

Additional Information on the Proposed Methodology

“Energy Saving by Introduction of High Efficiency Inverter Type Centrifugal Chiller”

1. Market share of chiller manufacturer in Vietnam

In Vietnam, the American manufacturers, such as Company A, Company B, and Company C, occupy high market share in chillers market and Japanese manufacturers, such as Company D has started to gain a certain proportion of share according to the market report¹ and an interview with a technical expert of chillers in Japan.

2. Research on the COP values of chillers in Vietnam

2.1 Catalogue COP values

However the market size of centrifugal chiller is very small at the moment, it is expected that it will expand in Vietnam as its economy grows. It is also expected that the same chiller manufacturers who already have certain market share of other chiller types (e.g. screw chiller) will continue to occupy high market share in centrifugal chiller market in the future. Therefore, catalogue COP values of centrifugal chillers sold by those manufacturers are collected on the web.

In the case of new installation, it is possible to assume that centrifugal type chiller of Company A, Company B, Company C and Company D, are chosen. In this methodology, only centrifugal type chiller of Company B and Company D are suitable. This is because the survey shows that company C probably has a refrigerant that is going to be phased out by Montreal Protocol. Centrifugal chillers of Company A are also excluded since Company A only sells non-inverter type centrifugal chillers in the market while the proposed methodology only covers inverter type centrifugal chiller as a project chiller.

As a result, total 49 COP values of inverter type including 26 from Company B and Company D, are ranging from 250 USRt to 1,500 USRt are obtained.

2.2 Standardized COP* values and determination of the reference COP values

COP values of centrifugal chillers marketed in Vietnam are calculated from values of the 49 catalogue data by manufacturer's testing based on industrial standards² and standardized with the equation as indicated in the proposed methodology. Standardized COP values are plotted in Figure 1 below.

*Standardized COP is calculated based on the same manner stated in Criterion 2 on the proposed

¹ Chapter 2.8.4 Vietnam, BSRIA Global Market Report on Chillers, BSRIA (Building Services Research and Information Association), 2016/11/24

² JIS B 8621:2011 Centrifugal Water Chillers, ANSI/AHRI 550/590-2011: Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle

methodology

It is observed that similar COP values fall into a certain cooling capacity range. Therefore, four cooling capacity ranges are set to determine the reference COP values for each range. The most efficient COP, which has the largest value, in each capacity range is selected as the reference COP and is shown in Table 1 below in red circles.

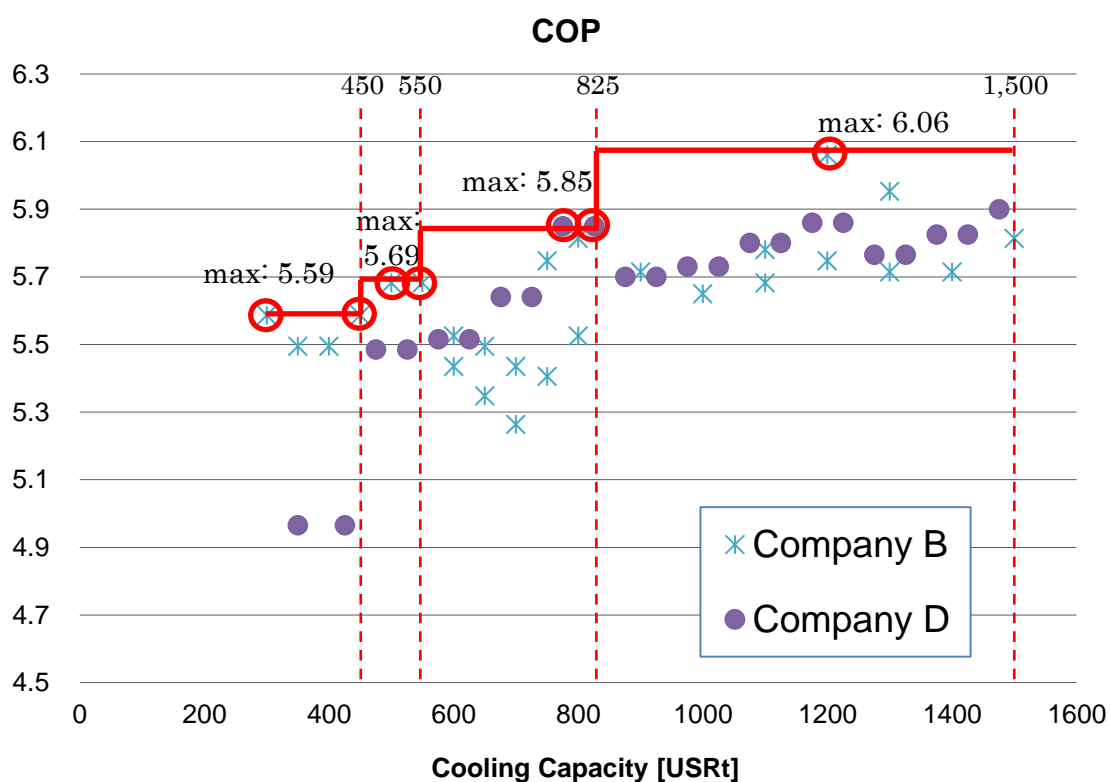


Figure 1: COP values of inverter type centrifugal chiller marketed in Vietnam

The reference COP for each cooling capacity range is determined and shown in Table 1 below. (“x” in the table represents cooling capacity per unit.)

Table 1: Established COP_{RE,i} for the proposed methodology

Cooling capacity per unit (USRt)	300 ≤ x < 450	450 ≤ x < 550	550 ≤ x < 825	825 ≤ x ≤ 1,50
COP _{RE,i}	5.59	5.69	5.85	6.06

*1 USRt = 12,000 BTU/hr = 3.52 kW