
British Standard Specification for

**Safety aspects in the design,
construction and installation of
refrigerating appliances and systems**

Exigences de sécurité de la conception, de la construction et de l'installation des appareils et systèmes de réfrigération — Spécifications

Sicherheitstechnische Grundsätze bei der Bemessung, Ausführung und Aufstellung von Kühlgeräten und -anlagen

Foreword

This revision of BS 4434 has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee. It is a thorough review of the requirements and content in BS 4434 : Part 1 : 1980 and BS 4434 : Part 2 : 1976 that relate to safety in the design, manufacture and installation of refrigerating systems and appliances, which are both superseded and are withdrawn. Aspects relating to operation and maintenance of commercial and industrial appliances and systems that were dealt with in the previous editions of Parts 1 and 2 have been retained as appendix H in this edition for guidance purposes.

Particular attention has been given, in the preparation of this revision, to presenting the safety requirements in a logical sequence from initial selection, through design and construction to installation, testing and documentary requirements. Attempts have been made to distinguish clearly between those considerations for which verifiable requirements can be specified and those which can only be dealt with in terms of general guidance information, much of which is now included in appendices.

Co-incident with the overall revision of BS 4434, attempts have been made to ensure, through liaisons with other relevant committees, that the role of BS 4434 in centrally coordinating the safety requirements for refrigerating appliances, components and systems is properly integrated within the framework of standards concerned.

Since commencing this revision, the 'Montreal Protocol' has been signed and is in the process of ratification.

This will have an effect on the availability and handling of some of the refrigerants mentioned in this standard, notably R11, R12, R113, R114, R115 and R13B1.

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

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Section one. General

1.0 Introduction

This standard is intended to minimize possible hazards peculiar to refrigerating appliances, systems and ancillary equipment; it does not constitute a technical design manual.

The standard is drawn up for the protection of life and limb and the health of the individual and also for the prevention of damage to property in the sense of premises but not, for example, goods in storage.

In order to attain these objectives, good design, construction, installation, operation and maintenance are necessary.

It is intended that this standard be applied to all kinds of refrigerating systems in which the refrigerant is evaporated and condensed in a closed circuit, including heat pumps and absorption systems, but excluding systems using air as the working fluid.

Attention is directed to relevant standards, refrigeration safety codes, pressure-vessel and piping codes, electrical codes and statutory regulations for health, safety and fire*. In many countries such documents exist and compliance with their provisions may be mandatory. In the absence of such rules a relevant document should be used that has received national or international recognition and has been accepted by agreement of all parties properly concerned in each transaction†.

Attention is also drawn to dangers common to all compression systems such as excessive temperature at discharge, erroneous operation (e.g. discharge valve closed while running) or reduction in mechanical strength caused by corrosion, erosion or vibration. Corrosion should have special consideration as conditions peculiar to refrigerating systems arise due to alternate frosting and defrosting, the covering of apparatus by insulation, and faulty vapour seals.

Special consideration should also be given to possible effects of low temperatures such as:

- (a) brittleness of materials;
- (b) freezing of ground beneath or adjacent to refrigerating equipment, with consequent danger to buildings;
- (c) ruptures in associated equipment caused for example by the freezing of products, water or heat-transferring liquids and consequent release of refrigerant to atmosphere or into other apparatus unsuitable for the pressure

resulting from, or excessive pressures exerted by, substances being processed and/or pumped.

In standards for particular classes or types of appliance, certain tests included in this standard may be specified as type tests only.

1.1 Scope

This British Standard specifies requirements for the safety aspects in terms of the design, construction, installation and inspection of refrigerating appliances, systems and ancillary equipment intended for use or installation in institutional, public assembly, residential, commercial and industrial occupancies.

It applies to new refrigerating systems, extensions and modifications of systems and for used systems on being re-installed and operated on another site.

It also applies in the case of the conversion of a system for use with another refrigerant, e.g. R12 to R114 or R717 to R22 (see appendix A).

It does not apply to the use of air as a refrigerant, or to liquefied gas storage tanks.

