



HVAC Scenario Analysis Facility

**Located at Hindmarsh, South Australia 5007
AUSTRALIA**

Australia's most versatile and relevant testing facility for Active Chilled Beams and HVAC project scenario mock-up testing with product thermal capacity validation capability and measurement of specific room air movement, temperatures and humidity for comfort analysis under project design conditions

A product engineering and customer support initiative from Dadanco Pty Ltd
Australia's original designer and manufacturer of Active Chilled Beams and Inffusers

Introduction

Dadanco's modern scenario analysis facility, located at our Hindmarsh South Australia premises, is designed to provide product thermal capacity validation and valuable project specific scenario testing of occupied zone thermal comfort parameters in a mock-up environment specific to a project design.

Performance parameters capable of being measured and observed in the facility include:

- Product thermal capacity validation under specific project design & operating conditions
- Radiant thermal wall building fabric load simulation (Water Source Wall) up to 215W/m² of floor area
- 'Thermal Mannequin' variable load devices for space load simulation of up to 75W/m² of floor area
- Air velocities in the conditioned space (Omni-directional)
- Air temperature and relative humidity values in the conditioned space
- Smoke visualization of air movement in the conditioned space

The scenario analysis facility is designed to satisfy the requirements of prEN 15116:2007 'Testing and rating of active chilled beams' and EN 14240-2004 'Ventilation for Buildings—Chilled Ceilings—Testing and Rating' representing Dadanco's continuing commitment to quality, technology development and support of our business as the only Australian only owned, operated, designed and manufactured active chilled beam.

The facility is intended to support both Dadanco's ongoing product developments and the increasing needs of our customers and projects in pursuit of higher energy efficiency HVAC solutions.

Lab Physical Specifications

The facility offers a wide scope of physical parameters and capabilities to meet a variety of analysis scenarios

PARAMETER	VALUE	COMMENT
Test Area	≤35.2m ²	4.0m x 8.8m (Variable to suit project requirements)
Test Area Ceiling Height	≤3.0m ²	Variable to suit test project requirements
Test Area Temperature Range	10°C ~ 35°C	Controllable to match test unit and design scenario
Thermal Wall Area	29m ²	Selectable from 20 individual hydronic radiant panels on 2 walls
Thermal Wall Temperature Range	5 - 60°C	Mixing Valve & Variable Flow Rate Control
Thermal Wall Output (Cooling Test)	11.0kW	Variable Hot Water Flow & Temperature Control
Thermal Wall Output (Heating Test)	2.8kW	Variable Chilled Water Flow & Temperature Control
Supply Air Temperature	7°C ~ 60°C	Variable Control Through Chiller & Boiler
Supply Air Flow Rate	10 ~ 320 L/s	Variable Across 2 Primary Air Handlers & In-Line Fans
Supply Air Static Pressure	20 ~ 400 Pa	Backward Curved Variable Controlled In-Line Fans
Extract Air Flow Rate	10 ~ 320 L/s	Variable Across 2 Primary Air Handlers
Test Unit Water Flow Rate	0.03 ~ 0.15 L/s	per Test Unit (Maximum 4 Simultaneous Test Units)
Test Unit Water Temperature	9°C ~ 55°C	Mixing Valve Control for Cooling & Heating Tests
Variable Electrical Load Circuit 1	0 ~ 1800W	Variac Controlled 'Thermal Mannequin' 10 ~ 180W each (Max 10 Units)
Variable Electrical Load Circuit 2	0 ~ 1800W	Variac Controlled 'Thermal Mannequin' 10 ~ 180W each (Max 10 Units)
Electrical Lighting Load Circuit	0 ~ 1100W	In-Ceiling Light Fixtures or 'Thermal Mannequins'

NOTE: Test facility operating parameters, space dimensions, imposed heat loads and test unit parameters can be tailored to suit any specific scenario analysis requirement. Contact Dadanco for specific needs or requirements.

Orders of Measurement Accuracy

PARAMETER	ACCURACY	PARAMETER	ACCURACY
Air Temperatures	±0.1°C	Water Flow Rates	±0.5%
Supply Air Flow Rate	±3%	Water Temperatures	±0.1°C
Air Relative Humidity	±2%	Supply Air Static Pressure	±1Pa
Test Space Air Velocities	±0.03m/s	Electrical Power Meters	±1%

Lab Equipment & Specifications

The quality and accuracy of the instrumentation and control system governs the reliability and dependability of the thermal capacity validation and scenario analysis for any project.

