

**UEE07 Electrotechnology
Training Package**

UEENEEJ007B

**Install refrigeration and air
conditioning systems, major
components and associated
equipment**

Learner Workbook

Version 1

**Training and Education Support
Industry Skills Unit
Meadowbank**



Product Code: 5243

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Introduction

1. General introduction

Welcome to 'UEENEEJ007B Install refrigeration and air conditioning systems, major components and associated equipment'.

This national unit of competence is part of the UEE07 Electrotechnology Industry Training Package.

2. Using this learner guide

This learner workbook may be used on its own, or it may be used as additional material to support the development of knowledge and skills required to achieve this unit of competence.

Group learning

If you are studying this unit of competency as part of a group of learners your teacher will guide you in how to use these materials, including which learning topics and activities should be completed.

Learning strategies

This learner workbook contains a variety of different learning activities to support the skills required to achieve this unit of competency. In addition to the activities described in this workbook, it is important that you discuss the issues raised with others such as your colleagues, friends, practitioners working in the field and other learners. Discussion plays an important role in understanding and remembering new information.

To promote active learning:

- 1 Come up with your own answers first, **before you attempt any readings**
- 2 Compare and discuss your answers with others.
- 3 Research the topic and access readings, videos, etc.
- 4 Ask yourself, 'What do I think about the subject material now that I have studied it in depth? What have I learned?'

The learner workbook is designed for you to work at your own pace and at a time convenient for you. It also allows you to self-direct and control your learning.

There may be some tutorials, practical sessions or workshops which you are required to attend. If this is required you will be notified of the times and dates of these activities at the commencement of the unit.

You also have access to tutorial support. This is an additional support service that can help you with time management, study skills, editing of your work, organisation and even literacy skills. It is important for you to contact your facilitator and ask for this support if you require it. Normally this service is accessed at your nearest TAFE College.

You may also need to access resources at a TAFE college or library. These resources may include computer facilities and software, books, library material and videos. The resources are listed under the 'resources' heading for this unit and references to these resources are made at the relevant sections of the workbook.

When working through the material there may be reference to legislation or regulations. Over time legislation and regulations may change. It is important that you access the most current version. Refer to your facilitator if you are unsure.

Four steps to learn new skills

This learner workbook is based on four main learning activities.

1. **Thinking** – Reflecting on the subject, your own experience and ideas, and what you hope to achieve from this learning process. Reflective thinking prepares you to learn new skills.
2. **Attending** – Reading the contents of this workbook carefully, with understanding. This may involve asking questions, rewriting material in your own words, discussing the material with other people, or reading additional reference materials. Attending provides you with the information you need to carry out a new skill.
3. **Doing** – Putting new skills into practice. This may involve following specific activities or assessment tasks in this workbook, or putting the new skill directly into practice in your workplace. Using new information in a practical way will help you to remember and understand.
4. **Reviewing** – Did the new skill achieve what you expected to achieve? Seek feedback from your workplace supervisor, teacher, clients or colleagues. Ask more questions if you need to. Complete the review activities in this workbook. When you have achieved competency, keep a record of your completed tasks as evidence of your skill.

Section 1 Fans and air distribution

Topics

- **Fans**
 - ⇒ Functions
 - ⇒ Types
 - ⇒ Operation
 - ⇒ Applications
- **Air distribution**
 - ⇒ Introduction
 - ⇒ Ducting types
 - ⇒ Components and control devices
 - ⇒ Duct sizing methods
- **Air flow**
 - ⇒ Measurement
 - ⇒ Adjustment – air balancing
- **Air filtration**
 - ⇒ Functions
 - ⇒ Types
 - ⇒ Operation
 - ⇒ Applications

Fans

Functions

In any refrigeration or air conditioning system a medium is required to be cooled (or heated) to allow heat energy to be transferred to the refrigerant. The most common medium used is air. To enable this to occur, air needs to move over the heat exchanger. Some (smaller) systems simply rely on natural convection but most use fans to move the air.

Fans work simply by creating a pressure difference between the inlet and the outlet which causes air movement.

There are a variety of fan types used in the refrigeration and air conditioning industry used for a mixture of different requirements, such as:

- Moving air across an evaporator coil
- Moving air across a condenser coil
- Circulating air through ducting
- Exhausting air from a space
- Supplying air into a space.

The type of fan chosen for a particular application will greatly depend upon the type of system (supply, exhaust, etc.) and the actual installation (restraints, access, available power supply and location, etc.).