Requirements for safety aspects in the design of appliances, systems and ancillary equipment are given in section two.

Requirements for safety aspects in the installation and location of appliances, systems and ancillary equipment are given in section three.

Requirements for testing, inspection, documentation and marking are given in section four.

Requirements for the instruction manual or leaflet are given in section five.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this British Standard the following definitions apply.

1.2.1 absorption refrigeration system (adsorption refrigerating system). A system in which refrigeration is effected by evaporation of a refrigerant, the vapour then

*For example:

for pressure vessels: BS 5500, BS 7005, and the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Rules for construction of pressure vessels, available from BSI Sales Department, Linford Wood, Milton Keynes, MK14 6LE.

for piping: BS 2871, ANSI — B.31-5 — Code for pressure piping — Refrigeration piping;

for electrical equipment: BS 3456 : Part 101 and Part 2 section 102-24 IEE Regulations for Electrical Installations;

for occupational exposure limits of refrigerants the current edition of Health and Safety Executive Guidance Note EH 40 'Occupational Exposure Limits' published annually by HMSO.

for more detailed consideration of certain refrigerants reference may also be made to the Institute of Refrigeration Codes of Practice for Ammonia and chlorofluorocarbons, Parts 1 and 2, published by the Institute of Refrigeration, Kelvin House, 76 Mill Lane, Carshalton, Surrey, SM5 2JR.

†For example, chapter 5 of the 'Guide to Refrigerated Storage' published by the International Institute of Refrigeration (Paris), and available from BSI Sales Department.

being absorbed or adsorbed by an absorbent or adsorbent medium respectively, from which it is subsequently expelled at a higher partial vapour pressure by heating and liquefied by cooling.

1.2.2 brazed joint. A gas-tight joint obtained by the joining of metal parts with non-ferrous filler metal alloys that melt at less than the melting temperatures of the joined parts. The parent metal does not participate by fusion in making the joint.

NOTE 1. Non-ferrous filler metal alloys used for brazed joints generally have a melting point higher than 450 °C.

NOTE 2. The term brazing includes the process otherwise known as silver soldering.

1.2.3 bursting disc. A safety device that will rupture at a predetermined pressure.

1.2.4 changeover device. A valve controlling two protection devices and so arranged that only one can be made inoperative at any one time.

1.2.5 coil. A heat-exchanging battery made of tubing formed into a compact shape by spiral or serpentine configuration.

1.2.6 compressor. A mechanically operated component for compressing a refrigerant vapour, drawing from an evaporating system and discharging to a condensing system.

1.2.7 condenser. A heat exchanger in the form of a vessel or arrangement of tubing in which vapour is liquefied by the removal of heat.

1.2.8 cooling coil. A heat exchanger of coil form intended to reduce the temperature of fluid passing in or around or through it.

1.2.9 cooling system. The part of the refrigerating system that includes the evaporator and any secondary system for the purpose of cooling air or other substances.

NOTE. For the purposes of this standard, cooling systems are classified into six types as illustrated and described in table 3.

1.2.10 design pressure. The pressure used in determining the necessary materials, thickness and construction for components with regard to their ability to contain pressure.

1.2.11 evaporator. A heat exchanger in which liquid refrigerant is vaporized by absorbing heat from the substance to be cooled.

1.2.12 exit. An opening in the outer wall, with or without a door or gate.

NOTE. Emergency exits are required to comply with the Building Regulations.

1.2.13 exit passageway. A passageway immediately in the vicinity of the door through which people leave the building.

1.2.14 fusible plug or fusible component. A safety device having a low temperature melting point element to release pressure at a predetermined temperature.

1.2.15 gauge pressure. The difference between the absolute pressure in the system and the atmospheric pressure at the site.

NOTE. The atmospheric pressure is generally assumed to be 1.013 bar*.

1.2.16 hallway. A corridor for the passage of people.

1.2.17 header. A pipe or tube component of a refrigerating system to which several pipes or tubes are connected.

