

Flanges for waveguides —

Part 2: Relevant specifications for flanges for ordinary rectangular waveguides

The European Standard EN 60154-2:1997 with the incorporation of amendment A1:1997 has the status of a British Standard

ICS 33.120.10

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- British Plastics Federation
- British Telecommunications
- Crown Agents for Oversea Governments and Administrations
- Electric Cable Makers Confederation
- Home Telephone Cable Makers Association (1960)
- Ministry of Defence
- Society of British Aerospace Companies Limited

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Electronic Engineering Association
- National Supervising Inspectorate (Telecommunication Engineering and Manufacturing)
- Coopted member

This British Standard, having been prepared under the direction of the Electronic Components Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1985

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Amendments issued since publication

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National foreword

This Part of BS EN 60154 has been prepared by Subcommittee EPL/46/2 (formerly ECL/6), and is the English language version of EN 60154-2:1997, *Flanges for waveguides — Part 2: Relevant specifications for flanges for ordinary rectangular waveguides*, including Amendment A1:1997, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 60154-2:1980, including Amendment A1:1997, published by the International Electrotechnical Commission (IEC).

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 66, 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.

English version

Flanges for waveguides Part 2: Relevant specifications for flanges for ordinary rectangular waveguides

(Includes amendment A1:1997)
(IEC 60154-2:1980 + A1:1997)

Brides pour guides d'ondes
Partie 2: Spécifications particulières de brides
pour guides d'ondes rectangulaires normaux
(Inclut l'amendement A1:1997)
(CEI 60154-2:1980 + A1:1997)

Flansche für Hohlleiter
Teil 2: Allgemeine Anforderungen an Flansche
für Rechteck-Hohlleiter
(Enthält Änderung A1:1997)
(IEC 60154-2:1980 + A1:1997)

This European Standard and amendment A1 were approved by CENELEC on 1997-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of the International Standard IEC 60154-2:1980, prepared by SC 46B, Waveguides and their accessories, of IEC TC 46, Cables, wires, waveguides, R.F connectors, and accessories for communication and signalling, was approved by CENELEC as HD 129.2 S2 on 1981-07-06.

This Harmonization Document was submitted to the formal vote for conversion into a European Standard and was approved by CENELEC as EN 60154-2 on 1997-07-01.

The following date was fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-06-01

Foreword to amendment A1

The text of document 46B/218/FDIS, future amendment 1 to IEC 60154-2:1980, prepared by SC 46B, Waveguides and their accessories, of IEC TC 46, Cables, wires, waveguides, R.F. connectors, and accessories for communication and signalling, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60154-2:1997 on 1997-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn. (dow) 1998-06-01

Introduction to IEC amendment 1

This amendment give the values of surface finish to be applied to the contact face of flanges.

Two sets of values are shown, one being the arithmetic mean and the other peak to peak. They both refer to the same level of finish. This is explained in ISO 468¹⁾.

Arithmetic mean:

- For flanges size down to R 320 0,8 µm
- For flanges size below R 320 0,4 µm

Peak to peak:

- For flanges size down to R 320 6,3 µm
- For flanges size below R 320 3,2 µm

¹⁾ ISO 468:1982, Surface roughness — Parameters, their values and general rules for specifying requirements

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Information on reflection

The reflections at the flange joint are of three kinds:

- a) those caused by the allowed deviations on the internal dimensions of the waveguides;
- b) those caused by lateral displacements of the two flange assemblies;
- c) those caused by the chokes (in the following, these reflections are not taken into account).

