

PROJECT PROFILE

EQUIPMENT: Radiator, Oil Cooler and Condenser Calorimeter

Customer: DENSO NORTH AMERICA

Location: Southfield, MI

Year Completed: 2013



1.0 EQUIPMENT DESCRIPTION

Climatic Testing Systems (CTS) has designed, manufactured and installed a Calorimeter Test Facility for testing large Radiators, Oil Coolers and Condensers at the Denso North America facility located in Southfield, MI.

The test facility includes a recirculating wind tunnel with airflow capacities up to 43,200 m³/hr 000 CFM, temperature conditioning system, radiator fluid test loop, oil test loop, charge air test loop, instrumentation and controls, LabVIEW Control Software.

2.0 PERFORMANCE SPECIFICATIONS

2.1 Calorimeter Air Flow Conditioning and Re-Circulation	
• Dry Bulb Temperature Range (Inlet to UUT)	10°C to 80°C
• Air Flow Range (Re-Circulated)	500 to 43,200 m ³ /hr
• Air Velocity	0 to 20 m/s ±0.1
• UUT Differential Pressure	0 to 1100 Pa
• Air Flow Control Stability	±1.0% of Flow @ Steady State
• Air Flow Measurement Accuracy	±0.5% of Flow
• Temperature Control Stability	± 0.5°C @ Steady State
• Temperature Measurement Accuracy (Before & After UUT)	±0.1°C (Psychrometric Sampler before and after UUT)
• Air Flow Measurement Method	ASHRAE Std. 33 Code Tester Tunnel Automatic Selection of Nozzles

2.2 Coolant supply Loop Specifications – Radiator Test	
• Coolant	Water with 3% rust inhibitor 50% Water/50% Ethylene Glycol
• Flow Rate	30 to 330 l/m ±0.2 l/m
• UUT Differential Pressure	0 to 10 PSI
• Flow Rate Control Stability	±1.0% of Flow rate @ Steady State
• Flow Rate Measurement Accuracy	±0.5% of Flow rate
• Coolant Inlet Temperature to UUT	20°C to 105°C ± 0.5°C
• Maximum Heat Rejection	450 kW

• Temperature Control Stability	$\pm 0.5^{\circ}\text{C}$ @ Steady State
• Temperature Measurement Accuracy (Before & After UUT)	$\pm 0.1^{\circ}\text{C}$
• Coolant Pressure at UUT Inlet	20 PSI (max)
• Coolant Pressure Control Stability	± 1.0 PSI
• Pressure Measurement Accuracy (Before & After UUT)	± 0.15 % of range

2.3 Oil Supply System Test Loop Specifications	
• Oil Types	Dextron 3 or equivalent Type A transmission fluid (Mercon LV)
• Flow Rate	2.2 to 22.7 l/m \pm 0.1
• Flow Rate Control Stability	$\pm 1.0\%$ of Flow rate @ Steady State
• Flow Rate Measurement Accuracy	$\pm 0.5\%$ of Flow rate
• Oil Inlet Temperature to UUT	-10°C to 160°C
• Temperature Control Stability	$\pm 0.5^{\circ}\text{C}$ @ Steady State
• Temperature Measurement Accuracy (Before & After UUT)	$\pm 0.1^{\circ}\text{C}$
• Oil System Pressure	0 to 800 kPa
• Oil System Pressure Control Stability	± 10 kPa
• Pressure Measurement Accuracy (Before & After UUT)	± 0.15 % of range

2.4 Condenser Test Loop Specifications	
• Refrigerant	R-134a, R-1234yf
• Maximum Heat Rejection	22 kW at 20°C
• Dry Bulb Temperature Range	As shown in Section 2.1
• Airflow Range	0 to 10,000 m ³ /hr
• Air Velocity	0 to 13.5 m/sec
• Control Stability	$\pm 3\%$
• Airflow Uniformity	Within 0.5 m/s measured at 9 points

3.0 CONTROLS

The calorimeter system utilized an Allen-Bradley CompactLogix Programmable Logic Controller to perform all machine control and alarm monitoring. A large color touch panel HMI was supplied to provide the operator with manual control of the systems.

CTS provided a Campbell Scientific data acquisition system and a LabView applications program to automatically execute all test sequences, collect all data, perform calculations and create reports.