Variable Speed Room Air conditioner

1. Outline of Technology

Room air conditioner, either a window type or a split type, usually consists of an indoor unit for cooling air of an air-conditioned room and an outdoor unit for rejecting heat to the outside ambient (see Figure 1).

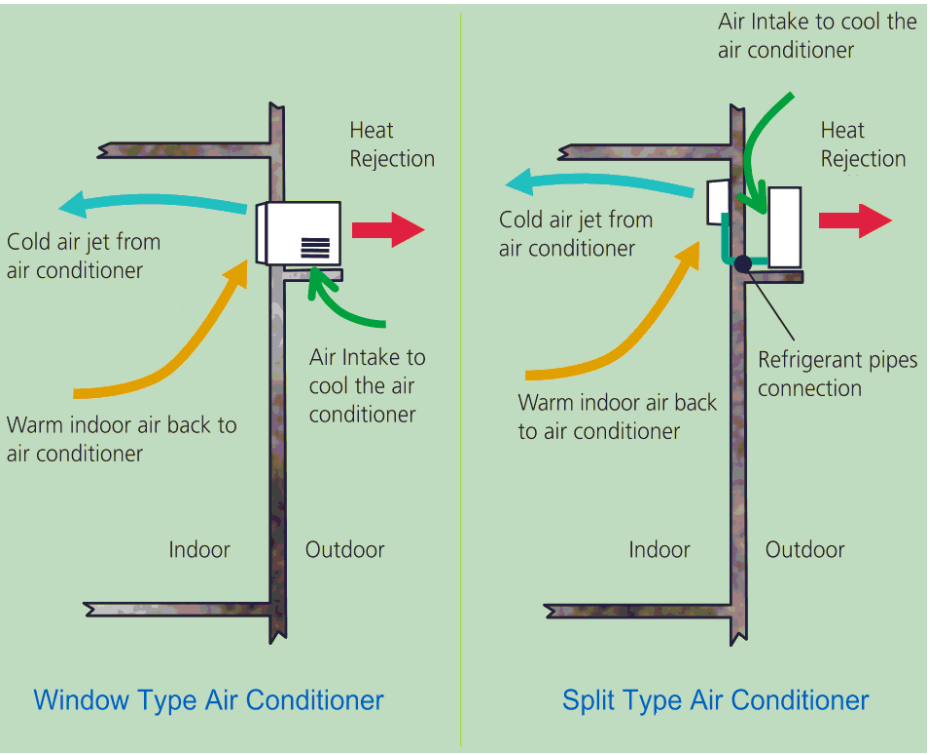

Figure 1 – Window type and split type room air conditioners

In the past, a traditional room air conditioner only has a constant speed compressor motor that either on or off. It switches off the compressor when the temperature set point is reach and on again when the temperature goes above the set point.

Nowadays, more and more variable speed room air conditioners are available in the market as the technology of inverter is more popular and mature. Typically, a variable speed room air conditioner is using a variable speed compressor motor by adopting inverter technology. The inverter inside the room air conditioner changes direct current (DC) to alternating current (AC) and is used to control the speed of the compressor motor so that the refrigerant flow can be regulated. As such, the cooling output of the room air conditioner can be varied to maintain a constant room temperature (see Figure 2).

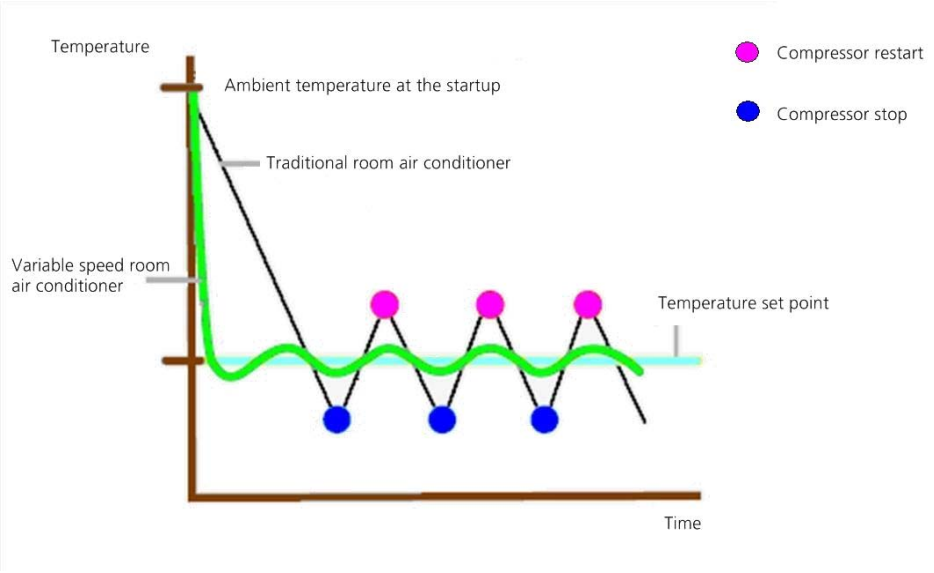

Figure 2 – Temperature fluctuation of variable speed and traditional room air conditioners

2. Comparison on Variable Speed and Traditional Room Air Conditioners

	Variable Speed Room Air Conditioner	Traditional Room Air Conditioner
1	Typically using variable speed compressor by adopting inverter technology and can be operated at part-load mode in response to room temperature.	Typically using constant speed compressor which is operated at on-off mode, i.e., cycling at either no load or full load in response to room temperature.
2	Consume less power**	Consume more power
3	Quicker to reach temperature set point	Slower to reach temperature set point
4	Less temperature fluctuation	Large temperature fluctuation
5	Outdoor unit is usually bigger in size due to accommodation of inverter unit. When compressor is running at part load, the outdoor unit has lower operating noise.	Outdoor unit is usually smaller
6	Commonly available in split type room air conditioner in view of larger space to accommodate inverter.	Available in both window type and split type room air conditioner

** Several variable speed room air conditioners with rated cooling capacity of ranging

from 5kW to 6kW were tested [1]. Test results indicated that the average SEER [2] is 4.85. When the feature of variable speed is disabled, the average SEER is only 2.95. This shows the energy saving potential of variable speed room air conditioner in practical operation over a period of time with full-load and part-load operating conditions. The estimated saving in annual energy consumption is up to 30% in summer months depending on actual operation.

For information, at the end of 2013, there are about 200 models of variable speed room air conditioners in the local market covered by the Mandatory Energy Efficiency Labelling Scheme (MEELS) [3].

Notes

1. The methodology for measurement of cooling capacity and energy consumption is based on the international standard ISO 5151:2010 – Non-ducted air conditioners and heat pumps – Testing and rating for performance.
2. Seasonal Energy Efficiency Ratio (SEER) is the total cooling output during a typical cooling season divided by the total energy consumption during the same period. SEER is calculated based on international standard ISO 16358-1:2013 Air-cooled air conditioners and air-to-air heat pumps – Testing and calculating methods for seasonal performance factors – Part 1: Cooling seasonal performance factor.
3. Homepage of the Mandatory Energy Efficiency Labelling Scheme (MEELS) http://www.energylabel.emsd.gov.hk/en/households/select.html.