Additional Information on the Proposed Methodology

"Installation of Energy-efficient Refrigerators Using Natural Refrigerant at Cold Storage"

1. Setting coefficient of performance (COP) values for reference refrigerator at a room temperature condition of -25 deg. C

(1) Selection of possible type of cooling systems except project cooling system

- Considering the cooling temperature of room temperature condition of -25 deg. C and the cooling capacity, following systems are identified as the possible type of cooling systems if project cooling system is not installed.
  a) HFC dry expansion system (single loop)
  b) NH_3 flooded, pump system (single loop)
  c) HFC/brine system (secondary loop)
  d) NH_3/brine system (secondary loop)

(2) Collection of COP values of the refrigerator for possible type of cooling systems

- For each cooling system identified above, COP values of the refrigerator are collected from manufacturers' catalogues.
- Among all the possible systems, catalogue values for HFC/brine system and NH_3/brine system are not found. However, the COP values for HFC/brine system and NH_3/brine system are always lower than those of single loop system[1] and it is assumed not to affect the conservative identification of reference COP.

[1] Brine system requires lower evaporation temperature of primary refrigerant compared to single loop system since heat exchange from the primary refrigerant to cooling air via brine (secondary refrigerant). For this reason, brine system consumes more energy than single loop system to keep the required temperature therefore, COP value of brine system is always lower than single loop system when primary refrigerant is the same for the both systems.

(3) Determination of the default value of reference COP

- COP values of refrigerators for possible systems at -25 deg. C (room temperature) are plotted in the following figure.

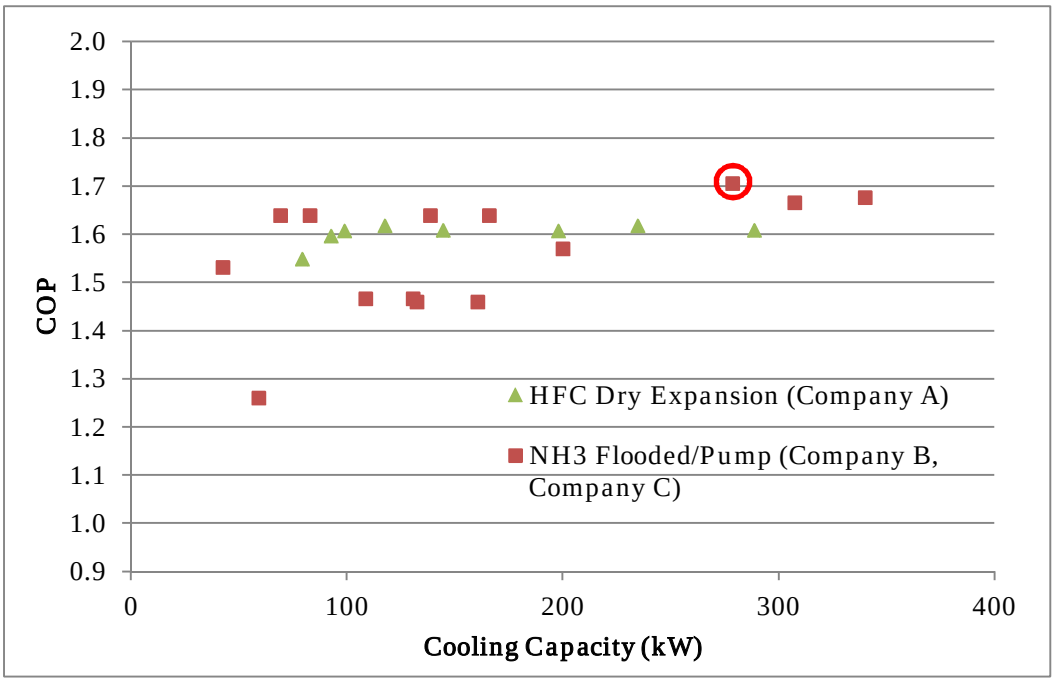


Fig.1 Comparison of COP at room temp. condition of -25 deg. C

- Catalogue COP values are collected from the manufactures with high market share in Myanmar: Company A, Company B and Company C.
- Range of refrigeration capacity found in the manufactures' catalogues is 42.4 to 340 kW.
- The maximum value amongst the obtained data is 1.71.
- The COP value for the reference refrigerator is determined as a default value of 1.71 in a conservative manner, applicable for the refrigerators with capacity up to 340 kW.