1.2.18 heat pump system. A refrigerating system designed to make use of the heat rejected by the system, e.g. for space heating.

1.2.19 heat-transferring liquid. Any liquid used for the transmission of heat without any change in its liquid state.

NOTE. See 2.2.4 for requirements regarding temperature limitations.

1.2.20 high pressure side. That portion of a refrigerating system which is subject to the higher or condensing pressure.

1.2.21 humanly occupied space. Space normally frequented or occupied by people with the exception of machinery rooms (1.2.30) and of refrigerated spaces (1.2.45).

1.2.22 internal gross volume. The volume calculated from the internal dimensions of a pressure vessel, no account being taken of the volume of any internal parts.

1.2.23 isolating valve. A valve used to shut off flow completely.

NOTE. Valves may be arranged to isolate sections of systems for the purposes of assembly or maintenance while other sections remain charged with refrigerant.

1.2.24 leakage test pressure. The pressure that is applied to test a system or any part of it for pressure tightness.

1.2.25 limited charge system. A refrigerating system in which the internal volume and total refrigerant charge are such that, with the system idle, the maximum working pressure will not be exceeded if complete evaporation of the refrigerant charge occurs.

1.2.26 liquid receiver. A vessel permanently installed in the high pressure side of a system to provide a reserve of liquid refrigerant.

1.2.27 lobby. An entrance hall or large hallway serving as a waiting room.

1.2.28 low pressure side. That portion of a refrigerating system which is subject to the lower or evaporating pressure.

1.2.29 machinery. The refrigerating equipment forming a part of the refrigerating system.

NOTE. This will include any or all of the following:

compressor, condenser, generator, absorber, (adsorber), liquid receiver, connecting piping, evaporator, pump, surge drum.

* 1 bar = 10^5 N/m^2 = 100 kPa.

1.2.30 machinery room. An enclosure in which equipment such as pumps and compressors are housed.

NOTE. For a refrigerating system this does not include evaporators located in a coldroom, refrigerator box, air cooled space or any other enclosed space.

1.2.31 maximum charge. The maximum allowable mass of the refrigerant in the refrigerating system.

1.2.32 maximum working pressure. The pressure that is not to be exceeded in any part of the system, irrespective of whether the system is or is not operating, except within the range of any pressure relief device. It may be differently specified for the high and low pressure sides.

1.2.33 non positive displacement compressor. A compressor in which increase in vapour pressure is attained without changing the internal volume of the compression chamber.

1.2.34 oil drain. An arrangement on a refrigerating system whereby lubricating oil carried from the compressor may be drained from the system.

1.2.35 piping. The pipes or tubes (including any hose, bellows or flexible pipe) for interconnecting the various parts of a refrigerating system.

1.2.36 positive displacement compressor. A compressor in which increase in vapour pressure is attained by changing the internal volume of the compression chamber.

1.2.37 pressure limiting device. A pressure actuated adjustable or factory pre-set non-adjustable instrument (e.g. high pressure switch) that is designed to stop the operation of the pressure imposing element and may also operate an alarm.

1.2.38 pressure relief device. A valve (1.2.39) or bursting disc (1.2.3) designed to relieve excessive pressure automatically.

1.2.39 pressure relief valve. A pressure actuated valve held shut by a spring or other means and designed to relieve excessive pressure automatically by starting to open at a pressure not exceeding the maximum working pressure and reclosing, to prevent further flow of fluid, after normal conditions of service have been restored.

1.2.40 pressure system. A refrigerating system comprising a pressure vessel or connected group of pressure vessels, any associated piping, and any associated compressor.

1.2.41 pressure vessel. A closed vessel containing fluid at a pressure differing from atmospheric pressure.

1.2.42 process valve. A valve used on a regular basis for process operations.

1.2.43 receiver. A vessel that stores refrigerant located in the refrigerating system.

1.2.44 refrigerant. A substance used to produce refrigeration by its vaporization.

NOTE. A table listing typical refrigerants and their physical properties is given in appendix A.

