STANDARD

**ANSI/ASHRAE Standard 22-2014**
(Supersedes ANSI/ASHRAE Standard 22-2007)

# Methods of Testing for Rating Liquid-Cooled Refrigerant Condensers

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**ASHRAE Standard Project Committee 22**
**Cognizant TC: TC 8.5, Liquid-To-Refrigerant Heat Exchangers**
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### Methods of Testing for Rating Liquid-Cooled Refrigerant Condensers



**NOTE**

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## FOREWORD

*ASHRAE Standard 22 prescribes methods for testing liquid-cooled refrigerant condensers. To attain this objective, the standard lists and defines the terms for rating liquid-cooled refrigerant condensers and establishes testing methods that are to be used as a basis for obtaining ratings of liquid-cooled refrigerant condensers.*

*The major changes made for the 2014 revision in the following:*

- *Title, Purpose, and Scope were updated.*
- *References were updated.*
- *Mandatory language was implemented.*
- *Requirement to use enthalpy for primary test calculation was added.*
- *Requirement for uncertainty analysis was added.*
- *An Informative Appendix for uncertainty calculation was added.*
- *An Informative Appendix for liquid enthalpy calculation was added.*
- *An Informative Appendix for detecting and removing noncondensable gases was added.*

## 1. PURPOSE

This standard prescribes methods of testing the thermal performance and liquid-side pressure drop of liquid-cooled refrigerant condensers.

## 2. SCOPE

This standard applies to the methods of testing for thermodynamic performance rating of liquid-cooled refrigerant condensers that operate at subcritical pressures of the refrigerant.

## 3. DEFINITIONS

***condensing heat rejection ($q_c$):*** the portion of the total heat rejection of a condenser that is used for desuperheating and condensing the entering refrigerant vapor to a saturated liquid. This is the product of the mass rate of refrigerant flow ($w_r$) and the difference between the enthalpy of the entering refrigerant vapor and that of the saturated refrigerant liquid at the leaving pressure.

***liquid-cooled refrigerant condenser:*** a factory-made assembly of elements by which the flows of refrigerant vapor and cooling liquid are maintained in such a heat transfer relationship that the refrigerant vapor is condensed into a liquid.

***subcooling:*** the difference between the bubble point temperature of the refrigerant corresponding to the pressure of the refrigerant leaving the condenser and the measured refrigerant temperature leaving the condenser.

***subcooling heat rejection ($q_s$):*** the total heat rejection minus the condensing heat rejection. This is the product of the mass rate of refrigerant flow ($w_r$) and the difference between the enthalpy of a saturated refrigerant liquid at the pressure of the leaving refrigerant and that of the refrigerant liquid at the actual leaving temperature.

***superheat:*** the difference between the measured refrigerant temperature entering the condenser and the dew-point temperature of the refrigerant corresponding to the pressure of the refrigerant entering the condenser.

***total heat rejection ($q_t$):*** the total useful capacity of a liquid-cooled refrigerant condenser for removing heat from the refrigerant circulated through it. This is the product of the mass rate of refrigerant flow ($w_r$) and the difference of enthalpy of the entering and leaving refrigerant fluid.

***uncertainty:*** an estimated value for the error in a measurement, which may be the result of both systematic and random error.

## 4. REQUIRED TEST RESULTS

**4.1** In expressing test results, the following parameters shall be stated:

a. condensing heat rejection ($q_c$), kW (Btu/h)
b. subcooling heat rejection ($q_s$), kW (Btu/h)
c. total heat rejection ($q_t$), kW (Btu/h)
d. dew-point temperature ($T_c$) of entering refrigerant vapor, °C (°F)
e. temperature of entering refrigerant vapor, °C (°F)
f. temperature of leaving refrigerant liquid, °C (°F)
g. temperature of entering cooling liquid, °C (°F)
h. temperature of leaving cooling liquid, °C (°F)
i. cooling liquid mass flow rate ($w_w$), kg/s (lb/h)
j. cooling liquid pressure drop through condenser, kPa (psi)

**4.2** For all parameters listed in Section 4.1, uncertainty shall be calculated as described in Section 7.4.

## 5. TEST METHODS

### 5.1 Standard Test Methods

**5.1.1** Tests shall consist of a primary measurement and a simultaneous confirming measurement at the conditions specified. The primary and confirming measurements shall be completely independent.

**5.1.2** Specified Conditions

**5.1.2.1** Specified conditions shall include the following:

a. either the total heat rejection, kW (Btu/h) or the dew-point temperature of entering refrigerant vapor, °C (°F)
b. temperature of the entering cooling liquid, °C (°F)
c. cooling liquid mass flow rate, kg/s (lb/h)
d. minimum superheat of entering vapor, °C (°F)
e. minimum and maximum ambient temperature, °C (°F)
f. subcooling, °C (°F), or leaving refrigerant temperature, °C (°F)
g. cooling liquid used
h. refrigerant used
i. maximum allowable uncertainty for the reported condensing heat rejection