

Overview

This Unit covers the competences required to inspect simple / packaged air conditioning systems as defined by the CIBSE TM 44 Figure 1.1: Summary of system types and their component parts. The competences would generally be applied where cooling is provided in conditioned spaces using indoor units that contain refrigerant to air heat exchangers and an integral air circulation fan. These may be either integral with outdoor units that contain the refrigerant compressor, refrigerant to outdoor air heat exchanger or circulation fan including distribution ductwork, or connected to the outdoor unit by refrigerant pipework.

Such systems include:

1. Unitary packaged systems
2. Split packaged systems
3. Multi-split packaged systems
4. Variable refrigerant flow (VRF) systems

The aim of the inspection is to assess the efficiency and sizing of the system compared to the cooling requirements of the building. In turn, this will enable the production of a report, which advises clients on issues that affect energy efficiency and the use of installed air conditioning systems, and suggest potential improvements.

The unit is about reviewing existing information relating to the air conditioning system, its maintenance and energy consumption. It is also about ensuring that the client understands that which is 'essential', that which is 'desirable' and that which is 'optional', and taking appropriate action where information is not forthcoming, is incomplete or inaccurate. You are expected to use existing information to identify any significant factors that may influence the conduct of the inspection e.g. access issues, the need to inspect a sample of system components, the need to start up or shut-down the system.

The unit also covers the competences required to conduct a thorough inspection of simple / packaged air conditioning systems including the visual inspection of all relevant aspects of the air conditioning system in accordance with the requirements set out within 'CIBSE TM 44: Inspection of air conditioning systems' which is consistent with the principles for the inspection of air conditioning systems set out in BS EN 15240: 'Ventilation for buildings. Energy performance of buildings. Guidelines for inspection of air conditioning systems', and EN 15240: 'Inspection of air conditioning systems'

You must carry out any specific, non-invasive and non-hazardous techniques that have been included within the agreed scope of works e.g. the use of a

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smoke pencil to observe air flow and use of temperature probes to test temperature and collect the information required to determine the energy performance of the system including methods of measuring evaporator and condenser efficiency.

This element also requires extensive knowledge and understanding of, for example, the design intent of the installed air conditioning system, the definitions and conventions embodied in 'CIBSE TM 44: Inspection of air conditioning system', and the factors relevant to determining the energy performance of air conditioning systems. The unit also covers the production of complete and accurate records of findings using appropriate methods and ensuring that records are legible and complete.

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Performance criteria

Review and record information relating to the energy performance of simple /packaged air conditioning systems

You must be able to:

- P1 identify essential, desirable and optional information including asset register of refrigeration plant
- P2 review available information and identify that which is relevant to the energy performance of the air conditioning system
- P3 review the installed equipment, controls, building fabric and layout
- P4 identify variations from any drawings, documents and records and evaluate any impact they may have on energy performance
- P5 review the relevant site information and identify any significant factors that may influence the conduct of the energy assessment
- P6 locate the equipment and assemble a minimum portfolio of relevant documentation if documentation is insufficient ie asset register
- P7 record where there is evidence of regular inspection and maintenance
- P8 record and comment on the frequencies and scope of maintenance to the air conditioning equipment and systems
- P9 compare system sizes with likely loads
- P10 inform the client(s) promptly in cases where your investigations reveal problems that prevent you from assessing the energy performance of the air conditioning system

Locate and inspect the condition of outdoor units

You must be able to:

- P11 note the general state of the equipment and the space immediately around them checking particularly for signs of oil/refrigerant leakage
- P12 check that the heat exchanger surfaces are free from debris
- P13 check for adequate airflow to and from the equipment and the potential for warmed air from outdoor unit(s) to be drawn into the building
- P14 check and record the temperature of refrigerant vapour entering the compressor to ensure it is in line with design conditions
- P15 check for warm air recirculation degrading outdoor unit efficiency

Locate and inspect the condition and operation of indoor units within treated areas

You must be able to:

- P16 assess the condition of heat exchangers for damage and /or blockages
- P17 check the presence and condition of air filters and filter changing and cleaning frequency for compliance with manufacturers' requirements
- P18 check facilities manager's complaints log for evidence of complaints clearly and unambiguously linked to ventilation problems
- P19 check and record temperature across fan coil unit to ensure it is in line with design conditions

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Locate and examine the controls responsible for the operation of the cooling units, the heating system controls and their associated temperature sensors

You must be able to:

