



**Australian Government**

# **MEM23141A Complete a building thermal performance survey**

**Release 1**

# **MEM23141A Complete a building thermal performance survey**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to carry out a detailed heat load estimate for a multiple zone commercial/industrial building and then analyse building thermal performance and document results.

## **Application of the Unit**

The unit applies to technicians in heating, ventilation and air conditioning (HVAC) manufacturing, servicing and maintenance enterprises who are required to conduct a building performance survey in order to inform the design and specification of HVAC equipment and system/s for a multiple zone commercial/industrial building, including consideration of improvements to building design.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit of competency.

## **Pre-Requisites**

|           |                                                          |
|-----------|----------------------------------------------------------|
| MEM23004A | Apply technical mathematics                              |
| MEM23006A | Apply fluid and thermodynamics principles in engineering |
| MEM23142A | Determine psychrometric processes and system performance |

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                                                       |     |                                                                                                                                                                  |
|---|-----------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Estimate heat load for a multiple zone commercial/industrial building | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area                                                           |
|   |                                                                       | 1.2 | Determine extent of the performance survey from work sheets, drawings, building specifications or other documentation and discussions with appropriate personnel |
|   |                                                                       | 1.3 | Determine sources of heat gains                                                                                                                                  |
|   |                                                                       | 1.4 | Coordinate work effectively with all team members                                                                                                                |
|   |                                                                       | 1.5 | Obtain and check resources and equipment required for the performance survey                                                                                     |
| 2 | Analyse the air conditioning heat and cooling load                    | 2.1 | Complete room sensible and latent heat estimates of a multiple zone building                                                                                     |
|   |                                                                       | 2.2 | Identify peak effective room latent, and sensible and latent heat loads over time of day and year for each zone                                                  |
|   |                                                                       | 2.3 | Determine the thermal performance of the building using simulation software                                                                                      |
| 3 | Investigate building design improvement options                       | 3.1 | Analyse alternative building design improvement options with respect to the effect on thermal performance using simulation software                              |
|   |                                                                       | 3.2 | Identify unacceptable high thermal loads on the building using check figures and industry standards                                                              |

- 3.3 Prepare recommendations for changes in building design/treatment to eliminate unacceptably high thermal loads
  - 3.4 Document and recommend improvements of thermal performance of the building to appropriate personnel
  - 3.5 Consult as required on unexpected situations and take appropriate action
- 4 Specify system design
  - 4.1 Determine equipment size, including coil and air handling unit capacities for constant and variable volume systems, and central refrigeration and boiler capacities based on the recommendations
  - 4.2 Document the completed survey with all recommendations, building design improvements/treatments, and appropriate system design specifications according to enterprise procedures
  - 4.3 Prepare a formal survey report in consultation with appropriate personnel and enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- sourcing appropriate drawings, documentation and specifications for buildings
- interpreting building design information for sources of heat gains
- computing standard thermal values in relation to a commercial/industrial building
- computing internal and system heat gains
- using American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook or similar Australian data books to determine design data
- using suitable computer software to determine equipment size for constant and variable volume systems and central refrigeration and boiler capacities
- communicate effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- heat gains in buildings
- heat transfer theory
- thermal properties of building materials, including materials designed to promote thermal conductivity or insulation
- heat transfer in buildings, including effects of:
  - ambient conditions
  - materials and equipment
  - windows and films
  - design effects, including external design, room and door design, and sun position calculations
- building heat flow, losses and gains, including:
  - convection
  - radiation
  - conduction
  - heat paths
- building heat loss and gain calculations

- thermal properties of buildings, including losses
- people loads
- cost implications of air conditioning and heating designs
- heat loads calculations, including lighting and equipment
- thermal lag
- relevant legislation and codes of practice
- energy efficiency and sustainability

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

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|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b> | <p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate essential knowledge and skills to complete a building thermal performance survey</li> <li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• carry out a building survey and load estimate for a multiple zone commercial building</li> <li>• complete a building thermal performance survey for different buildings. This must include:               <ul style="list-style-type: none"> <li>• minimum five (5) zones</li> <li>• internal and system heat gains</li> <li>• infiltration and fresh air rates</li> <li>• heat flow through windows accounting for internal and external shading</li> <li>• heat flows through building fabric</li> <li>• use of simulation software.</li> </ul> </li> </ul> |
| <b>Context of and specific resources for assessment</b>                                             | <ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | not disadvantage the candidate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Method of assessment</b>                | <ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul> |
| <b>Guidance information for assessment</b> | Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

|                                   |                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>WHS requirements</b>           | <p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul> |
| <b>Environmental requirements</b> | Environmental requirements include:                                                                                                                                                                                                                                                                             |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>                                          |
| <b>Appropriate personnel</b>   | <p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>                                                                                                                                                                                                                |
| <b>Heat gains</b>              | <p>Heat gains may include:</p> <ul style="list-style-type: none"> <li>• external</li> <li>• internal</li> <li>• system</li> <li>• U values and infiltration rates for various wall/roof constructions</li> <li>• measure sun azimuth and altitude angles, and overall shade factors for various windows</li> </ul>                                                                                                                                                                                                                |
| <b>Resources and equipment</b> | <p>Resources and equipment may include:</p> <ul style="list-style-type: none"> <li>• computer workstation</li> <li>• appropriate simulation and reporting software</li> <li>• reference manuals and charts</li> <li>• appropriate measurement equipment</li> <li>• building codes and codes of conduct</li> <li>• access to legislative and regulatory requirements</li> <li>• technical library</li> <li>• stationery</li> <li>• scientific calculator</li> <li>• appropriate tools of trade, equipment and materials</li> </ul> |

|                              |                                                                                                                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Industry standards</b>    | Industry standards include: <ul style="list-style-type: none"><li>• AS 1668 Parts 1 &amp; 2. The use of Mechanical Ventilation and Air Conditioning in Buildings</li><li>• EU Guidelines on ventilation</li><li>• ASHRAE 62-89 Ventilation standard</li><li>• AUBRCC or Building Code of Australia (BCA)</li></ul> |
| <b>Enterprise procedures</b> | Enterprise procedures may include: <ul style="list-style-type: none"><li>• use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• site operational procedures</li></ul>        |

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.