Emphasis is on quality, high orders of accuracy and reliable control to ensure quality results from scenario analysis

Temperatures

Equipment air and water temperatures are measured with BA/10K temperature probe sensors accurate to 0.1°C over 0-70°C

Test space air dry bulb temperatures are measured with Platinum Resistance Thermometers (PRT) Pt 100, manufactured to 1/10th DIN, accurate to 0.05°C over the range of 0-70°C

Test space radiant temperatures are measured with Ø50mm 'Black Globe' PRT Pt 100 sensors manufactured to 1/10th DIN, accurate to 0.05°C over the range of 0-70°C

Humidity

Test space air humidity is measured with DeltaOhm HD2007TCI-2 RH Hygrotransmitter humidity sensor accurate to ±2% from 5-90%RH

System Air Conditions

Primary air in-duct, return air in-duct and test unit entering and leaving air conditions are measured with 'Combo' temperature and humidity sensors accurate to 0.1°C over the range of 0-70°C and ±2% over 0-100%RH respectively



Air Velocities

Test space room air velocity is measured in a grid using 4 TSI 8475 omni-directional velocity sensors accurate between 0.05 - 2.5 m/s

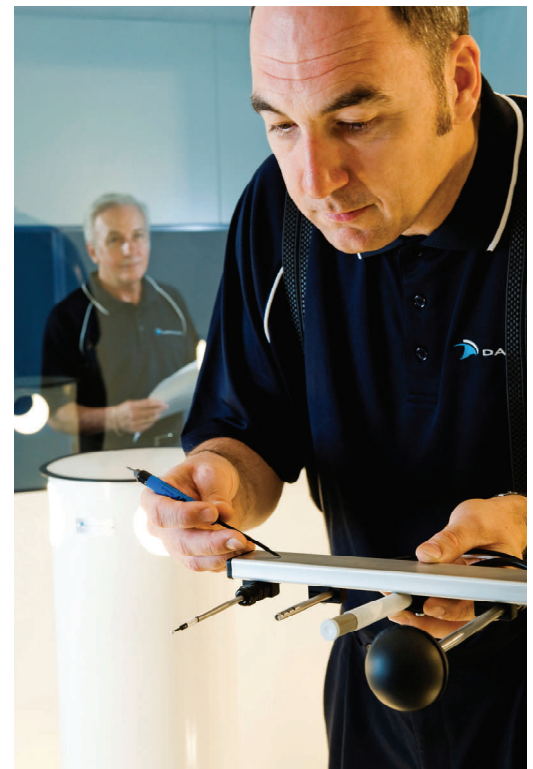
Omni-directional sensors are useful for measuring air speed magnitude (Turbulence Intensity) for 'Draft' calculations used in determining occupant comfort

Air Flow Rate

Primary air flow rates are delivered by Fantech backward curved in-line supply air fans controlled through 'Variac' auto transformers for infinite fan control.

Primary air and extract air mass flow rates are independently measured through in-duct velocity grids and compared to each other for accuracy and to determine any test room space leakage error. Low and High rate velocity grids are used in both the supply and return ducts to suit the range of air for each supply and return air duct or test scenario.

Primary air mass flow rates are cross-checked and validated using Dadanco's high accuracy pressure differential devices (orifice plate pipes) manufactured to ISO 5167-2



Water Flow Rate

Secondary water flow to radiant heat source walls and tertiary water flow to test units are measured separately using Siemens high accuracy EN 1434 Class 2 UH50 in-line ultrasonic flow meters

Tertiary water flow rates to test units are controlled with PICCV valves providing infinite flow control over designated ranges.

Secondary water flow to heat source wall is regulated through manual STAD balancing valves with master control through PICCV flow control valves.



Building Load Simulation

Fabric heat loads are simulated by 20 individually controlled radiant heating wall panels capable of delivering up to 380W/m^2 of wall surface area (the equivalent of 215W/m^2 of floor area) delivered through circulating hot water and high accuracy water flow control and measurement using ultrasonic flow meters.

Variable Space Loads

Variable space loads such as lighting, people and small equipment loads are simulated through in-ceiling light fixtures and variable current 'Thermal Mannequins' manufactured to the requirements of EN 14240:2004, connected through 'Variac' auto-transformers and Crompton Integra 1530 single-phase power meters accurate to 0.2% of measurement.



