Disclosure to Promote the Right To Information

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Indian Standard

REQUIREMENTS FOR REFRIGERANT CONDENSING UNITS

(First Revision)

ICS 97.130.20
FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by
the Refrigeration and Air-Conditioning Sectional Committee had been approved by the Mechanical Engineering
Division Council.

This standard was first published in 1985. The experience gained in implementing this standard has necessitated
this revision.

In this revision assistance has been derived from the following standards:

- ARI Standard 520-1997 ‘Positive displacement condensing units’
- ‘ASHRAE Standard 12-75 ‘Refrigeration terms and definitions’ issued by the American Society of
  Heating, Refrigerating and Air-Conditioning

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value,
observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with
IS 2 : 1960 ‘Rules for rounding off numerical values (revised)’. The number of significant places retained in the
rounded off value should be the same as that of the specified value in this standard.
Indian Standard
REQUIREMENTS FOR REFRIGERANT
CONDENSING UNITS
(First Revision)

1 SCOPE
This standard covers minimum requirements for the manufacture of electrically driven condensing units air cooled or water cooled of single stage compressor open type, hermetic and semi-hermetic for use in temperate and tropical climates. The standard is limited to machines using refrigerant R22 and non-CFC refrigerants like R134a, R410A, R407C and R404A but may be applied as appropriate to machines designed for use with other refrigerants.

2 TERMINOLOGY
For the purpose of this standard, the following definitions shall apply.

2.1 Refrigerating Capacity — For the purpose of this standard, refrigerating capacity is the capacity in watts obtained at specified conditions; it is equal to the increase in total enthalpy between the liquid refrigerant entering the expansion valve and superheated return gas multiplied by the mass flow rate of the refrigerant.

2.2 Energy Efficiency Ratio (EER) — A ratio calculated by dividing the refrigerating capacity in watts by the power input in watts at any given set of ratings expressed as watts per watt.

2.3 Manufacturer — For the purpose of this standard, the manufacturer is the company or organization, which evidences its responsibility by affixing its name or its nationally registered trade-mark or trade name, to the condensing unit.

2.4 Electrically Driven Open Type Water Cooled Condensing Unit — A unit consisting of compressor, drive motor, condenser, drive assembly, high pressure/low pressure (HP/LP) cut-out, drive guard, stop valves with interconnecting piping all mounted on common base.

2.5 Electrically Driven Open Type Air Cooled Condensing Unit — A unit consisting of compressor, air cooled condenser, fan, compressor drive motors (fan drive arrangement, if required), liquid receiver, HP/LP cut-out, drive assembly, stop valves with interconnecting piping all mounted on common base. (The condenser with fan and fan drive can be installed remotely depending upon the capacity and design.)

2.6 Electrically Driven Service Sealed Water Cooled Condensing Unit — A unit consisting of a compressor and drive motor both enclosed in same housing, condenser, stop valves with interconnecting pipe and fittings all mounted on common base.

2.7 Electrically Driven Service Sealed Air Cooled Condensing Unit — A unit consisting of a compressor and drive motor both enclosed in same housing, condenser, fan, and drive motor, with interconnecting pipe and fittings all mounted on common base and may consists of HP/LP cut-out, liquid receiver, stop valves. (The condenser with fan and drive can be remotely mounted depending upon the capacity and design.)

NOTES
1 In case of a belt driven compressor, it includes fly wheel, motor pulley, endless V-Belt in direct coupled units, it includes coupling and when required fly wheel.
2 During transportation the unit shall have pressure at least 35 kPa of refrigerant or inert gas or dry air of dew point -40°C or lower.

3 COMPONENTS
A condensing unit shall comprise of the following equipments:

a) Base with mounting attachments,
b) Hermetically sealed compressor (or compressor with drive motor in case of semi-hermetic and open type compressor),
c) Condenser,
d) Starter with over load protection (in open type or semi-hermetic) and starting devices and accessories (in hermetic/semi-hermetic compressors),
e) Drive arrangement (in open type),
f) Condenser fan (in air cooled),
g) Interconnecting pipe and fittings,
h) Liquid line strainer/liquid line drier,
j) Lubricating charge,
k) Holding charge, and
m) Name plate.

4 ANCILLARY EQUIPMENT
The following items may be included on specific requirement:
IS 11327 : 2007

5 TECHNICAL REQUIREMENTS

5.1 The unit shall be constructed to withstand normal handling during transport and servicing.

5.2 The test pressure for air-cooled high side components shall be saturation pressure corresponding to 62.7°C (maximum ambient temperature 46°C plus 16.7°C). The test pressure for water-cooled high side components shall be the saturation pressure corresponding to maximum local ambient temperature that is, 46°C. The test pressure for the low side components shall be the saturation pressure corresponding to 35°C temperature, which is the normal ambient temperature. The complete condensing unit shall be tested at the low side pressure, that is, the saturation pressure corresponding to 35°C. For guidance, the leak test pressures for few refrigerants are given in Table 1.

