Unimotive 26w, Flow Control Cube & Cold Plate

Temperature Control
For Automotive industry

Inspired by **temperature**

huber

CASE STUDY RESULTS

Authors

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Introduction

This Case Study demonstrates the Process temperature control abilities of the Unimotive 26w when used in conjunction with a Flow Control Cube (FCC) to control the flow through an aluminium cold plate (the "application") at different temperatures while a known heat load to simulate battery testing is applied.

To simulate the heat load from battery cells under test, a 360w heating mat was placed on top of the cold plate and insulated with an "Armorflex" sheet.

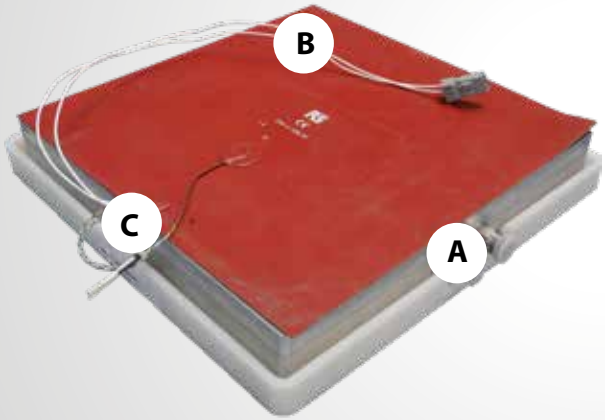
Three tests were made at different heat transfer fluid HTF flow rates at both 20°C and -20°C to demonstrate the speed of recovery as the heat load is first applied and then removed.
The results were recorded and are displayed using Huber's service software.

Equipment & Setup

The Cold Plate is connected to the FCC and the FCC connected to the Unimotive 26w using "M16 x 1" insulated metal tubing. A Pt100 is located inside the sleeve on the cold plate. The Unimotive is configured to control the temperature from this point, see figure 1. A 360w heating pad is placed on top of the Cold Plate and then insulation is placed over it.

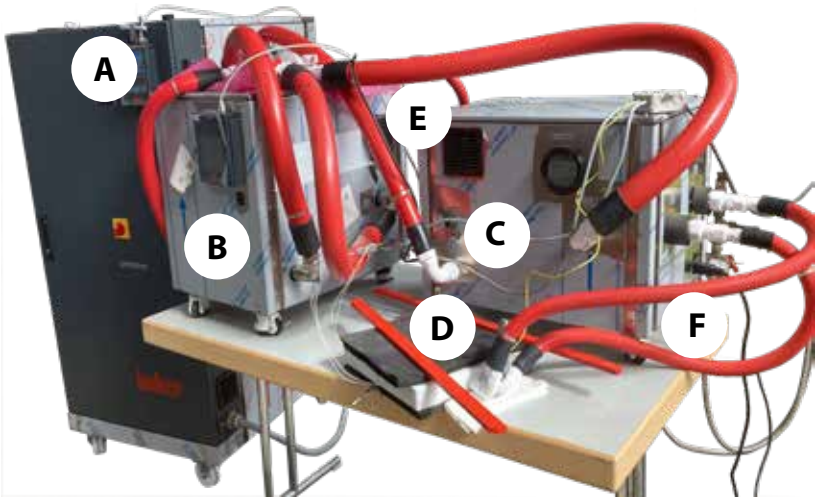
Huber Unimotive 26w

Cold plate



A	Cold plate
B	Heating mat (temperature sensor not used)
C	Pt100 temperature sensor connected to TCU

Figure 1: Close-up Image of Cold plate, PT100 Temp Sensor, Heater Mat, Cold plate PTFE Tray, Hosing connections used to carry out this study.



A	PT100 sensor
B	M-FCC, not active, isolated
C	FCC
D	Block with 360w heating mat
E	Tubing, Unimotive to FCC
F	Tubing, FCC to Block

Figure 2: Image of all equipment used in this study. Unimotive 26w, insulated metal hosing, cold plate with "Armourflex" insulation and PT 100 temperature sensor.

