INTERNATIONAL STANDARD

ISO 5145

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Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning

Raccords de sortie de robinets de bouteilles à gaz et mélanges de gaz — Choix et dimensionnement

Reference number
ISO 5145 : 1990 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5145 was prepared by Technical Committee ISO/TC 58, *Gas cylinders.*

Annexes A, B and C form an integral part of this International Standard. Annex D is for information only.

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Introduction

At the beginning of the 1960s the members of ISO/TC 58/SC 2 were charged with the task of drafting an International Standard on gas cylinder valve outlets.

It soon became obvious that millions of different types of valve outlets are in use, and the various countries concerned were not ready to give up their own systems. It was therefore only possible to draw up a list of the existing provisions, either standardized or in use, which was published as Technical Report ISO/TR 7470. The number and variety of such provisions give an idea of the complexity and scope of the task entrusted to ISO/TC 58/SC 2.

Towards the end of the 1970s ISO/TC 58/SC 2 realized that the task in hand could only be achieved by adopting a long-term solution; this was to create an ideal system of valve outlets which would not be interchangeable with the existing systems. This system would be based on the four fundamental criteria of safety, simplicity, compactness and tightness.

Two key actions were then undertaken in parallel:

— a classification and grouping of gases and gas mixtures;

— a practical definition of an original, non-interchangeable, connection system.

ISO 5145 represents a synthesis of these two actions. It is a practical guide for the selection of cylinder valve outlets for gases and gas mixtures. In view of the fact that no country seemed ready to give up their national standards and to adopt an International Standard specifying the dimensions of gas cylinder valve outlets, it was agreed that this International Standard need not be complied with where a national standard predates it.

ISO 5145 presents a logical system for determining valve outlets for gas cylinders for all gases or gas mixtures. It is of special interest for those countries which have no national standards or regulations. Its provisions can be called for in the future in cases where a new gas or gas mixture is developed industrially.

ISO 5145 thus represents a basis for international agreement in the more or less remote future.

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Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning

1 Scope

This International Standard establishes practical criteria for determining valve outlet connections for gas cylinders of a capacity not greater than 150 L.

It applies to the selection of gas cylinder valve outlet connections which have not yet been standardized on a national level. It particularly applies to countries having neither standards nor regulations and to new gases developed for industrial use.

This International Standard does not apply to connections used for cryogenic gas withdrawal or for respirable gases which are the subject of other International Standards.

2 General

Gas cylinders for medical use and gas cylinders for industrial use shall be differentiated in order to avoid confusion either by a suitable marking or by a colour code in accordance with ISO 32 and ISO 448.

Before selecting a valve outlet, reference shall be made to ISO 407 and ISO/TR 7470 to ascertain if an outlet is already in use in that geographic area for the gas under consideration. If this is the case, the existing outlet should be used.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 32 : 1977, *Gas cylinders for medical use — Marking for identification of content.*

ISO 286-1 : 1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*

ISO 286-2 : 1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

ISO 407 : — [1], *Small medical gas cylinders — Yoke-type valve connections.*

ISO 448 : 1981, *Gas cylinders for industrial use — Marking for identification of content.*

ISO 3601-1 : 1988, *Fluid systems — Sealing devices — O-rings — Part 1: Inside diameters, cross-sections, tolerances and size identification code.*

ISO/TR 7470 : 1988, *Valve outlets for gas cylinders — List of provisions which are either standardized or in use.*

1) To be published. (Revision of ISO 407 : 1983 and ISO 407 : 1983/Amd.1 : 1986.)

4 Principle of the determination of valve outlets

This International Standard establishes a method of allocating to any gas or mixture of gases contained in cylinders a four-digit code number [1] (FTSC). This code number categorizes the gas or gas mixture in terms of its physical-chemical properties and/or flammability, toxicity, state and corrosiveness (see clause A.1).

The FTSC code enables a gas or gas mixture to be assigned to one of the 15 "compatible" gas groups (see clause A.2). Valve outlet connections are allocated to each group (see clause 6).

4.1 Pure gases

Pure gases are assigned to one of the first fourteen gas groups, group 15 being reserved for specific gas mixtures. It is recognized that a "pure gas" may contain some impurities, but it is intended that this should not affect the valve outlet selection.

Five groups are assigned to individual named gases from which mixtures and other gases are excluded. These five groups are as follows:

a) group 2 — carbon dioxide;

b) group 5 — air;

c) group 10 — oxygen;

d) group 11 — nitrous oxide;

e) group 14 — acetylene.

