Unistat® 610w

Control dynamics on a Buchi Glas Uster 20-litre reactor

Requirement

Every Unistat can be set to ramp "Fast with small over shoot" or "No overshoot".
This case study looks at the response under different "control dynamics" of a Unistat 610w when cooling and heating a Buchi Glas Uster 20-litre reactor between 20 °C and -60 °C.

Method

The Unistat and reactor were connected using two 1.5 m insulated metal hoses. The reactor was filled with 15 litre of "M90.055.03", a Huber supplied silicon based HTF.

Results

The first & second curves (20 °C to 60 °C and back to 20 °C) show the function of "Periodic - fast, small overshoot" control dynamic. The first curve illustrates a heating process in a time of 16 minutes. It can be clearly seen that the internal temperature heats to 103 °C, thus the process temperature reaches -60 °C very quickly. The Unistat

610w cools the 20-litre reactor back to 20 °C in approximately 17 minutes through a ∆T of 40 K.
The third curve (20 °C to 60 °C) shows the same temperature profile but with "Aperiodic - no overshoot" control. The Unistat takes slightly longer (30 minutes) to heat to avoid any over or undershoot of the set-point.

Setup details

Unistat® 610w & Buchi Glas Uster reactor

Temperature range:	-60...200 °C
Cooling power:	7.0 kW @ 200…0 °C
	6.4 kW @ -20 °C
	3.3 kW @ -40 °C
	0.8 kW @ -60 °C
Heating power:	6.0 kW
Hoses:	2x1.5 m; M38x1.5 (#6656)
HTF:	DW-Therm (#6479)
Reactor:	20 litre jacketed glass reactor
Reactor content:	15 litre DW-Therm (#6479)
Stirrer speed:	70 rpm
Control:	process

On the point process temperature control after ramping from 20 °C to 60 °C at a rate >2.3 K/min.

Aperiodic "No overshoot" limits the ramp rate to ensure that the set point is not exceeded

Jacket cools to -38 °C from 60 °C at a rate > 9 K/min. for the fastest possible process cool down time

Periodic "Fast with small overshoot" allows a small overshoot of the set point but allows a faster ramp rate.

— Jacket temperature
— Process temperature
— Setpoint