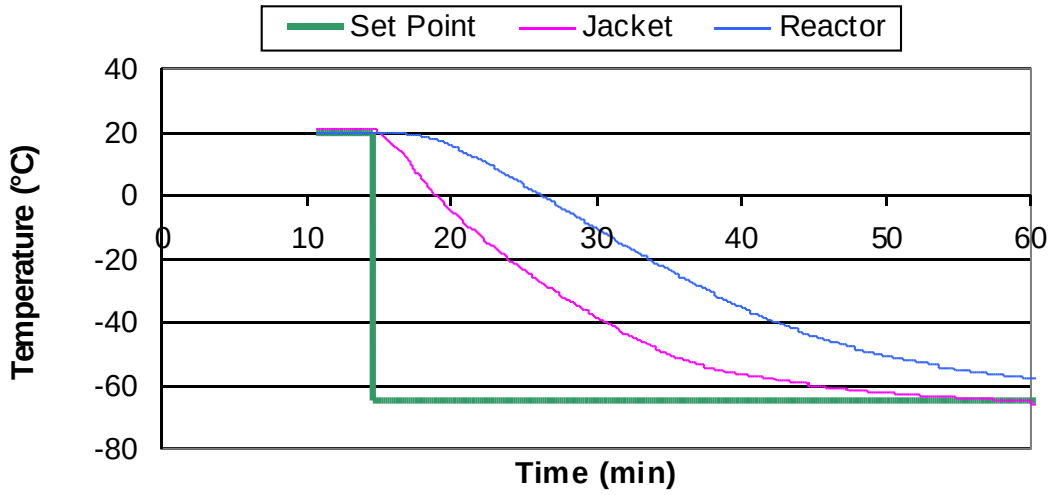

Figure 2: Ace Glass 1L Reactor with Presto LH85 (HL80 Bath Fluid, Ethanol Reactor Fluid)

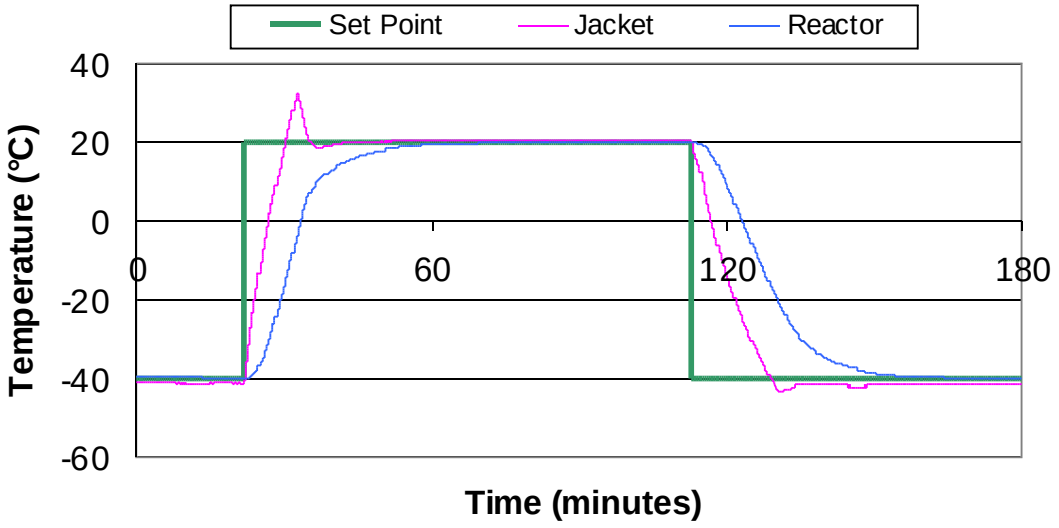

Figure 3: Ace Glass 1L Reactor with Presto LH85 (HL80 Bath Fluid, H5S Reactor Fluid)