Control & Data Acquisition

Total system control and data acquisition is provided by a custom designed 'Automated Logic' BMS system.

Data acquisition includes up to 16 test space data points plus up to 64 data points for test unit and system measurements

The scenario analysis results are developed by collecting and collating real-time measurements of the HVAC equipment performance, physical environment and thermal comfort levels in the conditioned test space.

System Control, Measurement & Data Acquisition Points

Available System Measurement & Data Acquisition Points

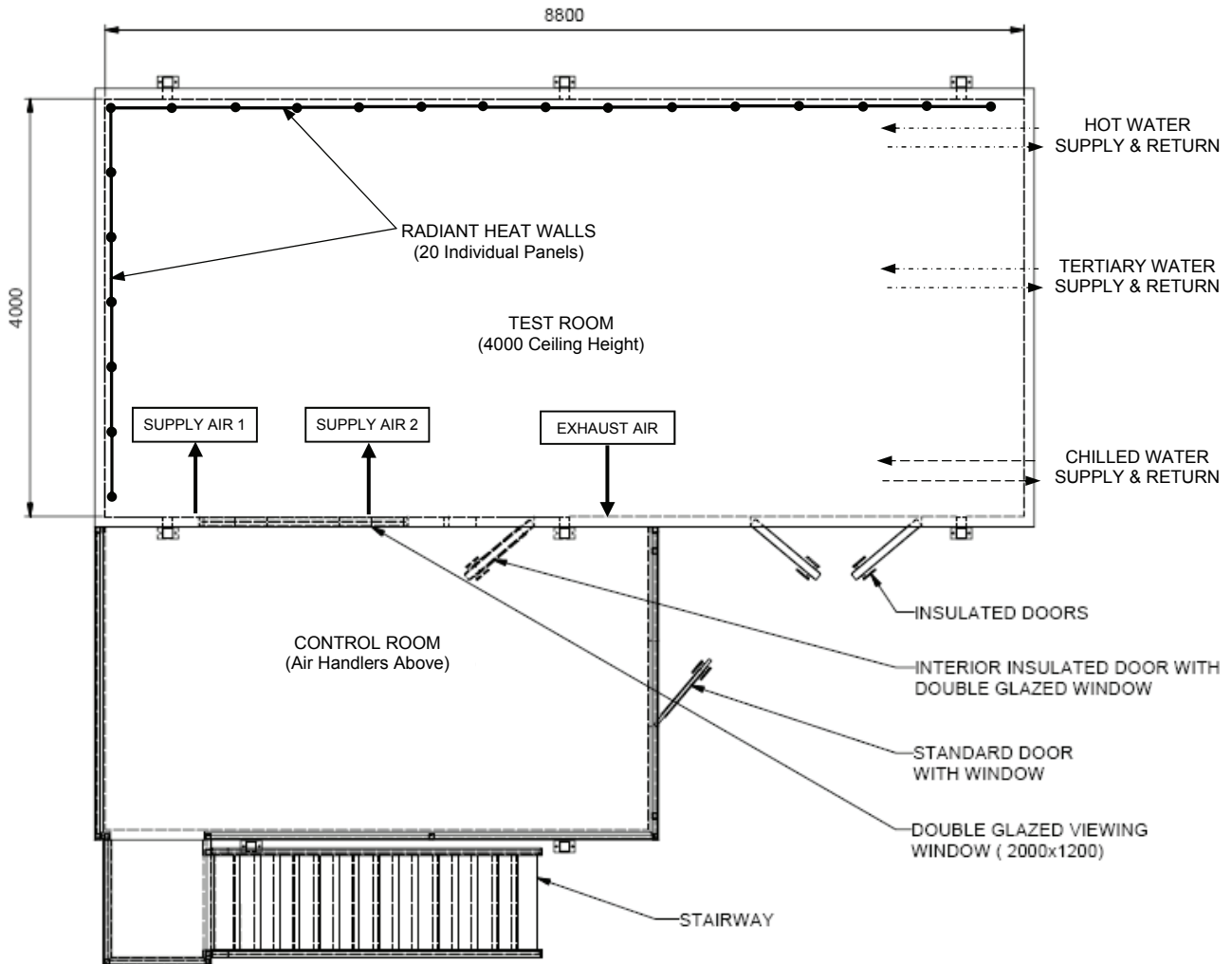
PARAMETER	QUANTITY	PARAMETER	QUANTITY
Primary Chilled Water Supply Temperature	2	Ambient Air Temperature	1
Primary Chilled Water Return Temperature	1	Lab Test Space Wall Internal Temperature	1
Heat Source Wall Water Supply Temperature	2	Test Units Entering Air Temperature	4
Heat Source Wall Water Return Temperature	2	Test Units Entering Air Humidity	4
Heat Source Wall Water Flow Rate	1	Test Units Supply Air Temperature	4
Primary Air Supply (in duct) Temperature	2	Test Units Supply Air Humidity	4
Primary Air Supply (in duct) Humidity	2	Test Units Condensate Sensor	4
Primary Air Supply (in duct) Velocity Grid	2	Test Unit Plenum Static Pressure	4
Return Air (in duct) Temperature	1	Test Unit Spare Dry Bulb Measurements	6
Return Air (in duct) Humidity	1	Test Space Average Air Temperature	2
Return Air (in duct) Air Velocity Grid	2	Test Space Average Air Humidity	1
Average Ceiling Space Temperature	1	Test Space Dry Bulb Temperature	4
Average Ceiling Space Humidity	1	Test Space Radiant (Globe) Temperature	4
Tertiary (Test Units) Water Supply Temperature	4	Test Space Air Speed (Velocity)	4
Tertiary (Test Units) Water Return Temperature	4	Thermal Mannequin Power Meter	2
Test Units Tertiary Water Flow Rate	1	Test Space Lighting Power Meter	1