Types

In most refrigeration or air conditioning system fan types may be one of the following three (3) types:

1. Propeller fans
2. Axial fans
3. Centrifugal fans.

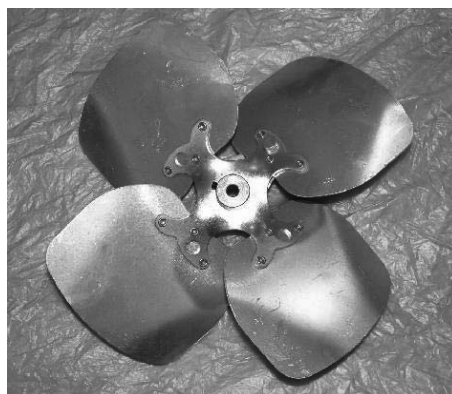
Not all of the above fans are able to be used for the same type of application. Some fans are capable of moving large volumes of air but against relatively low resistance whilst other can move against significantly high resistance.

Note: Resistance is considered to be the amount of 'static pressure' (Pascals – Pa) a fan is able to work against. Noise is also a factor in the type of fan used for an application.

The following discusses the features of the fans listed above, suitable applications and the installation requirements for each.

Propeller fans

These fan types are the simplest fan type in design and operation.



They consist of a 'boss' or 'hub' with a number of paddles attached. The diameter of propeller fans can be up to 500 mm. The pitch (angle) the paddles are set at determines the amount of air these fans are able to move. Can be made from a steel hub with aluminium paddles attached, completely pressed in one piece from steel or aluminium or even from plastic.

Although they are capable of moving reasonable volume amounts of air, they are only capable of doing so against a relatively small amount of static pressure – up to a maximum of 100 Pa.

Essentially, propeller fans are not designed to be connected to ducting. The resistance or static pressure is too high. They are essentially designed to move air from 'one side of the fan to the other'.

Ideal applications for them are:

- Condenser fans
- Evaporator fans (induced or forced draught coolers)
- Residential and light commercial exhaust fans (window and ceiling).

Activity 1



Activity

Using a supplier's catalogue (such as Actrol Parts or Heatcraft), research the different 'pitch' angles propeller fan blades are available in.

When installing propeller fans, care should be taken that no restrictions or blockages are created that will affect airflow, other than those that a manufacturer has fitted. The least amount of resistance for airflow for these fans will ensure they are working to their maximum efficiency.

Axial fans

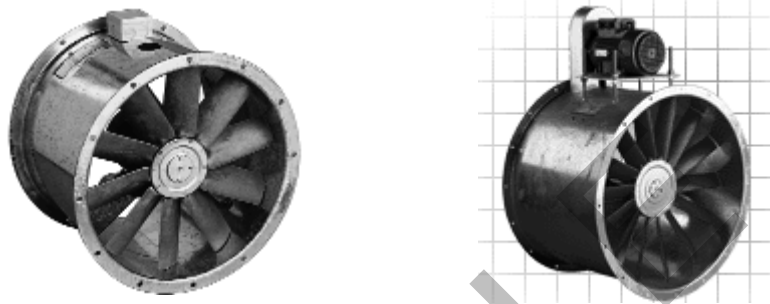
These fan types are similar in design to propeller fans having a centre boss or hub with blades attached. The main difference is in the design of the actual blades. Whilst the blades on propeller fans are shaped like 'paddles', axial fan blades are shaped in a more aerofoil design allowing them to cut through the air more smoothly. The design of the impeller of an axial fan is adjustable allowing blade angles to be adjusted to any required changes.

Axial fans are suitable for moving large quantities of air, although still at relatively low static pressures compared to the air volumes they are capable of moving.

Because of their design, they are ideally installed directly in round or square ducting saving on space. The impeller has adjustable blades which make it possible to adapt the fan to the requirement changes.

Belt driven axial fans are used in situations where it is important that the motor is kept out of the airstream due to high temperature or the corrosive nature of the gases/fumes involved.

Although they efficient in moving air, axial fans can generate higher noise levels than other types. The choice of application s for these fans must be carefully considered. Silencers or attenuators can be installed to minimise the noise.



Common applications for axial fans include:

- Exhaust and supply air systems
- Smoke spill and stair pressurisation
- Carpark exhaust
- Tunnel ventilation.

Centrifugal fans

These fan types are possibly the most widely used fan type in the HVAC (heating ventilation and air conditioning) industry. They are relatively simple in their design and operation.

Centrifugal fans consist of a fan wheel made up of a centre 'hub' with a number of blades mounted around the outside of the hub (see figure below). Air is drawn into the centre of the fan from the side (both sides if fan is double width) and is forced out at 90° due to 'centrifugal force' leaving the fan housing.