2. Setting coefficient of performance (COP) values for reference refrigerator at a room temperature condition of 0 deg. C and 5 deg. C

(1) Selection of possible type of cooling systems except project cooling system

- Considering the cooling temperature of room temperature condition of 0 deg. C and 5 deg. C and the cooling capacity, following system is identified as the possible type of cooling systems if project cooling system is not installed.

  a) HFC dry expansion system (single loop)

(2) Collection of COP values of the refrigerator for possible type of cooling systems

- For each cooling system identified above, COP values of the refrigerator are collected from manufacturers' catalogues.

i) Room temperature condition of 0 deg. C

- COP values of refrigerators for possible systems at 0 deg. C (room temperature) are plotted in the following figure.

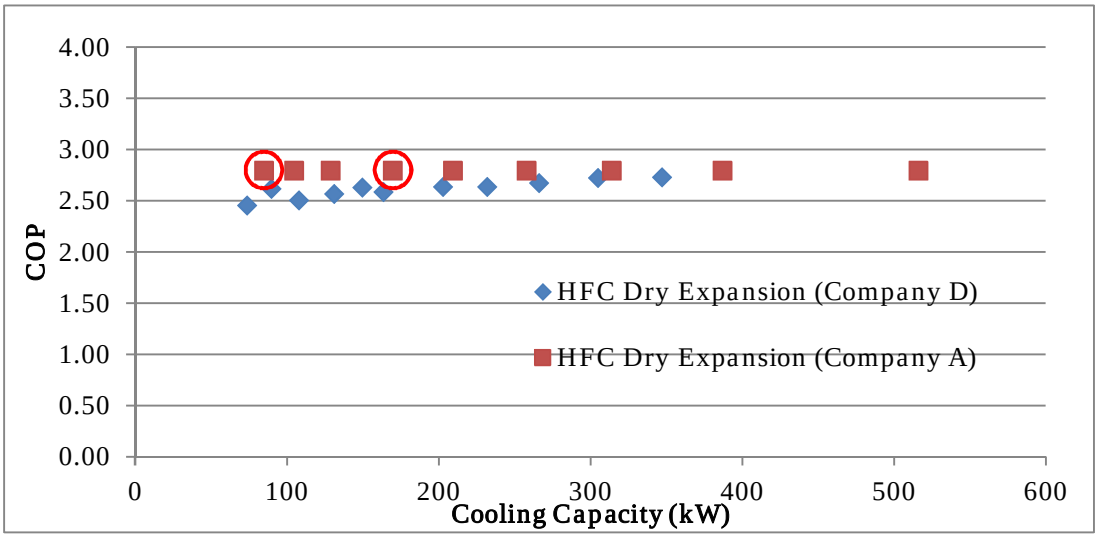


Fig.2 Comparison of COP at room temp. condition of 0 deg. C

- Catalogue COP values are collected from the manufactures with high market share in Myanmar: Company A and Company D.
- Range of refrigeration capacity found in the manufactures' catalogues is 73.6 to 516.4 kW.
- The maximum value amongst the obtained data is 2.788.
- The COP value for the reference refrigerator is determined as a default value of 2.79 in a conservative manner, applicable for the refrigerators with capacity up to 516.4 kW.

ii) Room temperature condition of 5 deg. C

- COP values of refrigerators for possible systems at 5 deg. C (room temperature) are plotted in the following figure.