5.3 The water circuit shall be tested to withstand a pressure of 850 MPa.

5.4 Pipes and connections to moving or resiliently mounted parts shall neither transmit vibration excessively nor foul adjacent parts. The unit shall not make excessive vibration and noise during normal operation.

5.5 Each unit with the refrigerant capacity equal to one or more than 1 tonne of refrigeration shall be provided with safety measures to prevent hazardous damage due to excessive pressure. The arrangement may be, pressure relief valve, bursting disc, fusible plug, soldered joint, special terminals or other suitable means, HP/LP cut-out.

5.6 Parts that need servicing or attention shall be easily accessible.

5.7 Stop valves may be provided with square operating stem ends of 6, 7, 8, and 12 mm across flats.

5.8 Compressor Motor

5.8.1 Compressor motors for open type condensing units shall meet the requirement of Indian Standard specifications as suitable to requirement. In air-cooled condensing unit the temperature rise of motors shall be measured in an ambient temperature of 46°C. The test shall be carried out with condenser and cooling surface with clean and unrestricted air supply.

5.8.2 The motor for service sealed compressor shall meet the following requirements:

a) The condensing unit shall be operated for not less than two hours at those conditions of compressor load on which the maximum temperature rise will occur. The maximum temperature of motor winding measured by resistance method shall not exceed that given in Table 2.

b) The voltage variation from name plate voltage shall not be more than ±10 percent during testing.

c) The motor shall be capable of starting the compressor and of running it up to full speed at a voltage of 85 percent of the rated voltage or at 94 percent of the lower value of rated voltage.

Table 1 Minimum Leak Test Pressure (Gauge)
(Applicable to condensing units for use in ambient temperature not exceeding 46°C)

(Clause 5.2 )

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Refrigerant</th>
<th>Low Side</th>
<th>High Side Air Cooled</th>
<th>High Side Water Cooled</th>
<th>Condensing Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>kPa</td>
<td>kPa</td>
<td>kPa</td>
<td>kPa</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>i)</td>
<td>R22</td>
<td>1255</td>
<td>2475</td>
<td>1770</td>
<td>1255</td>
</tr>
<tr>
<td>ii)</td>
<td>R134a</td>
<td>787</td>
<td>1692</td>
<td>1090</td>
<td>787</td>
</tr>
<tr>
<td>iii)</td>
<td>R407C</td>
<td>1441</td>
<td>2828</td>
<td>1914</td>
<td>1441</td>
</tr>
<tr>
<td>iv)</td>
<td>R410A</td>
<td>2337</td>
<td>3966</td>
<td>2689</td>
<td>1524</td>
</tr>
<tr>
<td>v)</td>
<td>R404A</td>
<td>1524</td>
<td>2958</td>
<td>2011</td>
<td>1524</td>
</tr>
</tbody>
</table>
Table 2 Maximum Motor Winding Temperatures  
(Clause 5.8.2)

<table>
<thead>
<tr>
<th>For Motor Insulation System Including Cellulose Materials, for Example Cotton, Paper</th>
<th>For Motor Insulation Systems Entirely of Non-cellulose Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>°C</td>
</tr>
<tr>
<td>Under running conditions</td>
<td>121</td>
</tr>
<tr>
<td>With locked rotor for limited periods</td>
<td>135</td>
</tr>
</tbody>
</table>

5.8.3 Suitable starters shall be provided for the motors as may be recommended by condensing unit manufacturer.

5.8.4 Motor shall be protected from overloading by overload relay sensitive to motor winding temperature or motor current or both.

5.9 If condensing unit is to be dispatched with pre-charged refrigerant, it shall be dehydrated before dispatch. The standard of dehydration obtained shall be producing a dew point lower that -40°C in the assembled unit.

6 TESTING AND STANDARD RATING CONDITIONS

6.1 The performance of the condensing unit shall be specified at the standard rating conditions.

6.1.1 A standard rating for a condensing unit consist of a standard capacity rating, identified by its standard rating conditions in Table 3, plus its associated power input rating when tested with its specified motor, its associated compressor speed (external-drive compressor only), and if a water cooled condensers is used, its cooling water consumption and pressure drop. The power required to operate the condenser fan of an air-cooled or evaporative cooled unit shall be included in the power input rating, when tested at specified voltage, phase frequency and with all accessories as supplied or specified by the manufacturer.

