



Request for Research
on Refrigeration System Design

- 1- The dimensions of Green Apple cold store are 12 m long (facing North), 8.4 m wide and 6 m high. The ambient air is 40 °C at 50% RH, The internal air is 3°C at 95% RH. The walls, roof and floor are all insulated with 80 mm polyurethane with a U value of 0.32 W/m².K. The soil temperature is 10°C. There are 20,000 kg of Green Apples arriving each day at a temperature of 20 °C and a specific heat capacity of 3.65 kJ/kg°C. Estimate 6 people working in the store for 6 hours a day they will give off around 270 Watts of heat per hour inside. If we have 16 lamps at 80 W each, running for 6 hours a day. In this cold room evaporator we'll be using 24 fans rated at 350 W each and estimate that they will be running for 18 hours per day. It uses an electric heating element rated at 2.5 kW, it runs for 30 minutes 3 times per day and the estimate that 30 % of all the energy it consumes is just transferred into the cold room. Estimate that there will be 2.5 volume air changes per day due to the door being open, the volume is calculated at 604.8 m³, each cubic meter of new air provides 2.5 kJ/°C, the air outside is 40°C and the air inside is 3°C.

Each Student is requested to Prepare his/her **Conceptual Design Report for the Refrigeration System for this cold Store building** in not more than 10 pages, including the **Refrigeration Cooling Load calculations for the cold store** to keep the specified weight of Green Apple **including the following items, calculations and diagrams/drawings:**

- a) ***Plot*** a schematic drawing for the proposed cold store Layout for Green Apple Storage Process, using the above mentioned orientation to save the refrigeration cooling Load, and ***Indicate*** the locations of each of the used refrigeration system components using vapor compression refrigeration cycle(s), as per ASHARE standard for Refrigeration Cooling Load, Chapter 12.
- b) **Calculate the total refrigeration load for this cold store** and ***List*** in a table the refrigeration cooling Load Components of outside load components and inside Load components listed above for the cold store, **in Tabulated Format.**
- c) ***Design*** and ***Plot*** a schematic diagram for the refrigeration system to be used based on simple vapor compression cycle, and **Select the used refrigerant and Present the cycle on P-h diagram of the selected refrigerant.**
- d) ***Size*** and ***Evaluate*** **all the system components based on your design, P-h presentation and Refrigeration Cooling Load Calculations** performed in the above items, such as Compressor(s) (No. and Capacity) , Indoor Air coolers (Evaporators) (No. and Capacity), Air Cooled Condensers (No. and Capacity), and ***Indicate*** the **number of Refrigeration circuits to be used to carry out the calculated Refrigeration cooling load.**

You are allowed to use CAD files or manual drawings to be attached to your Conceptual Design report for all the above items (from a to d).