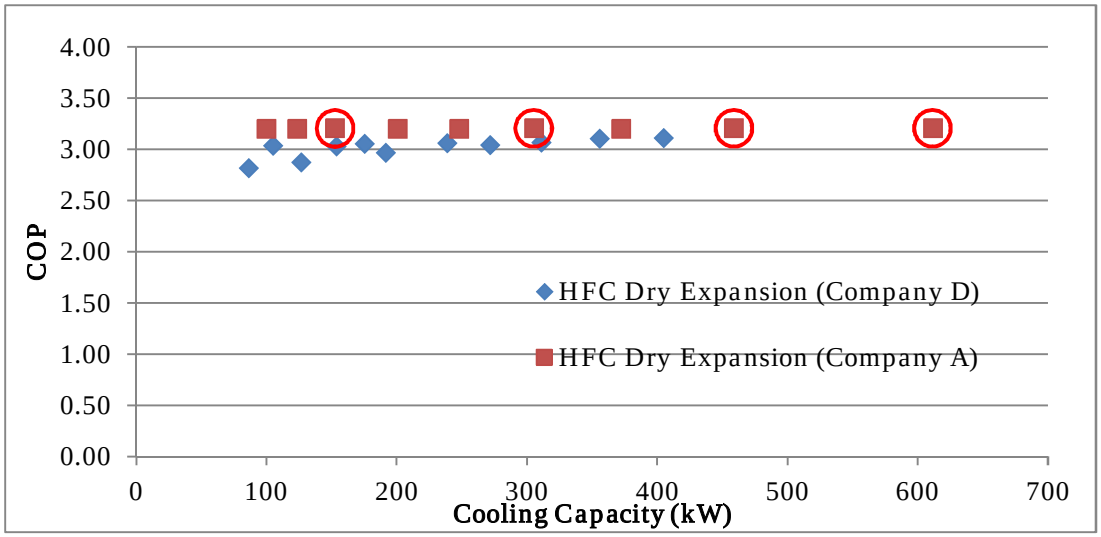
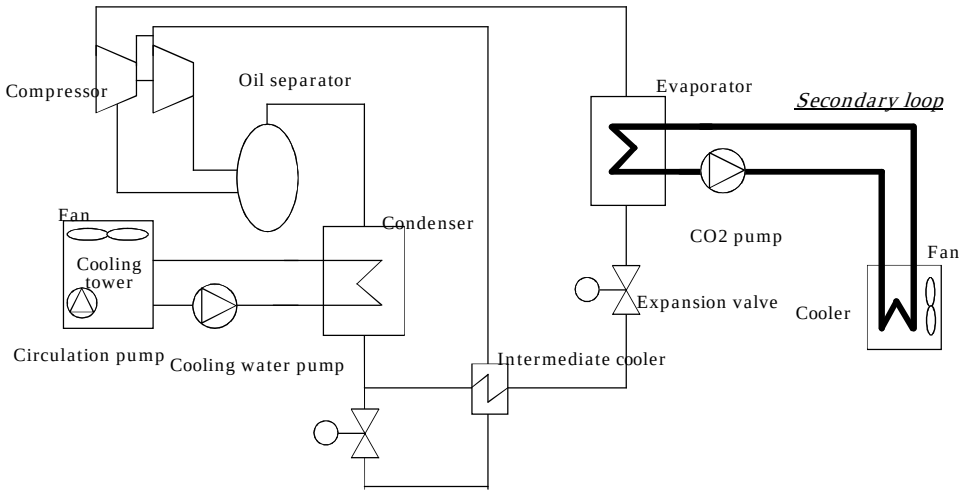


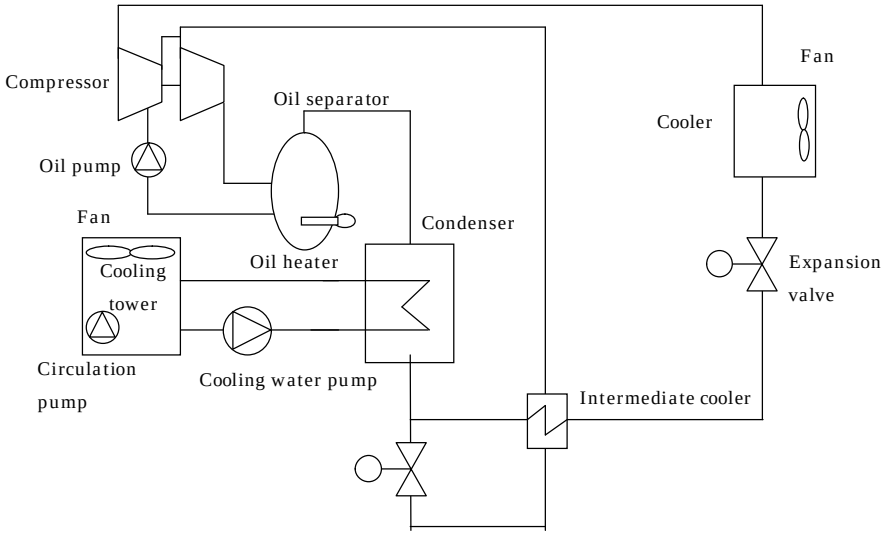
Fig.2 Comparison of COP at room temp. condition of 5 deg. C