- P20 assess appropriateness of positioning of cooling sensors in relation to factors such as local levels of internal gain, orientation, windows and draughts, exposure to solar radiation and seasonal differences
- P21 observe any control timers and note the current indicated weekday and time of day against the actual time
- P22 note the set times of on and off periods and whether manually overridden
- P23 assess the suitability of the timers and the suitability of the set periods in use
- P24 determine the set temperatures in each zone for heating and cooling
- P25 assess the suitability of the set temperatures in relation to the layout, activities and occupancy of the zones and spaces in relation to the manager's intent and in relation to each other
- P26 note the means of inhibiting the simultaneous operation of the heating and cooling equipment in the same location
- P27 note control arrangements for cooling units installed in spaces with opening windows and whether any physical (interlock) or administrative (staff instructions) are in place to prevent it
- P28 determine the type and age of the cooling units and the method of cooling capacity control from rating plate or documentary records
- P29 assess the likely efficiency compared to good current practice based on observations, checking the equipment rating plate(s) and where appropriate making physical measurements of performance to:
 - P29.1 estimate current cooling loads against appropriate optimum cooling loads for a typical building of the type being inspected
 - P29.2 establish the optimum size of the cooling system
 - P29.3 identify special cooling measures for specific areas
 - P29.4 assess cooling capacity using equipment rating plates and performance data available from manufacturers and online databases based on size and likely age of the equipment
 - P29.5 establish the ventilation rate in terms of volume of air being circulated through the building and prescribed ventilation rates in regulatory documentation and professional guidance
 - P29.6 determine airflow rates provided by fans in relation to ventilation requirements of the building and fan duties available from building logbooks, operational and maintenance manuals and rating plates and the total power required by supply and extract fans
 - P29.7 establish the specific fan power of the supply and extract installation from available information compared to recommended levels in guidance documents

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Conduct the inspection following best practice

You must be able to:

- P30 identify yourself to those present at the property before commencing the inspection
- P31 ensure that you have the equipment and resources needed for the inspection
- P32 use test equipment according to manufacturers' instructions
- P33 identify any circumstances when at the property that prevent you continuing with the inspection and explain the reasons to the client
- P34 carry out any specific, non-invasive and non-hazardous techniques that have been included within the agreed scope of works
- P35 make accurate observations and measurements which are necessary to provide data for assessment of the energy performance of the air conditioning system
- P36 make further investigations where observations are inconsistent with existing evidence and expected findings
- P37 draw the client's attention to obvious instances of inadequate maintenance or neglect, particularly where these might have implications for the health and safety of occupants or the public

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Knowledge and understanding

You need to know and understand:

- K1 the principles and theory of how an applicable air conditioning system works
- K2 the components and controls of air conditioning systems and their interrelationship
- K3 the design intent of the specific installed air conditioning system, and the impact of any changes in building usage over time on the air conditioning system installed
- K4 how to identify the type, features and location of the air conditioning system(s) present at the property
- K5 the design and operation of unitary packaged, split packaged, multi-split packaged and variable refrigerant flow (VRF) air conditioning systems
- K6 how to check that system settings are within appropriate limits set by manufacturers' data and design intent
- K7 how to read and interpret building drawings
- K8 factors affecting air conditioning systems efficiency in terms of:
 - K8.1 the inherent inefficiency of the system
 - K8.2 its state of maintenance
 - K8.3 its effective control
 - K8.4 the types of refrigerants and their global warming potential (GWP) and total equivalent warming impact (TEWI)
 - K8.5 the potential impact of the phasing out of ozone depleting refrigerants including the types of refrigerants and their global warming potential (GWP) and total equivalent warming impact (TEWI)
 - K8.6 the range of information that may be available relating to the air conditioning
- K9 system installed, its maintenance and energy consumption including:
 - K9.1 the design intent of the system installed
 - K9.2 the type, features including refrigerant type and location of the system installed
 - K9.3 the size of the area served by the system
 - K9.4 method of controlling temperature
 - K9.5 method of controlling periods of operation
 - K9.6 maintenance records relating to the system
- K10 energy consumption of the system where available
- K11 what information is essential, desirable and optional to the pre-inspection review
- K12 the action to take in cases where the information is not forthcoming, is incomplete or is inaccurate including:
 - K12.1 explaining to the client the consequences of inadequate information
 - K12.2 requesting information from other sources preparing 'essential'

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- information as part of the inspection procedure
- K13 how to review available information in order to identify that which is relevant to the energy performance of the air conditioning system)how to review available information in order to identify any significant factors that may influence the energy assessment including:
 - K13.1 concerns about information (e.g. missing, incomplete, out of date, inaccurate)
 - K13.2 health and safety considerations
 - K13.3 access issues
 - K13.4 the need to inspect a sample of system components (e.g. fan-coil units)
 - K13.5 the need to shut-down the system
 - K14 how to identify circumstances that prevent you from assessing the energy performance of the air conditioning system including:
 - K14.1 the discovery of unexpected or hazardous conditions or materials other potential threats to health and safety
 - K14.2 how to identify refrigerant leakage and the requirement to notify the responsible person immediately
 - K15 the definition of non-invasive techniques and associated safety precautions including risk assessment
 - K16 what equipment and resources are needed for the inspection
 - K17 how to carry out any specific, non-invasive and non-hazardous techniques included within the agreed scope of works
 - K18 how to make further investigations where observations are inconsistent with existing evidence and expected findings, and how to identify the causes of these inconsistencies
 - K19 the requirements and application of relevant regulations, standards and guidance that apply to the assessment of the energy performance of air conditioning systems
 - K20 how to identify potential risk areas in waterborne cooling systems where Legionella may be present and how to take precautionary action to protect yourself and others
 - K21 how to collate information required to assess the energy performance of air conditioning systems
 - K22 the types of advice that can be provided to clients during inspection
 - K23 the sources of information and advice about energy performance to which clients can be referred

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