Technical Specifications of Items used

Unit	Unimotive 26w
Catalogue number	1091.0001.01
Temperature range	-45°C…95°C
Heating power kW	24
Cooling power kW	200 20 0 -20 -40 ----- 28 25 14.5 2.6
Pump data	Flow Pressure 145 l/min 5.5 Bar
FCC	
Catalogue number	10925
Type of Flow Sensor	Inductive
Temperature range	-40°C…130°C
Flow range	0.2…80 l/min
Cold Plate	
Dimensions	30 cm x 30 cm x 10 cm
Material of construction	Aluminium
Weight	10 kg
Heating mat	
Output	396 w
Dimensions	30 cm x 30 cm
W/cm^2	0.44 w/cm^2
Test conditions	
Tubing	
Control	Process
Heat Transfer Fluid	Water / Glycol (Glycantine G40) 50/50

Introduction

The 'screen shots' on the following pages show the temperature control curves and minimum achievable temperature curves. In each screen shots below, the following colour codes apply:

1.) Blue is the Set-point

2.) Green is the HTF temperature

3.) Red is the application temperature

4.) Yellow is the HTF flow set point

The "recovery" is a demonstration of the ability of the Unimotive 26w to recover the set-point of the application after a sudden change in heat load achieved by turning the heat source "On" and after the set-point has been reached and stabilized and then "Off" again.

Recovery Results Summary

The table below (Table 1) shows both the decrease and the increase from the set-point in the application's temperature after a change in heat-load and the corresponding time taken for the set-point to be regained.

Conclusions

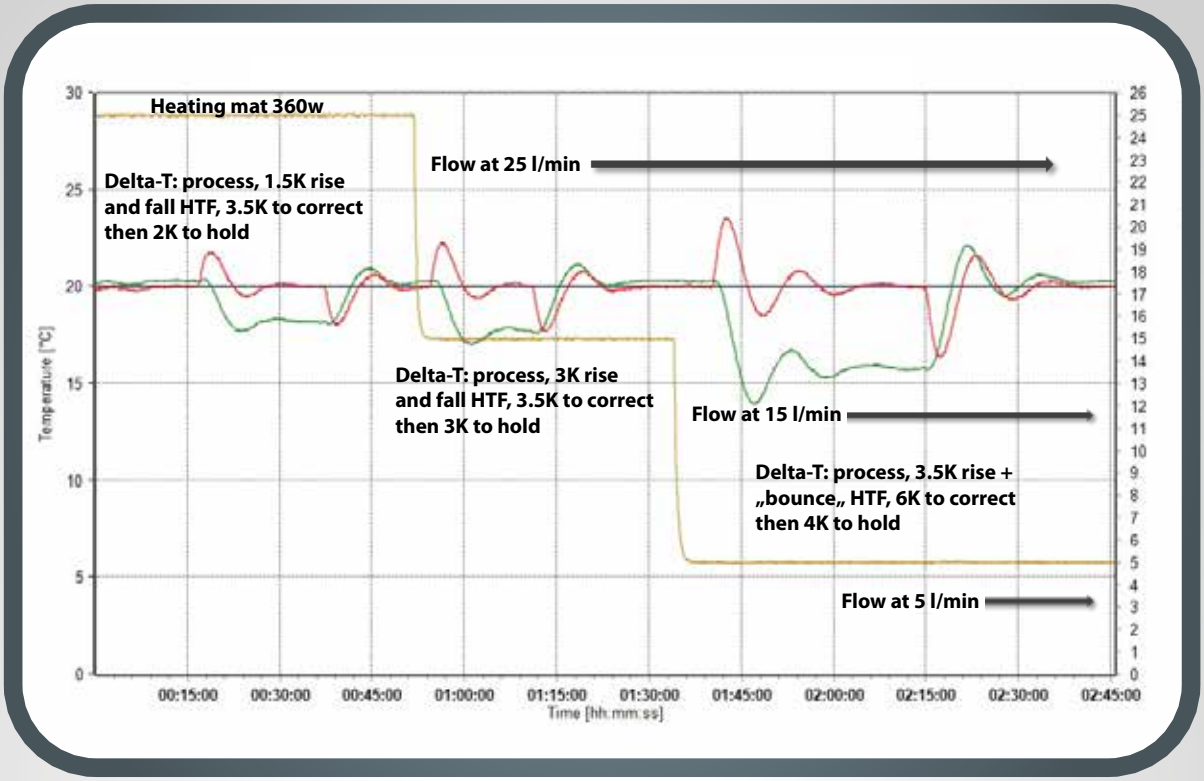
Specifying the best Unistat for any application with theoretical calculations can yield disappointing results.

