

Specification for

Electrically driven refrigerant condensing units

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Refrigeration, Heating and Air Conditioning Standards Policy Committee (RHE/-) to Technical Committee RHE/4, upon which the following bodies were represented:

- British Refrigeration Association
- Chartered Institution of Building Services Engineers
- Department of the Environment (Property Services Agency)
- Heating and Ventilating Contractors' Association
- Institute of Refrigeration
- Institution of Mechanical Engineers
- Polytechnic of the South Bank
- Process Plant Association
- Retail Consortium
- Rotating Electrical Machines Association (BEAMA Ltd.)

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Definitions	1
3 Design and construction	1
4 Testing	4
5 Documentation and marking	5
Appendix A Type testing of condensing units and their components	7
Figure 1 — Supply circuit for locked rotor test of a motor-compressor of the single-phase type	8
Table 1 — Conditions for the maximum continuous current test	10
Publications referred to	12

Foreword

This revision of BS 1608 has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee. It is a full technical revision of BS 1608:1966 which is withdrawn.

BS 1608 is intended to provide a broad outline specification for electrically driven condensing units for connection to a remote evaporator(s); it does not constitute a technical design manual.

Particular attention has been given, in the preparation of this standard to bringing it into line with current manufacturing techniques and practices and bearing in mind the requirements of the Health and Safety at Work etc. Act 1974. Information was obtained from UK manufacturers, users and contractors with a view to establishing requirements for ease of maintenance, component life, replacement of component parts and safety. A major addition to the standard is the inclusion of electrical requirements, mainly relating to hermetic and semi-hermetic compressors. These requirements generally follow those already being carried out in the industry and which are covered partly by other national standards. Some distinction is made between the requirements of the IEE regulations for installation of a condensing unit and the necessary internal wiring which is covered either by existing British Standards or in this standard.

This standard should be used in conjunction with BS 4434.

Account has been taken during the drafting of this standard of UL 303 (Refrigeration and Air Conditioning, Condensing and Compressor Units) and Publication IEC 335-2-34 Part 2 (Safety of household and similar electrical appliances. Particular requirements for motor compressors) for which the equivalent British Standard is BS 3456-102.34:1987.

Attention is also directed to relevant standards such as pressure vessel and electrical codes, and technical data sheets.

For example:

- a) for pressure vessels: BS 5500, ASME Boiler and pressure vessel code — Section VIII — Pressure Vessels, UL 207;
- b) for electrical equipment: BS 3456-201, BS 4999 and BS 5000, BS 5420, BS 5424-1, IEE Regulations for the Electrical Equipment of Buildings;
- c) for performance and component life testing: CECOMAF technical data sheets: GT4-002, 003, 004, 006 and 007 published by CECOMAF (The European Committee of Manufacturers of Refrigerant Equipment).

Electrical details relating to hermetic and semi-hermetic refrigerant compressors have been dealt with in detail as these requirements are not available elsewhere. In the case of external drive electric motors, however, these are adequately covered in British Standards for rotating machinery and are appropriately cross-referenced.

Most of the tests referred to in this standard are type tests only and are necessary to establish performance, safety or component life.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for the design, construction and testing of electrically driven refrigerant condensing units for connection to a remote evaporator(s) and for installation in accordance with the safety requirements of BS 4434.

This standard applies to electrically driven air or water cooled refrigerant condensing units of the single stage compressor type up to a power input of approximately 25 kW, generally for commercial and industrial applications. BS 1608 does not apply to condensing units which form an integral part of a unit air conditioner.

NOTE The titles of the publications referred to in this standard are listed on page 12.

2 Definitions

For the purposes of this British Standard the definitions given in BS 5643 apply, together with the following:

2.1 refrigerant condensing unit (electrically driven)

a factory assembled unit for performing part of the refrigeration cycle (compression and condensation) comprising refrigerant compressor(s) with motor(s), condenser(s), liquid receiver(s) (when required), interconnecting pipework and ancillary equipment, all mounted on a common base

NOTE 1 The compressor(s) may be of the open, hermetic or semi-hermetic type.

NOTE 2 The base may be a water cooled condenser with its own mounting feet.

2.2 controller

a device or group of devices that serves to govern, in a predetermined manner, the electrical power delivered to the apparatus to which it is connected

2.3 excess pressure protector

a device such as a pressure relief valve, bursting disc or fusible plug

2.4 primary single-phasing

the condition where an interruption occurs in the supply from one leg in the primary side of a star delta or delta star connection transformer(s)

2.5 rated voltage

the voltage (for three-phase supply, the voltage between phases) assigned to the unit by the manufacturer

2.6 rated voltage range

the voltage range assigned to the unit by the manufacturer, expressed by its upper and lower limits

2.7 secondary single-phasing

the condition where an interruption occurs in the supply from one leg in the secondary side of a star delta or delta star connection transformer(s)

2.8 single phasing

as applied to three-phase motors, a condition in which one leg of a three-phase circuit is open and under which the connected load may continue to operate

3 Design and construction

3.1 Assembly

3.1.1 Condensing units shall be so designed and constructed as to comply with the safety requirements of the relevant standards.