4.2 Gas mixtures

4.2.1 Definition

For the purposes of this International Standard, a gas mixture is defined as an intentional combination of two or more gases which may be either in the gaseous phase or liquefied under pressure when in a gas cylinder.

NOTE — This International Standard does not attempt to identify gas mixtures which may be safely and satisfactorily prepared; this is the responsibility of the gas manufacturer. It does not describe any methods or techniques for preparing gas mixtures.

4.2.2 Assignment of a gas mixture to a group

NOTE — Account should be taken of national regulations concerning gas mixtures that are approved for manufacture.

The principle of allocation of a four-digit numerical code to gas mixtures is the same as that for pure gases. However, the allocation of a code to a gas mixture, allowing the assignment of this mixture to one of the groups of gases and gas mixtures depends on the chemical and toxicological properties of the components, with the exception of the flammability and oxipotential where these properties in the final mixture determine the group to which the gas mixture belongs.

Gas mixtures shall be grouped according to the following principles:

a) gas mixtures comprising components, all of which are pure gases in the same group, shall be assigned to that group;

b) gas mixtures comprising components which have been assigned, as pure gases, to different groups shall be allocated to a group as follows:

1) group 9 — if the mixture is spontaneously flammable,

2) group 7 — if the mixture comprises group 7 corrosive and flammable components,

3) group 8 — if the mixture comprises group 8 toxic, corrosive and flammable components,

4) group 12 — if the final mixture has an oxipotential greater than that of air,

5) group 4 — for all other mixtures;

c) gas mixtures free from toxic components, subject to decomposition or polymerization, shall be assigned to group 13;

d) flammable gas mixtures free from toxic components shall be assigned to group 6;

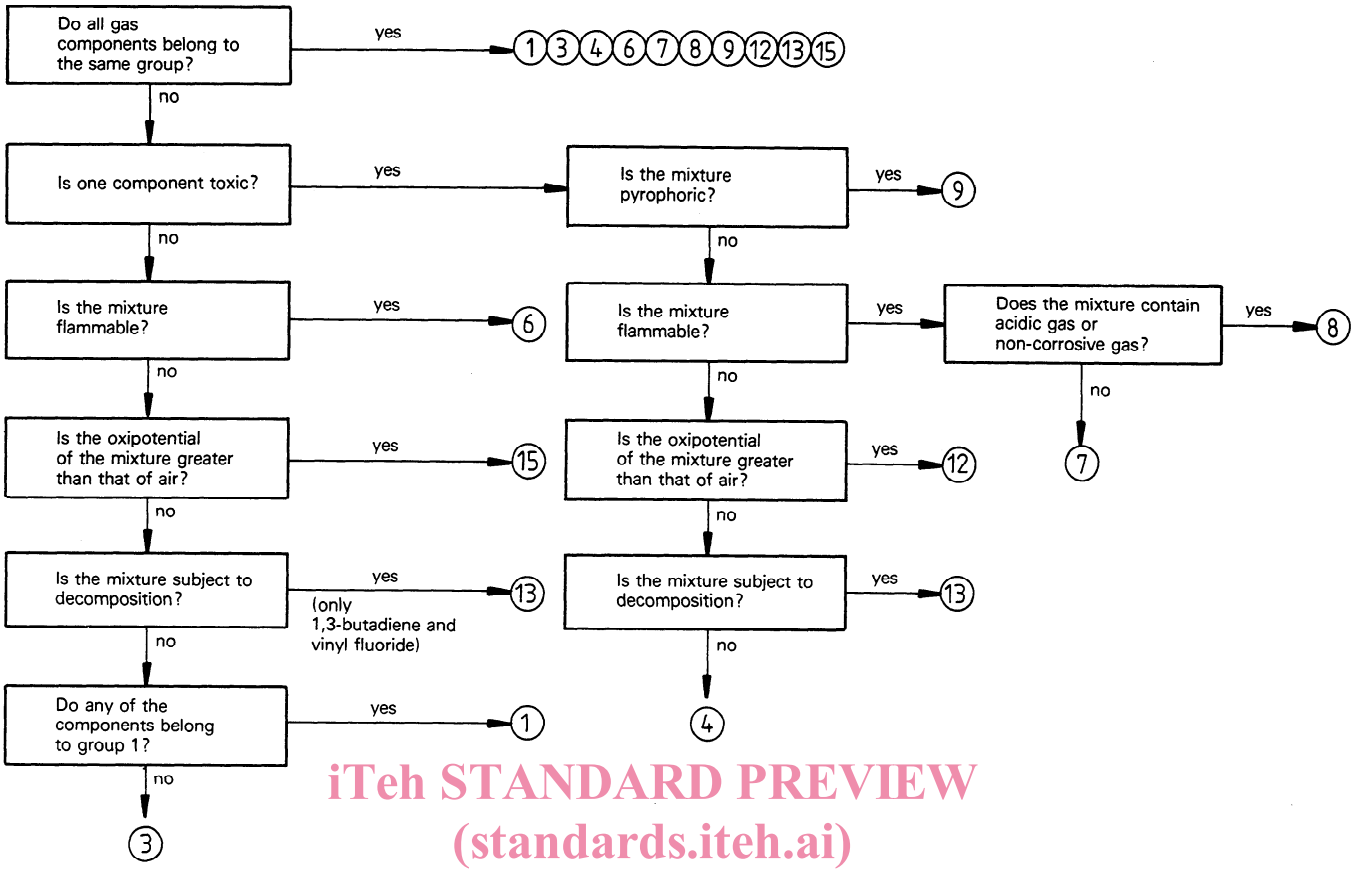
e) gas mixtures having an oxipotential greater than that of air but which are free from toxic components shall be assigned to group 15;

