Airedale Overview
ASHRAE seminar – 12th March 2016

Introduction:
Asim Ansari  Export Manager
Andrew Walker  Regional Manager – Middle East

To provide integrated thermal management solutions, differentiated through innovation and service
Who Are We?

40 years experience
Design to delivery
3kW to 2.0MW

Global provider of efficient cooling solutions
A Pioneer in free-cooling technology

Largest UK manufacturer of IT cooling solutions
An industry leader in rack level cooling
Our clients – Middle East
With a Strong Global Presence

50,000+ applications since 1974

1,500+ last year
Building HVAC Products:

- Commercial Heating
- Commercial Air Conditioning
- Commercial Ventilation
- Data Centre Cooling
- Air Handling Units
- Geothermal
Data Centre Solutions

Footprint and Density

Uptime

Operational Costs

Efficiency

Capital Costs
Data Centre Solutions

- **SmartCool™ & EasiCool™**
  - 6-233kW

- **OnRak™**
  - 3-35kW

- **InRak™**
  - 10-63kW

- **Condensers/Dry Coolers**
  - 12-174kW

- **AireFlow™ AHUs**
  - 100-300kW

- **Free-cooling Chillers**
  - 20kW-1.8MW

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Data Centre Solutions

ACIS™
Integrated
Controls Solutions

AireFlow™
AHUs
100-300kW

SmartCool™ & EasiCool™
Dry Coolers
6-233kW
12-174kW

OnRak™
Condensers/
Free-cooling
3-35kW
10-63kW

InRak™
AHUs
12-174kW
100-300kW

Condensers/
Free-cooling
20kW-1.8MW

www.airedale.com
Product Overview

To provide integrated thermal management solutions, differentiated through innovation and service
Precision Air Conditioning

SmartCool™
11 – 233kW

To provide integrated thermal management solutions, differentiated through innovation and service
Dedicated CW Range

• Up to 30% more cooling kW/m²
  – Benchmarked with similar products
• 15% more cooling
  – From previous generation
• Extensive Range
  – 42 models, 12 case sizes (W 600mm – 3500mm)
• Optimised coil areas
  – Improved air path and control
  – V-block and slab coil arrangement
• Three power supplies as standard

DX Range (up to 6 stages of cooling / i-drive)

• Up to 17% more cooling kW/m²
  – Compared with previous generation units
• Up to 46% energy savings
  – Free-cooling dual cool variant
• Up to 88% saving in power input
  – Utilising hot gas re-heat option
• Single or dual circuit
  – Dual cool with free-cooling option
  – DX air cooled (16–137kW)
  – DX water cooled (60–137kW)
- Suction riser (split units only)
- Liquid receiver
- Electrode Humidifier
- Isolator panel located in centre of unit (door interlocked)
- Tandem compressors on both circuits
- Removable fans
- Fixed control panel
- Filters on coil to reduce airside pressure drop
- Evaporator coil
- Airflow
Unique Fan Removal
System Configurations – 2X20

- 2 x DX circuits (100% or 50+50%)
  - 2 x Compressors on each circuit (tandem)
System Configurations – 2X2C

- 1 x CW circuit (100%)
- 2 x DX circuits (100%)
  - 2 x Compressors on each circuit
Key Features and Options

- EC backward curved fans as **standard** on every case size
  - Highly efficient **composite** EBM Radical fan
- EEVs as **standard**
- Larger surface area filters in metal casing (**low airside pressure drop**)
Key Features and Options

• **True 2N** redundancy on dual fluid units
• **Tandem compressors** offering **4 stages of DX cooling**
• Compliant Copeland scroll compressors
  – **Increased reliability**
  – **Extended operating envelope** up to +36°C return air temp (model dependant)
• 2 port regulating valves (**low waterside pressure drop**)
Precision Air Conditioning

EasiCool™
6 – 64kW

To provide integrated thermal management solutions, differentiated through innovation and service
EasiCool™ features