NOTE 1 For general electrical safety requirements see BS 3456-201.

NOTE 2 Ancillary components such as driers, oil separators, economizer coils, oil differential pressure switches, strainers, etc. which may be included in a unit, should meet the safety requirements of BS 4434.

NOTE 3 The manufacturer may decide to incorporate certain extra control facilities into the condensing unit such as variable speed control, head pressure control, etc. In these cases the electrical and pressure safety measures contained in this standard and in BS 4434 should be applied.

3.1.2 A condensing unit shall comprise at least the following components which shall comply with 3.2.1 to 3.2.6, as appropriate:

- a) base or frame;
- b) compressor(s);
- c) compressor drive;
- NOTE In the case of a belt-driven compressor, this includes belt(s), motor pulley and flywheel and guards. In the case of a direct coupled compressor, this includes coupling, guards and, when required, a flywheel.
- d) condenser(s);
- e) refrigerant piping;
- f) motors.

3.1.3 When the following components are supplied by the manufacturer they shall comply with 3.2.7 to 3.2.17, as appropriate:

- a) liquid receiver(s);

NOTE 1 Liquid receivers(s) may not be required on condensing units intended for use with capillary tube systems.

- b) air circulating fan(s) for air cooled condensers, compressor(s) and their motor(s);

NOTE 2 In cases where alternative methods of compressor cooling are available (suction/oil/water cooled, etc.) air circulating fans may not be provided.

- c) excess pressure protector;
- d) motor overload protective devices;
- e) pressure limiting device;
- f) guards against electrical and mechanical hazards;
- g) suction and liquid refrigerant shut-off valves and provision for the connection of pressure gauges (see also BS 4434);
- h) controller;

NOTE 3 The controller may be shipped loose with an appropriate electrical wiring diagram.

- i) enclosures;
- j) electric crankcase heaters;
- k) capacitors.

NOTE 4 When these components are supplied by other than the manufacturer it is important that they comply with 3.2.7 to 3.2.17.

3.2 Components

3.2.1 Base or frame

A base or frame with mounting attachments shall be provided for carrying the assembled components.

3.2.2 Compressors

3.2.2.1 Compressors shall comply with BS 4434.

3.2.2.2 A hermetic or semi-hermetic motor-compressor shall have a protection system capable of protecting the motor and wiring against damage due to excessive temperatures under locked rotor conditions, and at a maximum rated current. Type tests in accordance with A.3 and A.4 shall be carried out to determine the required motor/protector combination.

NOTE In order to protect against short cycling of compressors, a timed reset on the thermistor control unit or overload is recommended.

3.2.2.3 The protection systems on a hermetic or semi-hermetic motor-compressor shall comply with one of the following.

- a) A separate overload relay that is responsive to the motor current and will trip at a maximum of 140 % of the current marked on the compressor nameplate.
- b) A fuse or circuit breaker responding to motor current and rated at a maximum of 125 % of the current marked on the compressor nameplate.
- c) A protective system which will not permit a continuous current in excess of 156 % of the rated current (see also A.5).

3.2.3 Compressor drives

3.2.3.1 V-belt drives shall comply with BS 3790.

3.2.3.2 Couplings shall comply with BS 3170.

3.2.4 Condensers

3.2.4.1 Air cooled

Air cooled condensers shall comply with BS 4434.

3.2.4.2 Water cooled

Water cooled condensers shall comply with BS 4434.

3.2.5 Refrigerant piping

3.2.5.1 General

Refrigerant piping shall comply with BS 4434.

3.2.5.2 Copper piping

Copper piping shall comply with BS 2871-2 and shall be made from deoxidized copper designated C106 (see Table 2 of BS 2871-2:1972).

3.2.6 Motors

3.2.6.1 Compressor external drive motors shall comply with BS 4999 and/or BS 5000, as appropriate.

3.2.6.2 Hermetic and semi-hermetic motors shall comply with BS 4434, and with 4.1.

3.2.6.3 Fan motors shall comply with BS 2048, BS 4999 or BS 5000-11, depending on size or type.

The over current and over temperature protection of fan motors (see 3.2.10) shall be by means independent of the compressor motor protection.

NOTE Impedance protection may be accepted for motors where their locked rotor currents are insufficient to cause overheating.

3.2.7 Liquid receivers

Liquid receivers shall comply with either BS 5500 where the outside diameter exceeds 609.6 mm or alternatively with BS 7005 for smaller vessels. They shall also comply with BS 4434.

3.2.8 Air circulating fan(s)

Air circulating fan(s) shall be locked to the fan motor driving shaft.

NOTE It is recommended that fan blades should be balanced and protected to prevent distortion during transit.

3.2.9 Excess pressure protector

Excess pressure protectors shall comply with BS 4434.

3.2.10 Motor overload protective devices

3.2.10.1 All motors shall be protected by an over current protective device.

NOTE This protection may need to be supplemented by a thermal overload protection device.

3.2.10.2 External overload relays shall comply with BS 4941-1.

3.2.10.3 Built-in thermal protection for external drive motors shall comply with BS 4999-111.

3.2.10.4 Built-in thermal protection for hermetic and semi-hermetic compressors shall comply with clause 4.