f) non-toxic, non-flammable, gas mixtures having an oxipotential equal to or less than that of air, and comprising components from group 1, shall be assigned to group 1;

g) non-toxic, non-flammable, gas mixtures having an oxipotential equal to or less than that of air, and which are free from group 1 gases, shall be assigned to group 3.

A flow chart to facilitate the allocation of a gas mixture to a gas group is given in figure 1.

1) Attention is drawn to the fact that the only purpose of the numerical code is to group compatible gases together in order that the particular valve outlet assigned to each group may be selected. The code is only applicable for the valve outlet selection used in this International Standard and is not intended as an identification code.



The numerals in circles indicate the group to which the gas mixture belongs.

Figure 1 — Flow chart to facilitate the allocation of a gas mixture to a gas group

5 Determination of connection

5.1 Connection

A connection is a mechanical device which conveys gas via a gas cylinder valve to a filling or use system without leakage to the atmosphere. It shall be robust and able to withstand repeated connection and disconnection. It shall be designed such that it can only be used for the group of gases to which it is allocated.

A connection comprises a minimum of three parts (see figure 2):

a) a valve outlet — the part of the cylinder valve through which gas is discharged;

b) a connector — the part of the filling or use system through which the gas is conveyed;

c) a union nut — the means by which the connector is secured to the valve outlet and by which the seal is ensured.

The design of the double-recess type of connection is derived from the "step index principle".

The step index system comprises a double recess (faucet) into the valve outlet, into which a spigot of two differing diameters is designed to fit (see the figure in table 1). The lengths of the recesses and spigots are the same for each connection but the diameters vary depending on the group of gases for which the recess or spigot is designed. The form, dimensions and tolerances are illustrated in table 1 which provides for 42 non-interchangeable connections.

Three nominal diameters 24 mm, 27 mm and 30 mm have been adopted for the connections (see annex B). The thread is a Whitworth thread with a pitch of 2 mm (see figure 3).

Internal "double-recess step index connections" are not used because of their excessive size.

5.2 Leak tightness

Leak tightness is achieved by the sealing end of the connector bearing on the conical part of the valve outlet connection, this seal being maintained by the union nut.

Two methods for ensuring a gas-tight seal are illustrated in annex C. These methods are

a) a metal-to-metal bull-nose joint — the gas-tight seal is maintained by applying a high torque, using a wrench if necessary (see figure C.1), and

b) an elastomer O-ring seal which is fitted to a bull-nose or biconical connection end — the gas-tight seal is maintained using a low torque (see figure C.2).

Other methods of sealing may be adopted.

No details of the construction of the outside surface are given since this will be subject to the method adopted for applying the sealing torque (i.e. with a wrench or by hand).

This International Standard does not specify the choice of materials; however, it is necessary to employ materials for the O-ring, valve and valve connector which are compatible with the gas content in the cylinder and the service for which they are intended.