- Up to 37% increase in EER and 8% more cooling kW/m²
  - Compared with previous generation units
- EC fans
  - Up to 70% more efficient at part-load than AC equivalents
- Up to 62% saving in power input
  - Utilising hot gas re-heat option
- Optimised free-cooling
- Extensive range
  - 374 models, 6 case sizes
  - Width from 670mm to 2170mm
  - Upflow & downflow options
- Single circuit
  - DX air cooled
    - (6–64kW)
  - DX water cooled
    - (6-64kW)
  - Chilled Water

- Dual fluid option available
- Two refrigerants
  - R410A (EZRE)
  - R407C (EZE)
- Full function
  - Cooling, heating & dehumidification
  - Cooling only
- Three power supplies as standard
  - 400V - 50Hz (-0)
  - 380V - 60Hz (-1)
  - 220V - 60Hz (-2)
Precision Air Conditioning

AireTile™
0.74 – 1.2m³/s

To provide integrated thermal management solutions, differentiated through innovation and service
Data centre air flow management system

- Flow rate between 0.74 – 1.2m³/s
- Targeted air flow for high density servers
  - Removes hotspots
  - Improves efficiency of aisle containment systems

- Installation
  - Installed in the floor void directly in front of the server
  - 250mm x 595mm x 595mm (h x w x l)
  - 380mm x 595mm x 595mm (h x w x l)

- Four model types
  - Two fan types – low air flow EC fan (<0.74m³/s) or high air flow EC fan (1.2m³/s)

- High efficiency
  - Optimised design
  - Active air distribution
  - EC axial fans

- Flexibility
  - Ideal pre or retrofit solution
  - Two power supplies as standard: -0 (230V/1Ph/50Hz), -1 (220V/1Ph/60Hz)
  - Units can be standalone or networked (up to 64 units)
  - Multiple controls options
  - Static transfer switch (option)

- Resilience
  - Highly configurable to suit all data centres and load requirements
  - Integrated heavy duty floor grilles

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Precision Air Conditioning

Ecotel™
5 - 19kW

To provide integrated thermal management solutions, differentiated through innovation and service
Cabinets cooling solution for applications such as TELECOMS or NETWORK RAIL

- 5 models from 5 to 19kW
- Scroll compressors and Backward curved centrifugal fans
- 100% free-cooling only mode
- Up to 70% energy saving with free-cooling mode
- Single or dual system offer up to three stages of cooling
- Self-contained outdoor cabin cooler
- Emergency 48v DC cooling option
- Low noise emissions

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Precision Air Conditioning

LogiCool InRak
10 - 67kW

To provide integrated thermal management solutions, differentiated through innovation and service
Efficient in-row cooling solution for high density data centre applications

- Directs air horizontally to the front of the server racks
- Delivers complete confidence
  - *Built-in resilience and excellent efficiencies*
- Industry-leading cooling for its footprint
- Ultimate in scalable solutions for modern data centre
- EER up to 90.3
  - *CW, n+1*
- Designed and optimised for R410A
- Optimised free-cooling

- n+1 fan configuration
  - *Increased efficiency*
  - *Improved uptime*
- Aisle pressure control
  - *Air distribution management*
  - *Hot aisle containment and*
  - *Cold aisle containment*
  - *Open architecture*
- Pco5 Carel controller as standard
  - *Automatic transfer switch (option)*
  - *Controller back-up*
- Hot swappable fans
  - *Ease of maintenance*
  - *Fan assembly can be replaced while unit is running*
Precision Air Conditioning

LogiCool OnRak
3 - 35kW

To provide integrated thermal management solutions, differentiated through innovation and service
High density slim line rear door heat exchanger

- Delivers targeted cooling for high density racks
  - Temperature neutral
  - Easy to install, service and maintain
  - Can be supplied with integrated rack or adapted to fit a customer-specific rack (42-47U)

- Chilled water cooling – up to 35kW

- Optional redundancy features
  - n+1 fan configuration
  - UPS
  - Dual power supply

- EER
  - 104 (n)
  - 174 (n+1)

- Two configurations:
  - n (100% air volume)
  - n+1 (75% air volume)

- Performance:
  - 35kW (n)
  - 26.8kW (n+1)