6.2 Tolerances on the Standard Ratings

To comply with this standard, standard ratings shall be based on data obtained in accordance with the provisions of this section, and shall be such that any production unit, when tested shall meet these ratings except for an allowance to cover testing and manufacturing variation; the amount of this allowance for capacity and energy efficiency ratio (EER) shall be no less than minus 5 percent. In addition, the allowance for power input shall be no more than plus 5 percent of the rated values.

6.3 EER may be specified at the conditions as given in Table 3.

7 MARKING

7.1 Each unit shall have a name plate on which following information shall be marked in permanent and legible manner by manufacturer at easily visible place:

a) Name of manufacturer;

b) Model number;

c) Condensing unit power input including compressor and fan motor input, rated voltage for compressor and fan motor, frequency, phase and rated ampere and locked rotor ampere for compressor;

Table 3 Standard Rating Conditions for Condensing Units for Refrigeration Applications

(Clause 6.3)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Suction Dew Point Temperature °C</th>
<th>Compressor Type</th>
<th>Return Gas Temperature °C</th>
<th>Type of Condensing Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>Air Cooled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dry Entering Air</td>
</tr>
<tr>
<td>i)</td>
<td>7.2</td>
<td>All</td>
<td>18.3</td>
<td>35</td>
</tr>
<tr>
<td>ii)</td>
<td>–6.7</td>
<td>AllP</td>
<td>4.4/18.3(^2)</td>
<td>35</td>
</tr>
<tr>
<td>iii)</td>
<td>–23.3</td>
<td>Hermetic</td>
<td>4.4</td>
<td>32.2</td>
</tr>
<tr>
<td>iv)</td>
<td>–31.7</td>
<td>AllP</td>
<td>4.4/18.3(^2)</td>
<td>32.2</td>
</tr>
<tr>
<td>v)</td>
<td>–40</td>
<td>AllP</td>
<td>4.4/18.3(^2)</td>
<td>32.2</td>
</tr>
</tbody>
</table>

\(^{1}\) Sub-cooling in °C shall be stated as obtained under pertinent application conditions, as measured at the liquid line leaving condensing unit.

\(^{2}\) a) For hermetic type compressors 4.4°C return gas temperature shall be used.

b) For external drive accessible hermetic type compressors 18.3°C return gas temperature shall be used.
d) Maximum fuse current (for fuse selection);
e) Refrigerant to be used, for example R22, R134a, etc;
f) Application range, in °C; and
g) Nominal refrigerating capacity, in kcal/h.

7.2 BIS Certification Marking
Each refrigerant condensing unit may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to the manufacturers or the producers may be obtained from the Bureau of Indian Standards.

ANNEX A
(Foreword)
COMMITTEE COMPOSITION
Refrigeration and Air-Conditioning Sectional Committee, ME 03

Organization
Veermata Jijabai Technological Institute, Mumbai
All Indian Air Conditioning and Refrigeration Association, New Delhi
Annapurna Electronics and Services Ltd, Hyderabad
Applicomp (India) Ltd, Bangalore
BPL Compressors Unit, Patacheru
Bureau of Energy Efficiency, New Delhi
Carrier Aircon Ltd, Gurgaon
Central Mechanical Research Institute, Durgapur
Central Power Research Institute, Bangalore
Confederation of Indian Industry, Kolkata
Consumer Education and Research Centre, Ahmedabad
Directorate of Quality Assurance (Engg Div), Pune
Directorate General of Supplies and Disposals, New Delhi
Electrical Research and Development Association, Vadodara
Electronic Regional Test Laboratory, New Delhi
Emerson Climate Technologies (India) Ltd, Pune
Godrej Appliances Ltd, Mumbai