6 Allocation of connections

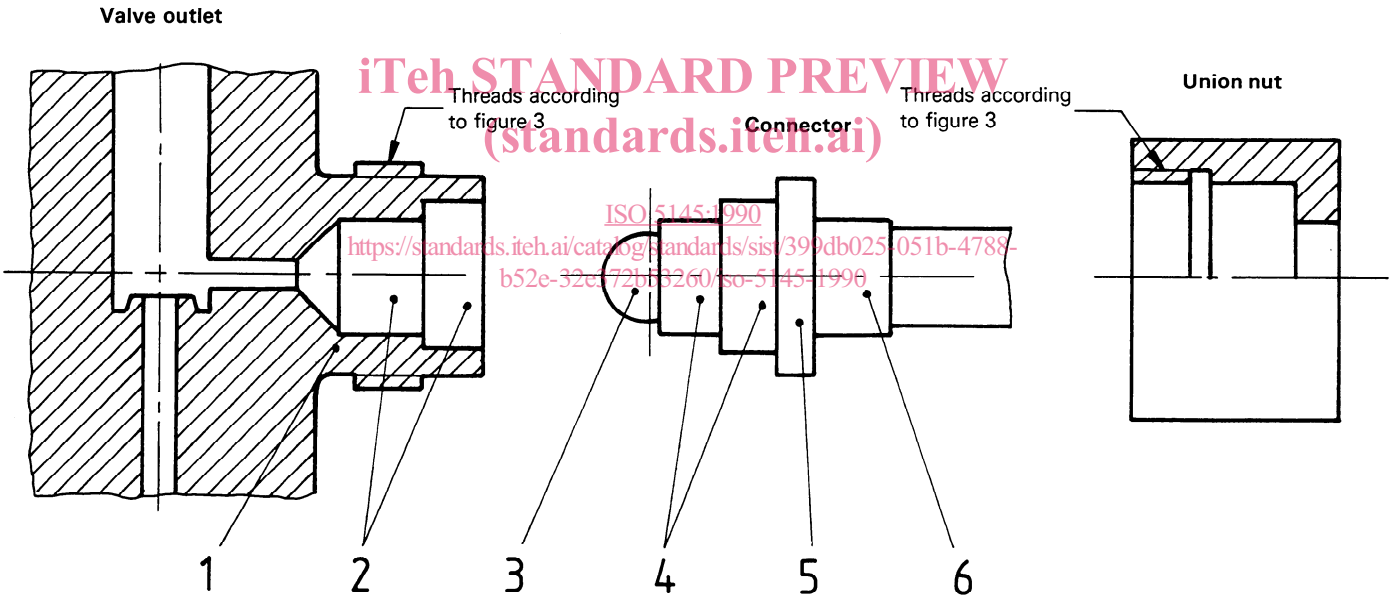
The allocation of 21 connections from the 42 that are available is shown in table 2.

Table 3 shows that each group of gases has been established in accordance with

a) the FTSC code;

b) the gases for other groups which may be component parts of the mixture of which the final properties are similar to those of that group;

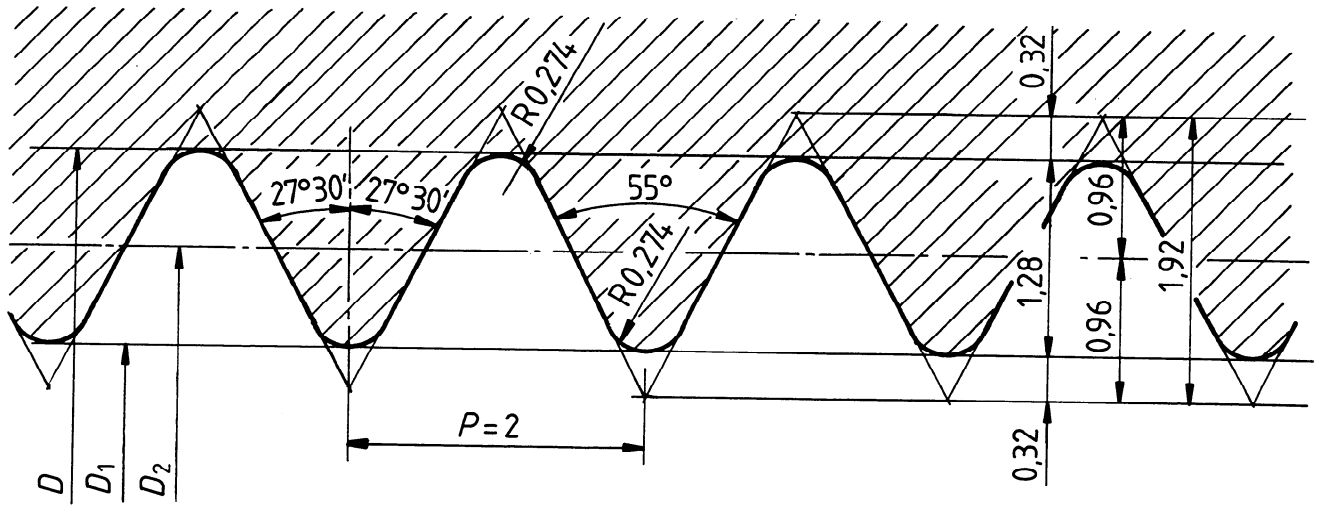
c) the connection(s) which is (are) allocated to the group.