This case study shows empirical data with detailed technical specifications such as the cooling and heating power of the Unistat, the surface area (cm^2) of the "component" under test (the heat pad) and the heat (w) that it generates. The data also demonstrates the lowest working temperatures under varying heat loads as well as the performance (response times and stability) at different set-points.

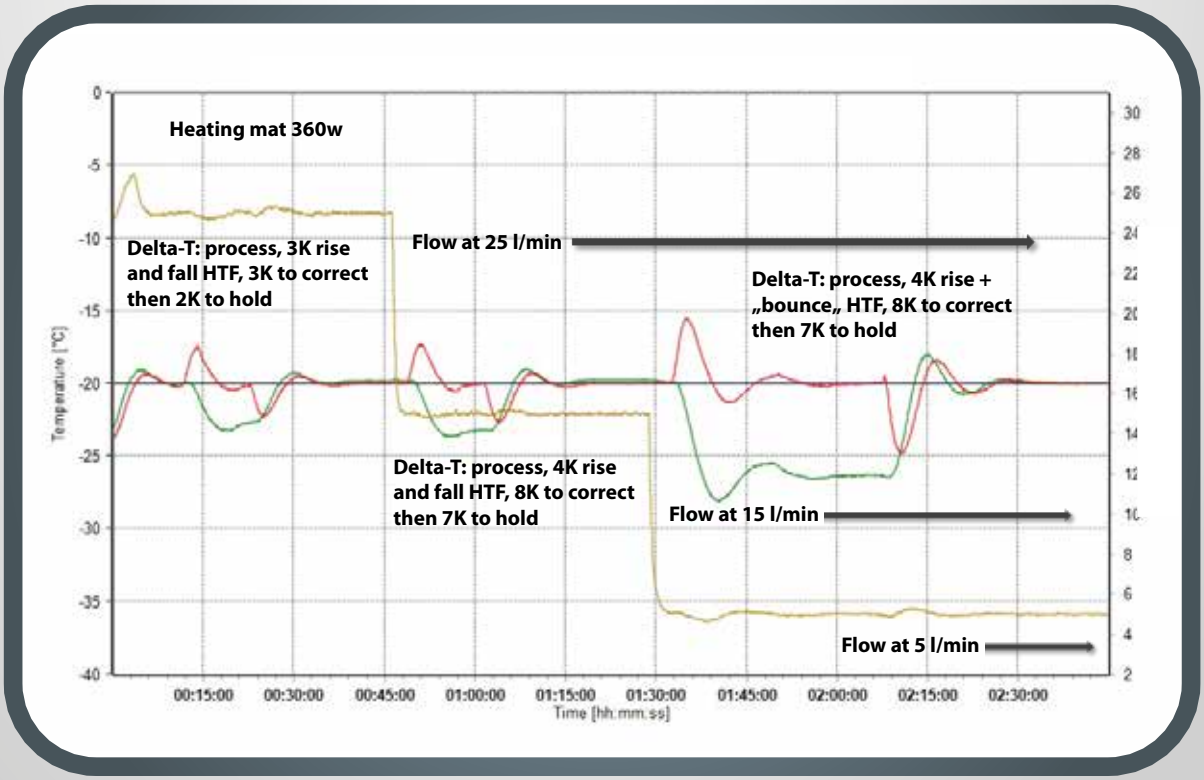
Flow	Set point	Increase	Recovery time	Decrease	Recovery time
25 l/min	20°C	1.5K	6 minutes	1.5K	5 minutes
15 l/min	20°C	3K	5 minutes	3K	6 minutes
5 l/min	20°C	3.5K	6 minutes	3.5K	6 minutes
25 l/min	-20°C	3K	6 minutes	3K	6 minutes
15 l/min	-20°C	3K	6 minutes	3K	6 minutes
5 l/min	-20°C	4K	6 minutes	4K	6 minutes

Table 1: Results summary.

Results at +20°C



Results at -20°C



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