1.2.45 refrigerated space. A refrigerated room used for operational or service purposes (e.g. cold stores, freezing tunnels, low temperature environmental areas).

1.2.46 refrigerating system. A combination of inter-connected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purposes of extracting heat.

1.2.47 sealed absorption system. A unit system in which all refrigerant-containing parts, except for a fusible component, are made permanently tight against refrigerant loss.

1.2.48 self-contained system. A complete factory-made system in a suitable frame and/or enclosure, that is fabricated and transported in one or more sections and in which no refrigerant containing parts are connected on site other than by companion or block valves.

1.2.49 soldered joint. A gastight joint, obtained by the joining of metal parts with metallic mixtures or alloys that melt at temperatures in general from 200 °C to 450 °C. The parent metal does not participate by fusion in making the joint.

NOTE. This definition does not apply to fusible plugs (1.2.14) or components used for relief purposes.

1.2.50 strength test pressure. The gauge pressure that is applied to test the strength of a refrigerating system or any part of it.

1.2.51 surge drum. A vessel containing liquid refrigerant at low pressure and temperature and connected by liquid feed and vapour return pipes to an evaporator.

1.2.52 unit system. A self contained system that has been assembled and tested prior to its installation and is installed without connecting any refrigerant containing parts; a unit system may include factory assembled companion or block valves.

1.2.53 vent. A device permitting fluid flow in order to maintain the balance of pressure between the atmosphere and the system.

1.2.54 vestibule with doors (air lock). An isolating chamber provided with separate entrance and exit doors allowing passage from one place to another whilst isolating one from the other.

1.2.55 welded joint. A gastight joint obtained by the joining of the metal parts in the plastic or molten state.

Table 1. Group classification of refrigerants	
Group	Refrigerant characteristics
1	Refrigerants which are non-flammable in vapour form at any concentration in air at atmospheric pressure and 20 °C and are of a low order of toxicity. Toxic decomposition products may result from contact with flames or hot surfaces in the presence of air. Major decomposition products of this group, with the exception of carbon dioxide, are hydrochloric and hydrofluoric acid. Although toxic, they provide an automatic and definite warning by their exceedingly irritant smell even at low concentrations.
2	Refrigerants which have toxicity as a dominant characteristic. It is almost impossible to make a functioning refrigerating system that would not produce toxic concentrations if the refrigerant escaped into the spaces concerned.
3	Refrigerants which have flammability or explosion hazards as their dominant characteristics. They are of a low order of toxicity.

1.3 Refrigerant groups

For the purposes of this standard refrigerants are classified into three groups as given in table 1.

NOTE. A list of typical refrigerants in each group is given in appendix A.

1.4 Categories of occupancy

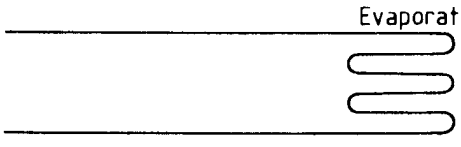
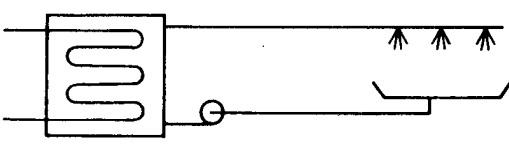
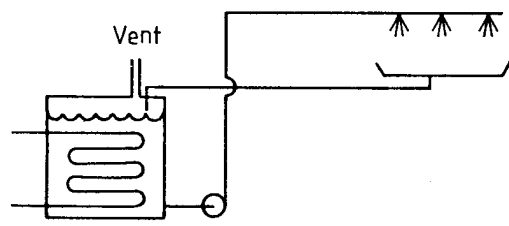
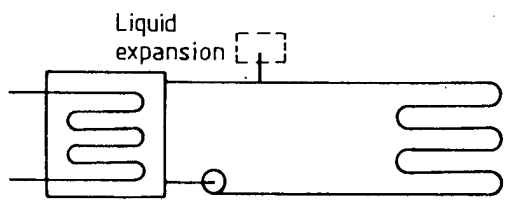
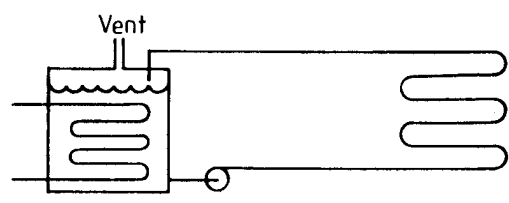
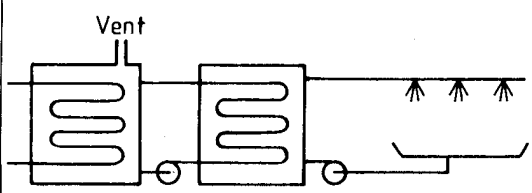
Occupancy is categorized according to table 2.

