

Unistat® 405

50 L Orb Pilot system with Huber Unistat 405. Heat-up time of 50 L of water from +20°C to +70°C

Requirement

This test demonstrates the time needed for a 50 L Orb Pilot reactor system filled with water to reach +70°C from +20°C, using a Huber Unistat 405 circulation thermostat equipped with a Pilot ONE controller. Reactor contents reached desired temperature after 120 minutes, with negligible overshoot of 0,2°C.

Method

The Orb Pilot reactor system was equipped with a 50 L single jacketed vessel, stirred by an A310 Hydrofoil impeller agitator powered by IKA Eurostar 200 Control overhead stirrer. The stirrer was set to constant 350 rpm.

Temperature control was provided by Huber Unistat 405 with Pilot ONE circulation thermostat. The process (reactor contents) temperature was measured by Pt100 RTD probe, connected directly to the Unistat controller unit. The circulator was connected to vessel by insulated oil pipes. Approx. 22 liters of Huber M60.115/200.05 thermal fluid was used as heat transfer liquid.

The Unistat was connected to a 400V 3-phase power supply, enabling the higher heating power setting (3 kW).

The circulation was set not to exceed 0.5 bar in the jacket, and the maximum temperature difference between jacket and reactor contents (ΔT) was set at +60°C.



Setup details

Orb Pilot jacketed reactor system

Vessel volume range:

10 L, 20 L, 30 L, & 50 L Single Jacketed Vessels (Flange sizes: DN235 and DN300), 10 L, 20 L, & 30 L Vacuum Jacketed Vessels (Flange sizes: DN235 and DN300)

Vessel profiles:

Jacketed, Vacuum Jacketed

Vessel shapes:

Torispherical with Detachable Bottom Outlet Valve (BOV) for easy cleaning and maintenance

Temperature range:

-40°C to +235°C

Accessory range:

Condensers, stirrers, probes, baffles, powder or pressure equalizing liquid funnels, port adapters, stoppers, etc. are all available on the Orb Pilot platform

Automation:

Automation upgrades available

Modes of operation:

Manual operation, automation using Reactor Master

Pressure range:

Vacuum (50 mbara) to 0.25 barg

Reagent addition and sampling:

Manual dosing, automated dosing (Volumetric)

Stirring options:

Multiple options available up to 500 rpm and 400 N/cm continuous mode

Other specifications:

Accessory Tower available which couples directly to Orb Pilot frame and accepts distillation collection vessel, liquid feed vessel, pump, or equipment shelf

Huber Unistat 405

Temperature Range:

-45°C to +250°C

Heating power:

1.5 kW (single phase operation) 3 kW (three-phase operation)

Cooling power:

1 kW (250°C to 0°C) 0.6 kW (-20°C)

Max. pump flowrate:

55 L min⁻¹

Max. pump pressure:

0.9 barg

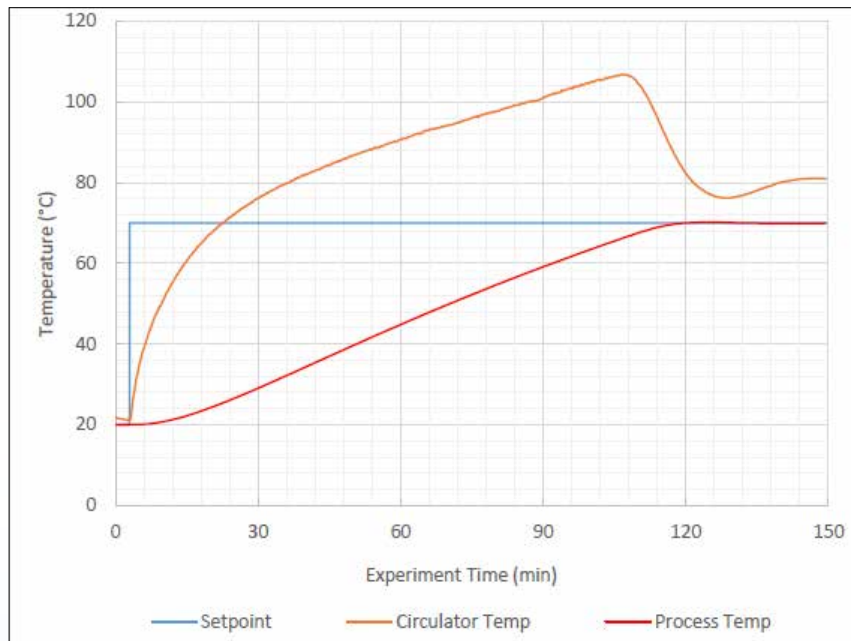
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Results

Before the experiment, the optimum temperature control parameters were determined using Pilot ONE automatic Fast Identification feature. Temperature control has been set to Process (to monitor reactor contents temperature), and using standard control parameters the contents were heated to +30°C. After 15 minutes of running, the fast identification was started using with target temperature of +45°C. After circa 40 minutes of running, the unit found optimal temperature parameters for control of 50 L of water. Afterwards, the system was controlled to equilibrate at starting temp of +20°C. After running at stable temperature (process and circulator), logging was started and setpoint increased to +70°C. After stable values were reached in the circulator and process, logging was stopped.



The reactor reached target temperature after 120 minutes with small overshoot of 0.2°C. Afterwards, the process temperature remained stable within 0.1°C. The circulator temperature has stabilized at +81°C after approximately 150 minutes. This test shows that even relatively low-powered circulators for this kind of application can achieve very good results heating a large volume of water; this is often considered a challenging task to complete in a timely manner.

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