- High efficiency
  - Optimised design
  - EC axial fans

- Resilient design with redundancy
  - n+1 fan redundancy
  - Hot swappable fans
  - Easily removable control panel
  - UPS (option)
  - Static transfer switch (option)

- Cooling features
  - Flexible connections
  - Constant flow control
  - Pressure differential management
  - Condensate management with water detection
  - Bleed and drain valves
  - Isolating solenoid valves (optional)
  - Fully EMC compliant
Airedale International Air Conditioning

Thank You

Andrew Walker  
Regional Manager – Middle East

To provide integrated thermal management solutions, differentiated through innovation and service
Inverter Technology and Aisle Containment

A Technical Overview

George Hannah - Technical Director – Airedale International Air Conditioning
SmartCool™ i-drive
5 - 83kW
• High efficiency, cost effective, DX, variable capacity PAC cooling product
  – Capable of supply air temperature control (+18°C to +26°C)
  – Suitable for high outdoor ambient temperatures (up to +50°C)
  – Suitable for pipe runs of 100m equivalent length
  – Uses high efficiency R410A refrigerant

  – 900 – 1800 mm case sizes (5 – 83kW)
  – DX air cooled, downflow only
  – 400V 3ph 50Hz or 380V 3ph 60Hz
### Case Size

<table>
<thead>
<tr>
<th>Width (mm)*</th>
<th>SV09</th>
<th>SV12</th>
<th>SV15</th>
<th>SV18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>900</td>
<td>1200</td>
<td>1500</td>
<td>1800</td>
</tr>
</tbody>
</table>

**11 units available in 4 case sizes**

All units are 890mm deep and 1980mm tall.
Standard Options and Features

Standard Features

• Performance Enhancing Features
  – New inverter driven compressors
  – Inverter drives
  – EEVs
  – Control to Absolute Humidity (g/kg)
  – Engineering Unit Conversion in software
  – Magnetic discharge non return valves
  – pCO5+ microprocessor technology
  – EC backward curved centrifugal ‘plug’ fans with composite impellers and profiled aerofoil blades

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Standard Features

- Safety/Reliability Features
  - Suction line strainer
  - Vibration eliminators
  - Door interlocked isolator switch
  - Oil separator
Standard Options and Features

Standard Features

• Aesthetic Features
  – PGD1 display
  – Aluminium extruded frame
  – Available in RAL 7021 and RAL 7035
  – Unobtrusive hinges
  – Corner Gussets
Optional Features

- Dual power supply
- Constant air volume control
- Constant air pressure control
- Enclosed Floorstands
- Power monitoring
- Compressor soft start (for fixed speed model)
- Refrigerant leak detection
- PGD1 audible/PGD Touch Display 4.3”
- Open, front and rear discharging floorstands
- Airflow independent dehumidification
## Capacity Ranges

### Gross Sensible Capacity (kW)

<table>
<thead>
<tr>
<th>SV Range</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV09</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Data at 24°C, 50% RH air on, 45°C condensing
- Low minimum turndown (16% of maximum capacity)
- Peak System EER Points
- High maximum capacity
Allows precise supply air temperature control

Avoids high starting current when cycling on/off

Allows overspeeding to achieve high capacities

Allows the compressor to operate near the edge of the envelope rather than shutting down

Allows quiet operation at lower compressor speeds
✓ HIGH return air temperatures (up to +40°C)
✓ Increased efficiency in supply temperature control scenario vs. fixed speed unit
✓ LONG pipe runs (up to 100m equivalent length)
✓ CAREFUL PIPEWORK DESIGN REQUIRED
✓ HIGH air side efficiency – Low fan power
✓ WIDE outdoor ambient envelope (-20°C up to +50°C)
✓ Efficient dehumidification - no reheat required
• Highly variable refrigerant flow rate (can be 16% - 100% of full load)

• Proper engineering practice requires a minimum refrigerant velocity to ensure oil return