1.5 Types of cooling system

Types of cooling system are designated in table 3 (see overleaf).

Table 2. Categories of occupancy		
Category	General characteristics	Examples
A Institutional	Where persons are restricted in their movement	Hospitals, court houses, prisons with cells
B Public assembly	Where people may freely assemble	Theatres, dance rooms, department stores, passenger stations, schools, churches, lecture halls, restaurants
C Residential	Where sleeping accommodation is provided	Homes, hotels, residential apartments, clubs, colleges
D Commercial	Where any number of people may be assembled, some being necessarily acquainted with the general safety precautions of the establishment	Business or professional offices, small shops and restaurants, laboratories, places for general manufacturing and the performance of work, markets with unrestricted entry
E Industrial	Where only authorized persons have access and where manufacturing, processing or storage of materials or products takes place	Plants manufacturing chemicals, food, beverages, ice cream and ice, refineries, cold stores, dairies, abattoirs

Table 3. Types of cooling system*

Designation	Refrigerating source	Space where air or substance is cooled	Notes
(a) Direct system		Evaporator	Evaporator in direct communication with substance to be cooled.
(b) Indirect open system			Evaporator cools a heat transferring liquid which is brought into direct communication with substance.
(c) Indirect vented open system			Similar to (b) but with open or vented evaporator tank.
(d) Indirect closed system			Evaporator cools a heat transferring liquid which passes through a closed circuit in direct communication with substance.
(e) Indirect vented closed system			Similar to (d) but with open or vented evaporator tank.
(f) Double indirect system			A combination of (b) and (c) where cooled heat transfer liquid passes through second heat exchanger.

*By analogy heat pumps are classified in a similar way.

Section two. Design and construction

2.1 Refrigerant group and cooling system

2.1.1 The refrigerant group and the type of cooling system (see 1.5) shall be selected according to the category of occupancy (see 1.4) as given in table 4.

NOTE 1. Table 4 gives cross-references to clauses specifying detailed requirements for the refrigerant and the type of cooling system selected in relation to the category of occupancy.

NOTE 2. When refrigerating systems are to be installed in locations adjacent to property classifiable in any of the categories described in table 2, it is important that due regard should be paid to the safety of the adjacent property and its occupants.

NOTE 3. The selection of the refrigerating/cooling system also depends on detailed considerations in relation to the nature of the intended installation. These are dealt with in section three.

2.1.2 Where there is more than one category of occupancy the most stringent requirements shall apply, except that when the occupancies are isolated (e.g. by tightly sealed partitions, floors and ceilings) the requirements of the individual occupancies apply.

2.2 Maximum charge of refrigerant

2.2.1 Refrigerants of group 1

2.2.1.1 Direct and indirect open cooling systems.

For systems designed to be used in occupancy categories A, B, C and D, the charge of refrigerant M_R (in kg) shall not exceed the mass given by the following

$$M_R = cV$$

where

c is the maximum allowable concentration (in kg/m³) of the refrigerant in the humanly occupied space as given in table 5

V is either

- (a) the volume (in m³) of the smallest humanly occupied space into which the whole of the refrigerant charge could leak or,
- (b) the total volume (in m³) of all humanly occupied spaces cooled by one air circulation system, provided the duct work serving those spaces cannot be shut off other than in an emergency.