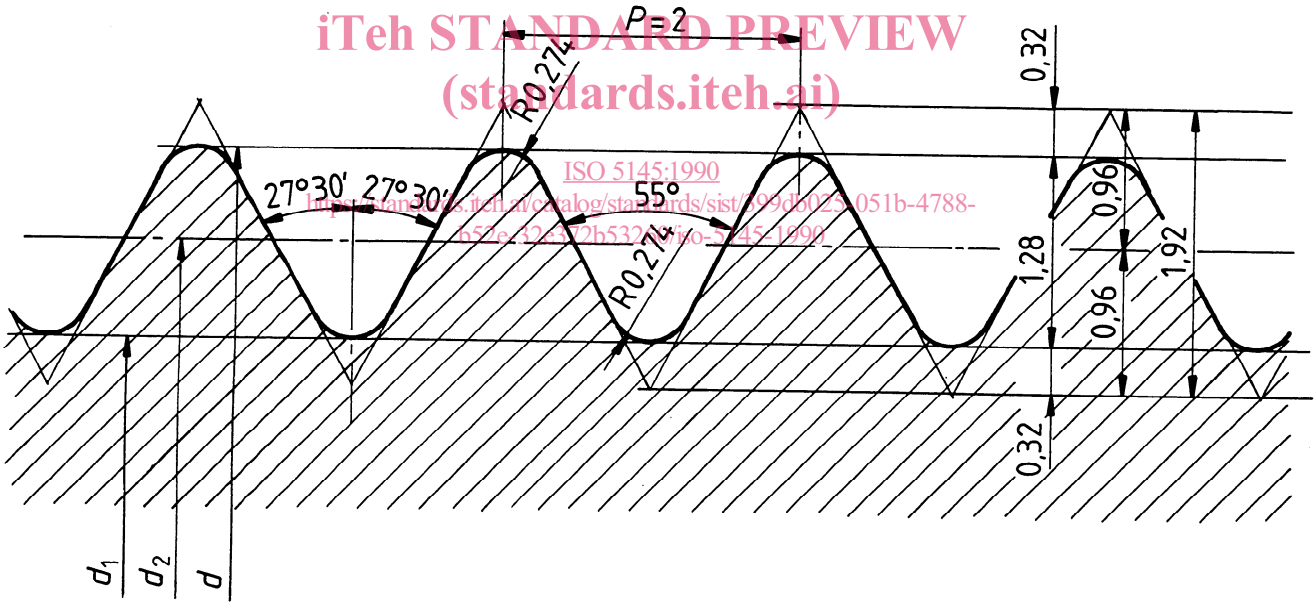
Reference	English	French	German
1	Valve outlet	Raccord de sortie	Seitenstutzen
2	Faucet	Matrice	Matrize
3	Nose	About	Kugelkopf
4	Spigot	Poinçon	Stempel
5	Shoulder	Épaulement	Schulterwehr
6	Shank	Hampe	Stiel