• This increases system pressure drop – hence impairs system performance

<table>
<thead>
<tr>
<th></th>
<th>Liquid Line</th>
<th>Discharge Line</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Discharge</td>
<td>Velocity (m/s)</td>
<td>Velocity (m/s)</td>
</tr>
<tr>
<td>Horizontal Run</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Vertical Run</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Liquid refrigerant carries oil effectively even at low velocities

No minimum velocity required for the liquid line

These thresholds MUST be adhered to at all times

Pressure drops should not exceed this maximum, however:

This is only a guideline – Maintaining refrigerant velocity takes precedent

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– Long vertical pipe runs present another problem
  • Refrigerant velocity must be higher to overcome gravity
  • Hence line sizes must be smaller
  • This further increases pressure drop
  • Oil traps also required

– For long vertical rises, the use of a double riser system is recommended
- Double risers are designed to deal with 2 situations

- Situation 2 - High Flow Rate
  - High velocity causes a large pressure drop through smaller pipe
  - Large pressure differential forces oil out of trap
  - Refrigerant flows through both pipes
  - Velocity decreases
  - Pressure drop decreases
Guidelines for Installers

• Pipe sizes in technical literature **MUST** be used

• Pipework installation details in literature **MUST** be rigorously followed
  – Gradients / slopes on horizontal lines
  – Location of oil traps on risers
  – Max equivalent lengths (100m)

• Systems with long vertical rises – Airedale recommends a **double riser system**
Trikon – Airedale Pipe Sizing Program

We can recommend pipe sizes for you (recommendations only)
Increasing Temperature = Increasing Opportunity

High Temperature Operation - Problem or Opportunity?
“The second law states that spontaneous natural processes increase entropy overall, or in another formulation that heat can spontaneously be conducted or radiated only from a higher-temperature region to a lower-temperature region, but not the other way around.”
Increasing Temperature = Increasing Opportunity

ROOM = 20 - 27°C

Increasing Opportunity

RACK = 28 - 47°C

Increasing Opportunity

CPU = 60 - 100°C
Server Technology Development

Discharge Air – Increasing Temperature

- 28 °C
- 35 °C
- 47 °C

Capacity – Increasing Density

- 2kW
- 8kW
- 31kW
“TC 9.9 obtained informal consensus from the major commercial IT equipment manufacturers for both recommended” and “allowable” temperature and humidity ranges and for four environmental classes,…..”

Table 3. 2011 and 2008 Thermal Guideline Comparisons

<table>
<thead>
<tr>
<th>2011 classes</th>
<th>2008 classes</th>
<th>Applications</th>
<th>IT Equipment</th>
<th>Environmental Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1</td>
<td></td>
<td>Enterprise servers, storage products</td>
<td>Tightly controlled</td>
</tr>
<tr>
<td>A2</td>
<td>2</td>
<td>Datacenter</td>
<td>Volume servers, storage products, personal computers, workstations</td>
<td>Some control</td>
</tr>
<tr>
<td>A3</td>
<td>NA</td>
<td></td>
<td>Volume servers, storage products, personal computers, workstations</td>
<td>Some control</td>
</tr>
<tr>
<td>A4</td>
<td>NA</td>
<td></td>
<td>Volume servers, storage products, personal computers, workstations</td>
<td>Some control</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>Office, home, transportable environment, etc.</td>
<td>Personal computers, workstations, laptops, and printers</td>
<td>Minimal control</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>Point-of-sale, industrial, factory, etc.</td>
<td>Point-of-sale equipment, ruggedized controllers, or computers and PDAs</td>
<td>No control</td>
</tr>
</tbody>
</table>
### Equipment Environmental Specifications

<table>
<thead>
<tr>
<th>Classes (a)</th>
<th>Product Operations (b)(c)</th>
<th>Product Power Off (c) (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry-Bulb Temperature (°C)</td>
<td>Humidity Range, non-Condensing (h) (i)</td>
</tr>
<tr>
<td>A1 to A4</td>
<td>18 to 27</td>
<td>5.5°C DP to 60% RH and 15°C DP</td>
</tr>
</tbody>
</table>