NOTE 1. It is not necessary to relate the maximum refrigerant charge to the volume of rooms crossed by piping if the pipelines are carried through rigid, tightly sealed, continuous, fire resistant channels or ducts vented to atmosphere or to a machinery room concerned with the system or to a space containing other parts of the system (see 3.1.3.2).

NOTE 2. M_R may be less than cV .

2.2.1.2 Indirect vented open, indirect closed, indirect vented closed and double indirect refrigerating systems.

The maximum charge of refrigerant shall be restricted in accordance with 2.2.1.1 unless the refrigerating system (other than components outside the building and piping, see 3.1.3.2) is to be installed in a machinery room, in which case no restrictions on charge shall apply.

2.2.2 Refrigerants of group 2

2.2.2.1 Direct, indirect open, indirect vented open and indirect closed refrigerating systems. The maximum charge of group 2 refrigerants and other restrictions on the use of group 2 refrigerants shall be as follows.

(a) *Category A occupancies.* The mass of refrigerant shall not exceed 2.5 kg and the use of the refrigerant shall be restricted to hermetically sealed absorption systems installed or designed to be used in kitchens, mortuaries and laboratories.

(b) *Category B occupancies.* The mass of refrigerant shall not exceed 2.5 kg and the use of the refrigerant shall be restricted to hermetically sealed absorption systems, or self-contained systems or unit systems installed or designed to be used only in kitchen departments, mortuaries and laboratories.

(c) *Category C occupancies.* The mass of refrigerant shall not exceed 2.5 kg and the use of the refrigerant shall be restricted to hermetically sealed absorption systems, self-contained systems and unit systems.

(d) *Category D occupancies.* The mass of the refrigerant shall not exceed 10 kg and the use of the refrigerant shall be restricted to hermetically sealed absorption systems, self-contained systems and unit systems.

(e) *Category E occupancies.* There are no restrictions on the charge. Systems using group 2 refrigerants shall have all compressors and high pressure side machinery installed in a machinery room with special requirements (see 3.2.2) or in the open air.

2.2.2.2 Indirect vented closed systems and double indirect refrigerating systems. The maximum charge of group 2 refrigerant shall be as follows:

- (a) for category A occupancies, 250 kg;
- (b) for category B occupancies, 500 kg;
- (c) for category C, D and E occupancies, no restriction on the charge.

Machinery shall be installed in a machinery room with special requirements (see 3.2.2) or in the open air as follows:

- (1) for category A and B occupancies, all machinery;
- (2) for category C, D and E occupancies where the refrigerant charge exceeds 500 kg, all compressors and high pressure side machinery.

Table 4. Selection of refrigerant group and cooling system in relation to category of occupancy

Cooling system	Refrigerant group														
	1					2					3				
	Occupancy					Occupancy					Occupancy				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
	Subclause giving restrictions on use														
Direct	2.2.1.1*	2.2.1.1		No restriction	2.2.2.1(a)†‡	2.2.2.1(b)†‡	2.2.2.1(c)†‡	2.2.2.1(d)†‡	2.2.2.1(e)†‡	Not to be used	2.2.3(a)‡	2.2.3(b)‡ 2.2.3(c)‡			
Indirect open															
Indirect vented open	2.2.1.2				2.2.2.2‡										
Indirect closed															
Indirect vented closed															
Double indirect															

*Cooling system not to be used if open flames are present without hooding and venting.

†Cooling system not to be used for air conditioning for human comfort.

‡Where the concentration, in the event of a leak, can exceed the figures specified in 3.4.2.1 the temperature of any hot surfaces or flames is to be at least 100 °C less than the minimum ignition temperature (see also 3.2.3).

Table 5. Maximum concentration of refrigerant in the event of major release

Refrigerant number	Maximum concentration
R	kg/m ³ (20 °C)
11	0.07
12	0.40
13	0.60
13B1	0.60
22	0.17
113	0.055
114	0.70
115	0.60
500	0.40
502	0.20
503	0.50

NOTE 1. The maximum charge of refrigerant and the calculation of the maximum concentration of refrigerant (see 2.2.1) is directly related to the humanly occupied space into which it could leak.