Representative(s)
PROF DR K. G. N. KHEDKAR (Chairman)
SHRI RAJENDRA MITAL
SHRI RAJEEV KAPIL (Alternate)
SHRI G. K. PRASAD
SHRI PREM CHANDER (Alternate)
SHRI B. P. HARISH
SHRI ASHOK K. GUPTA
SHRI MANISH GUPTA (Alternate)
SHRI K. K. CHAKRABORTY
SHRI TANMAY TATHAGAT (Alternate)
SHRI BHUPINDER GODARA
SHRI AJAY PRATAP SINGH (Alternate)
SHRI P. S. PARTI
SHRI K. MANOHARA
SHRI GUIHALA B. BALARAJA (Alternate)
SHRI V. AZHAKESHAN
SHRI A. HIRANANDANI (Alternate)
SHRI S. N. DESAI
SHRI P. C. JOSE
SHRI N. GUNASEKHARAN (Alternate)
SHRI A. K. SATWAH
SHRI R. K. AGARWAL (Alternate)
SHRI A. K. SINGH
SHRI S. K. NAYAK (Alternate)
SHRI ASHOK KUMAR
SHRI DAMAN K. GULATI (Alternate)
SHRI V. G. SARDASAI
SHRI N. M. INGLE (Alternate)
SHRI B. J. WADIA
SHRI N. T. DESAI (Alternate)
<table>
<thead>
<tr>
<th>Organization</th>
<th>Representative(s)</th>
</tr>
</thead>
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<tr>
<td>Hindalco Industries Limited, Mumbai</td>
<td>Shri Suresh Desai, Shri S. Devdoss (Alternate)</td>
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<tr>
<td>Idfos Industries Ltd, Ghaziabad</td>
<td>Shri S. K. Seth, Shri Anuruchi Bhat (Alternate)</td>
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<tr>
<td>Indian Institute of Chemical Engineering, Kolkata</td>
<td>Shri S. Ghosh, Shri Y. H. Chhapur (Alternate)</td>
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<tr>
<td>Indian Institute of Technology, New Delhi</td>
<td>Shri Sanjeev Jain, Shri P. M. V. Subbarao (Alternate)</td>
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<tr>
<td>Indian Society of Heat, Refrigeration Air-Conditioning Engineers, New Delhi</td>
<td>President</td>
</tr>
<tr>
<td>Indraprastha Gas Limited, Delhi</td>
<td>Shri B. K. Nath, Shri Harshal Undhiyay</td>
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<tr>
<td>Intertek Testing Services (I) Pvt Ltd, New Delhi</td>
<td>Shri S. L. Pandya, Shri U. C. Sharma (Alternate)</td>
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<td>Krishak Bharati Co-operative Ltd, Surat</td>
<td>Shri Kishore M. Joshi, Shri Rasik P. Khandekar (Alternate)</td>
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<tr>
<td>Lawkim Motors Ltd, Dist Satarthane</td>
<td>Shri S. C. Panchibhai, Shri B. K. Sharma (Alternate)</td>
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<td>L.G. Electronics India Pvt Ltd, Greater Noida</td>
<td>Shri G. Radhakrishna, Shri D. K. Suryakalyan, Shri S. K. Jha (Alternate)</td>
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<tr>
<td>National Dairy Development Board, Anand</td>
<td>Shri Nilesh M. Bhatt, Shri T. G. S. Babu</td>
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<td>National Thermal Power Corporation Ltd, New Delhi</td>
<td>Shri Manish Gulati, Shri Ritesh Singh (Alternate)</td>
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<td>Nirma University of Science and Technology, Ahmedabad</td>
<td>Shri Shantanu Somani, Shri Rajeev Kapil (Alternate)</td>
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<td>Refrigeration and Air-Conditioning Manufacturer Association, New Delhi</td>
<td>Shri Girish Sethi, Dr Ajay Mathur (Alternate)</td>
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<td>Samsung India Electronics Ltd, Noida</td>
<td>Shri S. R. Kella, Shri Chirag Rawal (Alternate)</td>
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<td>Tecumseh Products India Ltd, Hyderabad</td>
<td>Shri Sethuraman, Shri V. Srinivasan (Alternate)</td>
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<tr>
<td>The Energy and Resources Institute, New Delhi</td>
<td>Shri A. K. Mehta, Shri A. K. Joshi, Shri M. Gopi Krishna (Alternate)</td>
</tr>
<tr>
<td>Vadilal Enterprises Ltd (RSD), Ahmedabad</td>
<td>Shri T. C. Kapoor, Shri H. Wadiwa (Alternate)</td>
</tr>
<tr>
<td>Videocon Appliances Ltd, Aurangabad</td>
<td>Shri Nilesh Patil, Shri V. Sugosh, Shri N. B. Panth (Alternate)</td>
</tr>
<tr>
<td>Volga Airetechnics Ltd, Ahmedabad</td>
<td>Shri C. K. Veda, Scientist ‘F’ &amp; Head (MED)</td>
</tr>
<tr>
<td>Voltas Limited, Mumbai</td>
<td>[Representing Director General (Ex-officio)]</td>
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<td>Voluntary Organization in Interest of consumer Education, New Delhi</td>
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<td>Western Refrigeration Pvt Ltd, Mumbai</td>
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<td>BIS Directorate General</td>
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Member Secretary
Shri S. Chowdhury
Scientist ‘E’ (MED), BIS
Bureau of Indian Standards

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Amendments Issued Since Publication

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