MECHANICAL DESIGN AND INSTALL HVAC CHECKLIST

INTRODUCTION

This TECHnote provides a checklist intended to assist the architect or building designer in the assessment of proposals for the design and installation of HVAC systems.

NATSPEC *0702 Mechanical design and install* is applicable to simple mechanical installations in which the specification will be prepared by the architect or building designer and the mechanical design will be undertaken by the contractor without the involvement of a specialist mechanical consultant. Obtain the advice of a qualified mechanical engineer if you are concerned about the adequacy of the information provided in the submission or the proposed system.

UNDERSIZING OF PLANT

A common cause of occupant dissatisfaction with air conditioning systems is the under sizing of plant. Manufacturers may also exclude undersized plant from warranty coverage. Under sizing may be intentional, when a tenderer seeks a competitive advantage, or the result of technical incompetence, particularly errors in cooling load calculation and equipment selection.

Providing correctly sized plant is the most important step towards achieving a satisfactory outcome.

SUBMISSIONS

The *0702 Mechanical design and install* **SUBMISSIONS** clause requires the contractor to submit information on the method used to calculate loads and select equipment, before starting work. This submission needs to be evaluated by the specifier.

Making a submission does not relieve the contractor of the responsibility for complying with the specification, particularly in relation to correctly sizing the plant and zoning the systems.

The following checklist addresses common shortcomings in contractor designed installations so that timely action can be taken, or inadequate proposals rejected.

CHECKLIST

System

- Is there a drawing of the proposed duct, pipe and equipment layout and does it show the proposed zoning?
- Does the zoning reflect the distribution of cooling loads? For example, there should be separate zones for:
  - Each face of the building (typically 3 to 4 m deep).
  - High heat load rooms like conference and computer rooms.

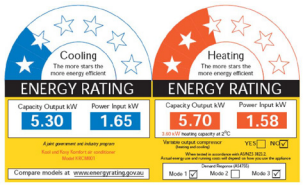
Rooms on the corners of buildings require particular attention. Normally buildings are zoned based on the direction the exterior wall faces. In the case of rooms on corners this presents difficulties as one face may require cooling while the other needs heating. For example, at 11 am on a spring day, an office on a south-east corner may require cooling due to its east face but if supplied by the south zone may receive heating.

Are fire provisions adequate? For example, if the space includes or is bounded by a firewall, how will compliance with codes be handled with regards to penetrations?

- Are the proposed plant locations adequate? In particular:
  - Is access for inspection and maintenance adequate and safe?
  - Can plant be removed?
  - Is equipment hot air likely to be short-circuited?

- Is it likely to cause noise or vibration problems? Design of noise barriers is, generally, the responsibility of the architect/designer.

- Does the method of heating agree with the specification: Is it primarily or fully reverse cycle? It should be. If there is electric heating, it should be < 20% of the total heating load.



Relevant website

www.energyrating.gov.au

This federal government website provides information on Minimum Energy Performance Standards (MEPS) requirements for single phase and 3-phase air conditioners to 65 kW cooling capacity.

Relevant documents

NATSPEC TECHnote DES 041 *Using design and install services worksections*

Relevant worksection

0702 Mechanical design and install

MECHANICAL DESIGN AND INSTALL HVAC CHECKLIST

Plant capacity

- Have the *Total* and *Sensible cooling capacities* and *Heating capacity* of the proposed equipment been provided?
- Are the capacities adjusted for the specified outdoor and indoor conditions? They should indicate they are at an Air On or Air Entering condition; for cooling typically about 1°C above the specified room conditions. They should not be at the standard rating conditions of 27°C dry bulb, 19°C wet bulb.
- Are there any other adjustments e.g. for recirculated condenser air? If there are, should the design be amended to eliminate them, e.g. by relocating plant to prevent condenser air short-circuiting?
- Is the *Sensible capacity* of the equipment greater than the calculated *Sensible load*? It is essential that this is correct, or the plant will not maintain temperature adequately. If the *Sensible capacity* is correct, the *Total capacity* will usually exceed the calculated *Total load,* but this should be checked also.
- Is there a statement of assumptions on which calculations are based? Are they reasonable?
- Are there any departures from the documentation? Are they reasonable or will they adversely affect performance or operation of the installation? Look for qualifications relating to:
  - Assumed heat loads, particularly if expressed as W/m^2.
  - Exclusions relating to ventilation systems, e.g. assuming that natural ventilation will be adequate.
  - Things to be provided or done by the principal.
  - Limitations on warranty or maintenance.
  - Changes to duration of warranty period.
  - Exclusions from maintenance.

Cooling and heating loads

- Are the outside design conditions, corresponding geographic location and source of data stated?
- Does the location used for outside design conditions have a similar climate to that of the site?
- Is the name of the calculation method stated and is it one of the documented methods? Calculations from other methods may be little better than guesses and should be rejected.

Subcontractor

- Are the licence numbers and type of licences provided for persons who will be responsible for the installation? If split systems are to be provided, are the licences of the correct type for installation of refrigeration systems?
- What provision has the mechanical contractor made for attending to breakdowns?

Equipment

- Have the makes and model numbers of proposed equipment been provided?
- Is the air conditioning plant manufactured by a well-known company with an established dealer and service network available at the site?
- Is the equipment tested and certified to Air-Conditioning and Refrigeration Equipment Association (AREMA) requirements? Literature should bear the triangular AREMA logo. If it does not, can you be sure it will achieve the manufacturer's claimed performance?

Ventilation systems

- Have proposed ventilation systems been identified?
- Do they avoid known sources of heat, fumes, dust etc?
- If systems have been omitted, will they be treated as variations to the contract?

DEFINITIONS

There are three fundamental terms used in relation to air conditioning plant capacity:

- ***Sensible capacity***: The cooling effect you can sense (feel). It is the capacity of the plant to reduce temperature in the air conditioned space.
- ***Latent capacity***: The ability of the plant to remove moisture from the air. The system need only have enough capacity to reduce relative humidity to a comfortable level, say 60%. Provided the room temperature is correct, greater *Latent capacity* will not increase comfort but the plant will cost more to operate.
- ***Total capacity***: The sum of the *Sensible capacity* and the *Latent capacity.*

Sensible load, Latent load and *Total load* are corresponding terms relating to the amount of cooling required as opposed to the plant's capacity to provide it. For a typical office, the *Sensible load* will be in the order of 80% to 90% of the *Total load*. It is essential that the *Sensible capacity* of the air conditioning plant be at least equal to the calculated *Sensible load.* Most packaged air conditioning equipment of the type supplied on contractor designed projects will produce more *Latent cooling capacity* than is needed.