Figure 2 — Connection

Dimensions in millimetres



a) Internal thread



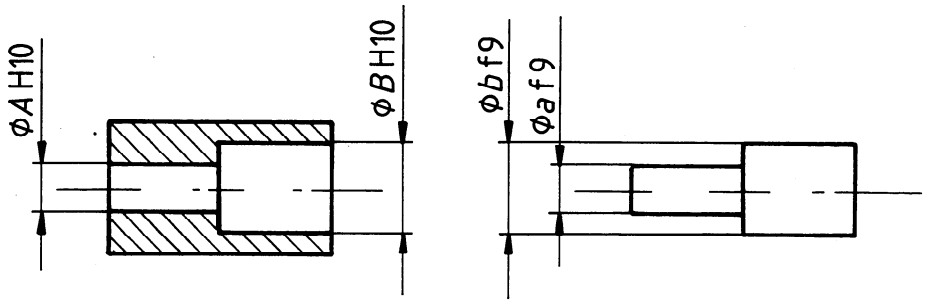
b) External thread

Nominal diameter = major diameter	D, d	24	27	30
Pitch diameter	D_2, d_2	22,72	25,72	28,72
Minor diameter	D_1, d_1	21,44	24,44	27,44

Figure 3 — Whitworth thread

Table 1 — Non-interchangeable combinations $A + B$

Dimensions in millimetres



Faucet Spigot

Nominal diameter of the connection = nominal thread diameter D, d	Constant $A + B$						Available combinations		
	28		32		36				
	A	B	A	B	A	B	Right-hand thread	Left-hand thread	Total of right- and left-hand threads
24	11,2 11,9 12,6 13,3 14	16,8 16,1 15,4 14,7 14	—	—	—	—	5	5	10
27	—	—	11,8 12,5 13,2 13,9 14,6 15,3 16	20,2 19,5 18,8 18,1 17,4 16,7 16	—	—	7	7	14
30	—	—	—	—	12,4 13,1 13,8 14,5 15,2 15,9 16,6 17,3 18	23,6 22,9 22,2 21,5 20,8 20,1 19,4 18,7 18	9	9	18
Total number of combinations							21	21	42

NOTE — For the tolerances, see ISO 286.

Table 2 — Allocation of valve outlets for gases and gas mixtures

Nominal diameter of the connection																
24					27					30						
A-B combination	Left-hand thread		Right-hand thread		*A-B* combination	Left-hand thread		Right-hand thread		*A-B* combination	Left-hand thread		Right-hand thread			
	Group (application) [1]	Gas or gas mixture (FTSC code)	Group (application) [1]	Gas or gas mixture (FTSC code)		Group (application) [1]	Gas or gas mixture (FTSC code)	Group (application) [1]	Gas or gas mixture (FTSC code)		Group (application) [1]	Gas or gas mixture (FTSC code)	Group (application) [1]	Gas or gas mixture (FTSC code)		
mm					mm					mm						
11,2-16,8	8 (M)	Cyclopropane (2200)	3 (M)	Helium (0150; 0160)	11,8-20,2			15 (M)	Air-oxygen mixture	12,4-23,6			3 (M)	Helium-oxygen mixture (O_2 < 20 %)		
11,9-16,1			(M)	Special mixtures	12,5-19,5					13,1-22,9			15 (M)	Oxygen-helium mixture (He < 80 %)		
12,6-15,4			15 (M)	78 % N_2-22 % O_2 mixture	13,2-18,8			15 (M)	50 % O_2-50 % N_2O mixture	13,8-22,2			15 (M)	O_2-CO_2 mixture (CO_2 < 7 %)		
13,3-14,7	6 (I)	(2150; 2160)	3 (I)	(0150; 0160)	13,9-18,1	13 (I)	(5100; 5200; 5300; 5301; 5350; 5360)	5 (I, M)	Air (1150; 1160)	14,5-21,5			15 (M)	CO_2-O_2 mixture (CO_2 > 7 %)		
			3 (M)	N_2 only												
14-14	6 (I)	Hydrogen (2150; 2160)	10 (I, M)	Oxygen (4150; 4160)	14,6-17,4	9 (I)	(3300; 3310; 3350)	4 (I)	(0200; 0201; 0203; 0213; 0300; 0303; 0253; 0263)	15,2-20,8						
					15,3-16,7	8 (I)	(2250; 2260)	11 (I, M)	Nitrous oxide (4110)	15,9-20,1	8 (I)	(2200; 2201; 2203; 2300; 2301;)				
					16-16	6 (I)	Commercial butane and propane	2 (I, M)	Carbon dioxide	16,6-19,4	7 (I)	(0202; 2202)				
										17,3-18,7	6 (I)	(2100; 2110) (except H_2 and commercial butane and propane)				
										18-18	14 (I)	Acetylene (5130)	1 (I)	(0100)		

1) I, Industrial; M, Medical.