**Recommended** (Applies to all A classes; individual data centers can choose to expand this range based upon the analysis described in this document)

<p>| | | | | | | | | |</p>
<table>
<thead>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>15 to 32</td>
<td>20% to 80% RH</td>
<td>17</td>
<td>3050</td>
<td>5/20</td>
<td>5 to 45</td>
<td>8 to 80</td>
<td>27</td>
</tr>
<tr>
<td>A2</td>
<td>10 to 35</td>
<td>20% to 80% RH</td>
<td>21</td>
<td>3050</td>
<td>5/20</td>
<td>5 to 45</td>
<td>8 to 80</td>
<td>27</td>
</tr>
<tr>
<td>A3</td>
<td>5 to 40</td>
<td>-12°C DP &amp; 8% RH to 85% RH</td>
<td>24</td>
<td>3050</td>
<td>5/20</td>
<td>5 to 45</td>
<td>8 to 85</td>
<td>27</td>
</tr>
<tr>
<td>A4</td>
<td>5 to 45</td>
<td>-12°C DP &amp; 8% RH to 90% RH</td>
<td>24</td>
<td>3050</td>
<td>5/20</td>
<td>5 to 45</td>
<td>8 to 90</td>
<td>27</td>
</tr>
<tr>
<td>B</td>
<td>5 to 35</td>
<td>8% RH to 80% RH</td>
<td>28</td>
<td>3050</td>
<td>NA</td>
<td>5 to 45</td>
<td>8 to 80</td>
<td>29</td>
</tr>
<tr>
<td>C</td>
<td>5 to 40</td>
<td>8% RH to 80% RH</td>
<td>28</td>
<td>3050</td>
<td>NA</td>
<td>5 to 45</td>
<td>8 to 80</td>
<td>29</td>
</tr>
</tbody>
</table>
SmartCool Return Air / Outdoor Ambient Envelope

Return Air Temperature Control

Supply Air Temperature Control

ASHRAE Recommended Envelope

ASHRAE Allowable Envelope

Ambient Temperature (°C)

Return Air Temperature (°C)
High Temperature Operation -
Problem or Opportunity?
Open aisle (500 kW facility)

Temperature (°C)

- 45
- 40
- 35
- 30
- 25
- 20
- 15
- 10
- 5

Total heat load: 5 kW per rack
Total number of cabinets: 100
Cold aisle containment (500 kW facility)

Temperature (°C)

- 45
- 40
- 35
- 30
- 25
- 20
- 15
- 10
- 5

Total heat load: 5 kW per rack
Total number of cabinets: 100
Hot aisle containment (500 kW facility)

Temperature (°C)

Additional IT opportunity = 420kW

Total heat load | 10 kW per rack

Total number of cabinets | 50
Supply Air/Return Air Relationship

Temperature °C

Return Air

Supply Air

Open Aisle

Cold Aisle

Hot Aisle
## Annual Energy Consumption

<table>
<thead>
<tr>
<th></th>
<th>Open Aisle</th>
<th>Hot Aisle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed Speed (SC)</td>
<td>Variable Speed (SV)</td>
</tr>
<tr>
<td>Location</td>
<td>Doha</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>24 hours per day / 7 days per week</td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>26.5kW Base + 26.5kW Variable</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Return Air</td>
<td>Supply Air</td>
</tr>
<tr>
<td>Air Temperature</td>
<td>24°C</td>
<td>N/A</td>
</tr>
<tr>
<td>Air Humidity</td>
<td>45%RH</td>
<td>N/A</td>
</tr>
<tr>
<td>Rated Capacity</td>
<td>54.7kW</td>
<td>N/A</td>
</tr>
</tbody>
</table>
In this case, an energy saving of 18% can be achieved.
Hot aisle containment (500 kW facility)

22% saving on the capital cost of the cooling system

Only 7 units required
The Future

What Comes Next?

George Hannah - Technical Director – Airedale International Air Conditioning
Increasing Opportunity

ROOM = 20 - 27°C

Increasing Opportunity

RACK = 28 - 47°C

CPU = 60 - 100°C
Any Other Questions?