- Catalogue COP values are collected from the manufactures with high market share in Myanmar: Company A and Company D.
- Range of refrigeration capacity found in the manufactures' catalogues is 86.2 to 612.6 kW.
- The maximum value amongst the obtained data is 3.197.
- The COP value for the reference refrigerator is determined as a default value of 3.20 in a conservative manner, applicable for the refrigerators with capacity up to 612.6 kW.

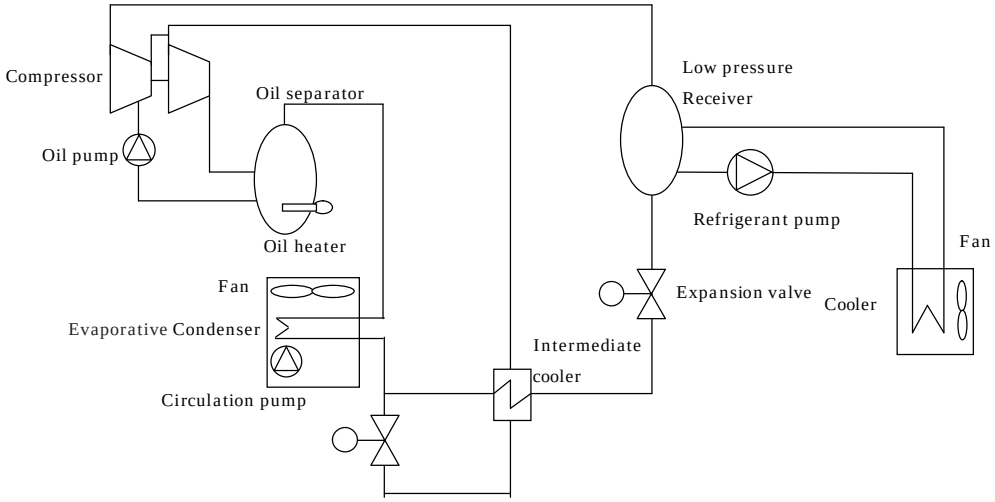
<ANNEX>Schematic diagrams of cooling systems



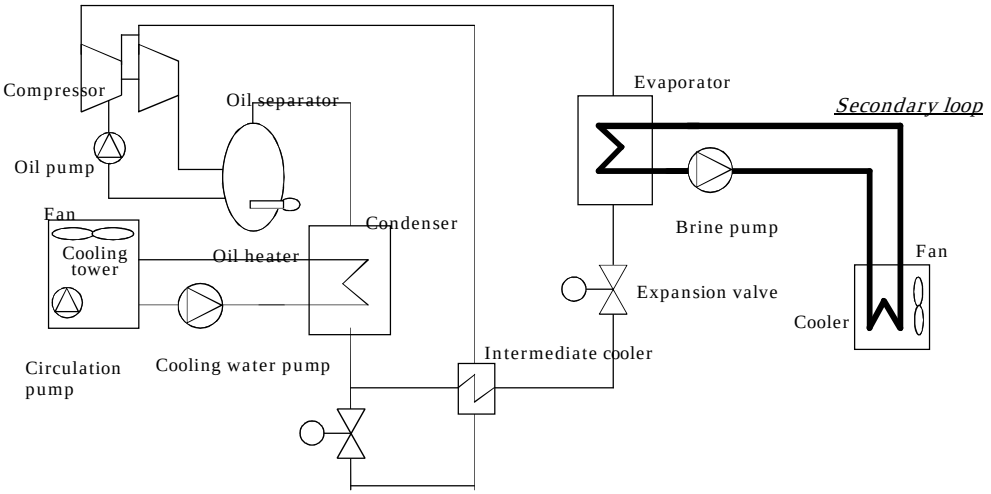
<Project cooling system> NH_3/CO_2 system



HFC dry expansion system



NH_3 flooded, pump system



HFC or NH_3/brine system