System Control Functions

PARAMETER	METHOD
Primary Chilled Water Temperature	Chiller
Primary Hot Water Temperature	Boiler
Heat Source Wall Water Temperature	Mixing Valve
Heat Source Wall Water Balancing (20)	STAD Valve
Heat Source Wall Water Flow Control (3)	PICCV Valve
Tertiary (Test Units) Water Temperature	Mixing Valve
Tertiary (Test Units) Water Flow Control (8)	PICCV Valves
Primary Air (in duct) Temperature	PAHU
Primary Air Flow Rate (PAHU-1)	Variac
Primary Air Flow Rate (PAHU-2)	Variac
PAHU Water Hot & Cold Water Control	PICCV Valves
Hot & Cold Water Changeover Control	I/O Valves
Thermal Mannequin 1 Voltage Control	Variac
Thermal Mannequin 2 Voltage Control	Variac
Primary Chilled Water Circulation	Pump
Primary Hot Water Circulation	Pump
Heat Source Wall Circulation	Pump
Tertiary (Test Units) Water Circulation	Pump



Physical Dimensions



PLAN VIEW

On-site equipment and instrumentation includes:

EQUIPMENT / INSTRUMENT	PARAMETER
Screened PRT Pt100 Sensors	Test Space Air Dry Bulb Temperatures
Globe PRT Pt100 Sensors	Radiant Temperature
Hygrotransmitter	Test Space Air Relative Humidity
TSI 8475 Velocity Sensors	Omni-directional Test Space Air Speed
DataTaker 16-Channel	Test Space Data Acquisition
BA/10K Probe Sensors	Equipment Air Dry Bulb & Water Temperatures
BA/10K 'Combo' Duct Sensors	Supply & Return Air Temperature and Humidity
Pressure Differential Transducers	Measurement/Display of Air Static Pressure
Ultrasonic Flow Meters	Water Mass Flow Rate
3-Phase Chiller, Boiler & Pumps	Water Temperature Control & Circulation
Hydronic Radiant Heat Walls	Imposed Vertical Heat Load Simulation
'Thermal Mannequins'	Test Space Variable Heat Load Simulation
'Variac' Auto Transformers	Variable AC current control for electrical loads
1-Phase Digital Power Meters	Data Capture of Electrical Circuit Input Power
Automated Logic BMS	System Control and Data Acquisition

Scenario Analysis

Controlled environment analysis of the project design can provide:

- Ability to verify the design
- Validate product thermal performance
- Confidence in evaluating the system
- Answer 'What If' scenarios
- Experience thermal comfort
- Validate IEQ comfort expressions
- Visualization of the installation and air movement in the conditioned space
- Trial design concepts
- Test commissioning settings

For assistance in employing scenario analysis in projects, contact:

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