

JAPANESE INDUSTRIAL STANDARD

JIS
B 8606-1984Testing of Refrigerant Compressors
ERRATUM

Page	Position	Wrong	Correct
4	Table 1., Division, Others	Others $\pm 0.5\%$	(Delete)
6	Table 3., Heat exchanger type evaporator calorimeter method	Temperature and temperature difference of heating medium between calorimeter inlet and outlet	Temperature and temperature difference of heating medium between calorimeter inlet and outlet ⁽¹⁾
6	cooled condenser method	Cooling water temperature at condenser inlet Cooling water temperature at condenser outlet	cooling water temperature and temperature differences at condenser inlet and outlet ⁽¹⁾
7	Below Table 3.	(Addition)	The accuracy of thermometer in the measurement of temperature differences shall be $\pm 0.1^\circ \text{C}$.
13	Formula of 2.4.5(2)	h_{f2}	h_{f1}

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**Testing of Refrigerant
Compressors**

JIS B 8606—1984

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Japanese Standards Association

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In the event of any doubt arising, the original
standard in Japanese is to be evidence

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Testing of Refrigerant Compressors

B 8606-1984

1. General Rules

1.1 Scope This Japanese Industrial Standard specifies the test method for determination of the refrigerating capacity of displacement type single-stage refrigerating compressors of the closed and semiclosed type, herein-after referred to as the "compressors", by using a refrigerant.

Remarks 1. Unless otherwise specified, the term 'pressure' used in this standard means the absolute pressure.

2. The units and numerical values given in { } in this standard are in accordance with customary system of units and are appended for reference.

1.2 Definitions The main terms used in this standard shall mean as follows:

- (1) displacement type compressor The displacement type compressor shall mean a compressor of the reciprocating type, rotary type, or screw type.
- (2) refrigerating capacity The refrigerating capacity shall mean the value obtained by multiplying the enthalpy difference between the saturated refrigerant liquid at a temperature corresponding to the discharge pressure at the measuring position at the compressor outlet and the suction gas at the measuring position at the compressor inlet by the flow rate of refrigerant per hour.
- (3) stationary state The stationary state shall mean a state in which the values of meter indication are stabilized within the maximum allowable variation ranges shown in Table 2 when meter indications important for the purposes of the test are continuously observed during the time required for the stabilization of those indications before starting the measurement for the test, or during the entire testing time including the said time for stabilization.
- (4) oil circulation ratio The oil circulation ratio shall mean the ratio of the weight (or mass) of the oil to the weight (or mass) of the mixed liquid in the mixed liquid of refrigerant and oil circulating in the fluid circuit during the test.

Applicable Standards:

JIS B 8600-Standard Conditions of Rating Temperature for Refrigerating Compressors

JIS Z 8762-Measurement of Fluid Flow by Means of Orifice Plates and Nozzles

Reference Standard:

ISO 917 Testing of Refrigerant Compressors

1.3 Quantity Symbols and Unit Symbols Used The main quantity symbols, their meanings, and their unit symbols used in this standard shall be as shown below.

