

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 916

TESTING OF REFRIGERATING SYSTEMS

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BRIEF HISTORY

The ISO Recommendation R 916, *Testing of refrigerating systems*, was drawn up by Technical Committee ISO/TC 86, *Refrigeration*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this subject was entrusted to Sub-Committee ISO/TC 86/SC3, the Secretariat of which is held by Belgium. The work began in 1960, and was carried out using as a basis for discussion the “Recommendations for an international code for refrigerating machines”*, published in November 1957 by the International Institute of Refrigeration. The work led to the adoption of a Draft ISO Recommendation.

In March 1967, this Draft ISO Recommendation (No. 1153) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Germany	Sweden
Belgium	Greece	Switzerland
Canada	Hungary	U.A.R.
Chile	Italy	United Kingdom
Czechoslovakia	Netherlands	Yugoslavia
Denmark	New Zealand	
France	Poland	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in December 1968, to accept it as an ISO RECOMMENDATION.

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TESTING OF REFRIGERATING SYSTEMS

INTRODUCTION

This ISO Recommendation has for its object the determination of the technical performance of a refrigerating system, but not of the functional duty of a complete installation or of the performance of its individual components.

The term *refrigerating system* implies the conventional vapour compression type consisting of compressing, condensing and evaporating apparatus, together with the interconnecting piping, and the accessories necessary to complete the refrigerant circuit.

The determination of technical performance for other refrigerating systems such as, for example, absorption machines and ejector type machines is not provided for in this ISO Recommendation, but may be dealt with in other ISO Recommendations.

The only tests envisaged are those of complete refrigeration systems operating normally and under steady working conditions (frequency, voltage, water supply, etc.), and where the refrigerant is entirely in a liquid state at entry to the expansion valve.

The direction of the tests should be entrusted only to persons possessing the necessary technical knowledge and experience.

When none of the combined methods given in this ISO Recommendation is practicable or acceptable, it may be possible to restrict the test to a determination of the performance of the compressor only, in accordance with ISO Recommendation R 917, *Testing of refrigerant compressors*.

1. UNITS

Quantity	Symbol	International system (SI) units	Usual metric units	Usual non-metric units	Conversion factors
absolute temperature customary temperature	T, Θ t, θ	K	K °C	°R °F	$t\text{ }^{\circ}\text{C} = T\text{ K} - 273.15$ $t\text{ }^{\circ}\text{F} = T\text{ }^{\circ}\text{R} - 459.67$
pressure	p	N/m ²	kgf/cm ²	lbf/in ²	$1\text{ kgf/cm}^2 = 98\,066.5\text{ N/m}^2$ $1\text{ lbf/in}^2 = 6894.76\text{ N/m}^2$
density (mass density)	ρ	kg/m ³	kg/m ³	lb/ft ³	$1\text{ lb/ft}^3 = 16.0185\text{ kg/m}^3$
specific enthalpy	h	J/kg	kcal _{IT} /kg	Btu/lb	$1\text{ kcal}_{IT}/\text{kg} = 4186.8\text{ J/kg}$ $1\text{ Btu/lb} = 2326\text{ J/kg}$
specific entropy	s	J/(kg·K)	kcal _{IT} /(kg·K)	Btu/(lb·°R)	$1\text{ kcal}_{IT}/(\text{kg}\cdot\text{K}) = 4186.8\text{ J}/(\text{kg}\cdot\text{K})$ $1\text{ Btu}/(\text{lb}\cdot^{\circ}\text{R}) = 4186.8\text{ J}/(\text{kg}\cdot\text{K})$
specific heat capacity	c	J/(kg·K)	kcal _{IT} /(kg·°C)	Btu/(lb·°F)	$1\text{ kcal}_{IT}/(\text{kg}\cdot^{\circ}\text{C}) = 4186.8\text{ J}/(\text{kg}\cdot\text{K})$ $1\text{ Btu}/(\text{lb}\cdot^{\circ}\text{F}) = 4186.8\text{ J}/(\text{kg}\cdot\text{K})$
specific latent heat of evaporation	l	J/kg	kcal _{IT} /kg	Btu/lb	$1\text{ kcal}_{IT}/\text{kg} = 4186.8\text{ J/kg}$ $1\text{ Btu/lb} = 2326\text{ J/kg}$
thermal conductivity	λ	W/(m·K)	kcal _{IT} /(h·m·°C)	Btu/(h·ft·°F)	$1\text{ kcal}_{IT}/(\text{h}\cdot\text{m}\cdot^{\circ}\text{C}) = 1.163\text{ W}/(\text{m}\cdot\text{K})$ $1\text{ Btu}/(\text{h}\cdot\text{ft}\cdot^{\circ}\text{F}) = 1.730\,73\text{ W}/(\text{m}\cdot\text{K})$
surface coefficient of heat transfer	α	W/(m ² ·K)	kcal _{IT} /(h·m ² ·°C)	Btu/(h·ft ² ·°F)	$1\text{ kcal}_{IT}/(\text{h}\cdot\text{m}^2\cdot^{\circ}\text{C}) = 1.163\text{ W}/(\text{m}^2\cdot\text{K})$ $1\text{ Btu}/(\text{h}\cdot\text{ft}^2\cdot^{\circ}\text{F}) = 5.678\text{ W}/(\text{m}^2\cdot\text{K})$
overall coefficient of heat transfer	K	W/(m ² ·K)	kcal _{IT} /(h·m ² ·°C)	Btu/(h·ft ² ·°F)	$1\text{ kcal}_{IT}/(\text{h}\cdot\text{m}^2\cdot^{\circ}\text{C}) = 1.163\text{ W}/(\text{m}^2\cdot\text{K})$ $1\text{ Btu}/(\text{h}\cdot\text{ft}^2\cdot^{\circ}\text{F}) = 5.678\text{ W}/(\text{m}^2\cdot\text{K})$
kinematic viscosity	ν	m ² /s	m ² /s St	ft ² /s	$1\text{ ft}^2/\text{s} = 0.092\,903\,0\text{ m}^2/\text{s}$ $1\text{ St} = 0.0001\text{ m}^2/\text{s}$
mass flow rate	q_m	kg/s	kg/h	lb/h	$1\text{ lb/h} = 126 \times 10^{-6}\text{ kg/s}$
heat flow rate	Φ	W	kcal _{IT} /h	Btu/h	$1\text{ kcal}_{IT}/\text{h} = 1.163\text{ W}$ $1\text{ Btu/h} = 0.2931\text{ W}$
refrigerating capacity (overall, net, useful)	Φ_o	W	fg/h	ton	$1\text{ fg/h} (= 1\text{ kcal}_{15}/\text{h}) = 1.163\text{ W}$ 1 ton of refrigeration (= a heat flow rate of 12 000 Btu/h removed by the refrigerating system from the cold body) = 3516.85 W
refrigerating performance (overall, net, useful)	ϵ	—	—	—	—
efficiency	η	—	—	—	—
power	P	W	kW ch	kW hp	$1\text{ ch} = 735.499\text{ W}$ $1\text{ hp} = 745.700\text{ W}$
area of an exchange surface	A	m ²	m ²	ft ²	$1\text{ ft}^2 = 0.092\,903\,0\text{ m}^2$
relative humidity	φ_p	—	—	—	—
specific humidity (mixture ratio)	x	—	—	—	—

It is recommended that the figures 1, 2, 3, etc. be used to indicate any state point of the refrigerant (see, for example, Fig. 1).

Inferior indexes	ambient atmosphere, air	a
	water	w
	heat transfer liquid (brine, alcohol, etc.)	f
	refrigerant	(no index)
	saturated	s