NOTE 2. The maximum concentrations of refrigerants apply to accidents and incidents producing a major release of refrigerant. They do not refer to safe levels for regular day to day exposure for which reference should be made to tables of 'Occupational Exposure Limits' (Guidance Note EH 40 from the Health and Safety Executive).

NOTE 3. The limits on the safe amount of refrigerant are set to avoid narcosis, cardiac sensitization and lack of oxygen. Cardiac sensitization refers to the ability of a chemical to make the heart sensitive to adrenaline.

2.2.3 Refrigerants of group 3

Group 3 refrigerants shall not be used for occupancy categories A, B and C.

The maximum charge of refrigerant and restrictions on the use of group 3 refrigerants shall be as follows:

- (a) *Category D occupancies.* The mass of refrigerant shall not exceed 2.5 kg and the use of the refrigerant shall be restricted to unit systems installed or designed to be used in laboratories.
- (b) *Category E occupancies.* For installations on floors with more than one person per 10 m², the mass of refrigerant shall not exceed 2.5 kg and the use of the refrigerant shall be restricted to unit systems.
- (c) *For other category E occupancies.* Category 3 refrigerants may be used, but when the mass of refrigerant exceeds 2.5 kg the machinery shall be installed in machinery rooms with special requirements (see 3.2.2) or in the open air and all electrical equipment shall comply with the requirements for hazardous areas.

NOTE. For further guidance, see appendix G, BS 5345, BS 4683 and BS 5501.

2.2.4 Secondary refrigerants (heat-transferring liquids)

Secondary refrigerants used in any indirect system in any occupancy shall have either:

- (a) no flashpoint; or
- (b) a flashpoint higher than 55 °C.

2.3 Design and maximum working pressures

2.3.1 Maximum working pressure

The system shall be such that the maximum working pressure is not exceeded, with the system either in operation or at rest, except within the operating range of any pressure relief valve (see 2.7.3.1.1).

NOTE 1. The overall system may, for operational reasons, be sub-divided into two or more parts (e.g. low and high pressure sides) for each of which there might be a different maximum working pressure.

The maximum working pressure is decided by the designer taking into account such factors as:

- (a) the ambient temperature;
- (b) the build-up of non-condensable gases prior to purging;
- (c) the margins between the (operating) pressure and the switching pressure of the pressure limiting device;
- (d) the setting of any pressure relief device;
- (e) the method of defrosting;
- (f) the application (e.g. cooling or heat pump applications);
- (g) solar radiation;
- (h) fouling.

NOTE 2. The maximum working pressure will be higher than the pressure at which the system (or part system) normally operates.

NOTE 3. The interrelationship between maximum working pressure and other pressures referred to in this standard is shown in appendix D.

2.3.2 Component design pressure

NOTE 1. Notwithstanding any subdivision of the refrigerating system into functional parts (e.g. low and high pressure sides), the system will comprise a number of components (e.g. vessels, interconnecting pipework). Some of the components may be separately ordered (perhaps as stock items) from manufacturers/suppliers other than the designer/manufacturer of the system.

The design pressure for each component shall not be less than the greater of either of the following:

- (a) the maximum working pressure of the system or part system (see 2.3.1); or
- (b) the pressure corresponding to the appropriate saturation temperature selected from the following:
 - (1) for the high pressure side with air-cooled condensing: at least 50 °C;
 - (2) for the high pressure side with water-cooled condensing: at least 40 °C;
 - (3) for the low pressure side: at least 30 °C.

NOTE 2. The minimum saturation temperatures specified in (b) are appropriate for temperate zones, e.g. the UK. Saturation temperatures above the minimum may need to be used when the refrigerating system is to be installed in countries where high ambient temperatures are anticipated.

NOTE 3. Examples of minimum design pressures in relation to saturation temperatures are given in appendix E.