Quantity symbol	Meaning	Unit symbol	Reference (Customary unit symbols)
c	Specific heat of liquid	J/kg·K	kcal/kg°C
c_o	Specific heat of oil	J/kg·K	kcal/kg°C
G	Heat leakage coefficient	W/K	kcal/h°C
h_{f1}	Specific enthalpy of saturated refrigerant liquid corresponding to pressure of compressor discharge gas	J/kg	kcal/kg
h_{f2}	Specific enthalpy of refrigerant liquid at expansion valve inlet	J/kg	kcal/kg
h_{f3}	Specific enthalpy of refrigerant liquid at condenser outlet	J/kg	kcal/kg
h_{g1}	Specific enthalpy of refrigerant at compressor inlet	J/kg	kcal/kg
h_{g2}	Specific enthalpy of refrigerant at calorimeter outlet	J/kg	kcal/kg
h_{g3}	Specific enthalpy of refrigerant at condenser inlet	J/kg	kcal/kg
n	Number of revolutions of agitating shaft	Hz	rpm
P	Supply power to heater of calorimeter	W	W
P_i	Supply power to electric motor of agitator	W	W
ΔP_i	Pressure difference of heat medium at calorimeter inlet and outlet	Pa	kg/cm ²
Q	Flow rate of mixed liquid of refrigerant and oil	m ³ /s	m ³ /h
q_{mf}	Mass flow rate of refrigerant	kg/s	kg/h
q_{mi}	Mass flow rate of heating medium or cooling water	kg/s	kg/h
q_{mn}	Mass flow rate of refrigerant measured with nozzle or orifice	kg/s	kg/h
q_{mv}	Mass flow rate of refrigerant passing through branched condenser	kg/s	kg/h
T	Agitating torque	N·m	kgf·m
t_a	Mean ambient temperature	°C	°C
t_c	Mean surface temperature of calorimeter	°C	°C
t_f	Saturated refrigerant temperature corresponding to compressor discharge pressure	°C	°C
t_g	Temperature of refrigerant at compressor inlet	°C	°C
t_p	Saturated refrigerant temperature corresponding to pressure of secondary refrigerant	°C	°C

Quantity symbol	Meaning	Unit symbol	Reference (Customary unit symbols)
t_r	Mean saturated temperature of refrigerant in condenser	°C	°C
t_i	Temperature of heating medium or cooling water at calorimeter inlet	°C	°C
t_o	Temperature of heating medium or cooling water at calorimeter outlet	°C	°C
w	Oil circulation ratio	—	%
η	Efficiency of electric motor	—	—
ρ	Density of liquid refrigerant	kg/m ³	kg/m ³
ρ_i	Density of heating medium	kg/m ³	kg/m ³
ρ_o	Density of oil	kg/m ³	kg/m ³
ϕ_e	Refrigerating capacity of compressor	W	kcal/h
ϕ_h	Heat input to heater of calorimeter	W	kcal/h
ϕ_i	Heat input by agitation	W	kcal/h
ϕ_l	Leakage heat	W	kcal/h

1.4 Kind of Test Methods The test methods shall be as follows:

- (1) Evaporator calorimeter method
- (2) Gas refrigerant flowmeter method
- (3) Liquid refrigerant flowmeter method
- (4) Water cooled condenser method

Each of the refrigerating capacity shall be measured by employing two test methods of (1) to (4) or different test apparatus, under the same operating condition. It is required beforehand to confirm that the difference of the measured refrigerating capacity between them is within $\pm 4\%$.

1.5 Preparation for Test The preparation for the test shall be made as follows:

- (1) The compressor to be tested shall be attached with all the ancillary equipment necessary for normal operation.
- (2) The specified refrigerant and lubricating oil shall be charged in the test apparatus.
- (3) The uncondensed gas in the fluid circuit shall be excluded from the test apparatus, and it shall be confirmed that it is free from leakage of the refrigerant.

1.6 Measuring Devices to Be Used for Testing The following measuring devices shall be used:

- (1) **Measuring Positions** The positions of installing the measuring devices shall be as follows:
- (a) The pressure and temperature at the compressor inlet shall be measured at the same position. The measurement shall be made on the straight part of the pipe 4 or more times of its diameter (at least 150 mm) apart from the suction opening or stop valve of the compressor.
 - (b) The pressure at the compressor outlet shall be measured at a position on the straight part of the pipe 4 or more times of its diameter (at least 150 mm) apart from the discharge opening or stop valve of the compressor.
- (2) **Types and Precisions of Measuring Devices** The precisions of the measuring devices used for the test shall be as specified in Table 1.

Table 1. Precisions of Measuring Devices

Division		Precision
Temperature difference meters		Temperature difference between inlet and outlet of heat medium of calorimeter or cooling water, $\pm 0.1^{\circ}\text{C}$
Thermometers		$\pm 0.3^{\circ}\text{C}$
Pressure gauges		Suction pressure (reading of absolute pressure), $\pm 1.5\%$ Discharge pressure (reading of absolute pressure), $\pm 2.0\%$
Flowmeters		Liquid refrigerant, $\pm 1.0\%$ Gas refrigerant, $\pm 2.0\%$ Others, $\pm 1.0\%$
Time		$\pm 0.1\%$ (elapsed time)
Mass (weight)		$\pm 0.2\%$
Electric instruments	Indicating type	$\pm 0.5\%$
	Integrating type	$\pm 1.0\%$
Others		$\pm 0.5\%$

1.7 Test Conditions The testing cycle shall be set according to the test conditions agreed upon beforehand between the parties concerned with the delivery. The standard conditions of rating temperature shall be as specified in JIS B 8600.

1.8 Operating Conditions The operating conditions shall be as follows:

- (1) There shall not be abnormal air flow around the test apparatus.
- (2) The compressor shall be started and the testing cycle shall be adjusted to the test conditions of 1.7.
- (3) The measurement shall be started after the stationary state shown in Table 2 is reached.
- (4) When the test conditions are changed, the measurement shall be started after the stationary state has been reached under the new conditions.
- (5) To determine the refrigerating capacity under the specified test conditions, measurement shall be made 4 or more times consecutively aiming at the same conditions. The respective measurements shall be made at intervals of 15 to 20 min, and the refrigerating capacity shall be calculated by using the mean value of 4 consecutive readings as the measured value. However, in the case of an automated test apparatus for which it is confirmed that the indicated value of refrigerating capacity during the operation in stationary state falls within $\pm 1\%$ continuously for 1 h, the number of times of measurement may be one.

Table 2. Maximum Allowable Variation in Stationary State

Measuring item	Variation quantity	Allowable value
Supply voltage and frequency	Difference between rated value (value indicated in nameplate) and measured value	$\pm 2\%$
Compressor suction pressure	Difference between saturation pressure corresponding to temperature of test conditions of 1.7 and measured value	$\pm 1\%$ or $\pm 2 \text{ kPa} \{\pm 0.02 \text{ kgf/cm}^2\}$
Temperature of compressor suction gas	Difference between temperature of test conditions of 1.7 and measured value	$\pm 3^\circ\text{C}$
Compressor discharge pressure	Difference between saturation pressure corresponding to temperature of test conditions of 1.7 and measured value	$\pm 1\%$ or $\pm 10 \text{ kPa} \{\pm 0.1 \text{ kgf/cm}^2\}$

Remark: For the allowable values of quantity variations in compressor suction pressure and discharge pressure, either larger value may be used.

1.9 Test Record The recording items required in this test shall be as shown in Table 3.

Table 3. Recording Items

	Recording items		Necessary or unnecessary of record on leakage heat quantity examination
	Date of test, time of beginning, time of termination, test No., name of tester		Necessary
Compressor being tested	Name of manufacturer, type, manufacture number		
Rated test condition	Kind of refrigerant Compressor suction pressure Compressor discharge pressure Compressor suction gas temperature		Necessary
Test condition	Cooling system of compressor Presence or absence of oil cooler Presence or absence of injection Crankcase heater		
Measuring instrument	Name, type, accuracy, dimensions of measuring instrument used		Necessary
Measured values of refrigerating capacity test	Recording items commonly required for all test methods	Time of measurement Ambient temperature, atmospheric pressure Refrigerant pressure at compressor suction opening Refrigerant temperature at compressor suction opening Refrigerant pressure at compressor discharge opening Supply voltage and its frequency Compressor input and its current	Necessary Necessary Necessary
	Evaporator calorimeter method	Common recording items for evaporator calorimeter method	
		Secondary refrigerant calorimeter method	Necessary
		Brine tank type calorimeter method	Necessary
		Heat exchanger type evaporator calorimeter method	Necessary
		Direct heating type calorimeter method	Necessary