When the deviations on the dimensions of the waveguides (according to IEC Publication 153-2, Hollow Metallic Waveguides, Part 2: Relevant Specifications for Ordinary Rectangular Waveguides) and of the assemblies (according to this standard) sum up to cause maximum lateral displacement and maximum changes of the waveguide internal dimensions, the theoretical maximum reflection may be calculated from:

$$\text{reflection loss} = 10 \log_{10} \frac{1}{\left[\frac{\lambda_g^2 \Delta a}{4a^3} + \frac{\Delta b}{b} \right]^2 + \left[\frac{4.9348 \lambda_g (\Delta a')^2}{a^3} - \frac{7.8957 (\Delta b')^2}{\lambda_g b} \right]^2} \text{ dB}$$

where:

a = basic inside width of the waveguide

b = basic inside height of the waveguide

λ_g = waveguide wavelength

Δa and Δb are the waveguide internal deviations

$\Delta a'$ and $\Delta b'$ are displacements of the waveguide axes

NOTE 1 The first term within brackets represents the worst case reflection component at a flange joint caused by changes of the waveguide internal dimensions.

NOTE 2 The second term within brackets represents the reflection component at a flange joint caused by the displacement of the flange assemblies.

At the high end of the waveguide frequency band, the reflection component is maximum when the displacement exists in the short wall direction only.

At the low end of the waveguide frequency band, the reflection component is maximum when the displacement exists in the long wall direction only.

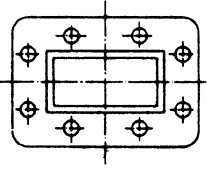
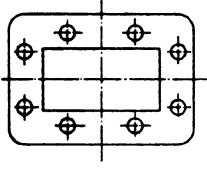
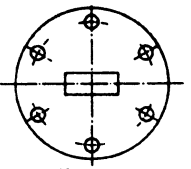
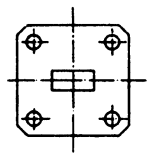
NOTE 3 The maximum reflection at the high end of the waveguide frequency band is smaller than the maximum reflection at the low end of the band for the same magnitude of displacement.

NOTE 4 The "reflection loss" in decibels is given as a positive quantity.

The worst "reflection loss" in (positive) decibels for waveguides R 14 to R 500

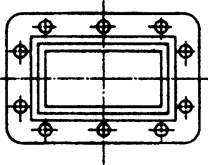
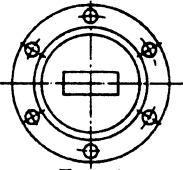
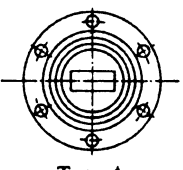
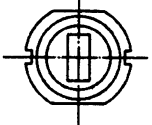
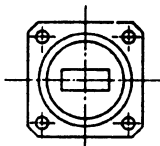
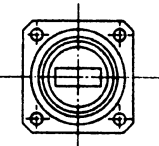
Frequency	R 14 to R 180	R 220	R 260	R 320	R 400	R 500
$f = 1.25 f_c$	42.4 dB to 41.9 dB	41.4 dB	41.0 dB	39.3 dB	37.4 dB	35.9 dB
$f = 1.50 f_c$	45.0 dB to 44.3 dB	43.7 dB	43.6 dB	41.9 dB	40.0 dB	38.5 dB
$f = 1.90 f_c$	46.4 dB to 45.5 dB	44.9 dB	45.0 dB	43.3 dB	41.4 dB	39.9 dB

Survey of types

No choke, no gasket goove					
Wave-guide	Flange	Wave-guide	Flange	Wave-guide	Flange
R 3	 Type D	R 3	For subsequent study	R 3	
R 4		R 4		R 4	
R 5		R 5		R 5	
R 6		R 6		R 6	
R 8		R 8		R 8	
R 9		R 9		R 9	
R 12		R 12		R 12	
R 14		R 14		R 14	
R 18		R 18		R 18	
R 22		R 22		R 22	
R 26		R 26		R 26	
R 32		R 32	 Type E	R 32	 Type A
R 40		R 40		R 40	
R 48		R 48		R 48	
R 58		R 58		R 58	
R 70		R 70		R 70	
R 84		R 84		R 84	
R 100		R 100		R 100	
R 120		R 120	For subsequent study	R 120	 Type B
R 140		R 140		R 140	
R 180		R 180		R 180	
R 220		R 220		R 220	
R 260		R 260		R 260	
R 320		R 320		R 320	
R 400		R 400		R 400	
R 500		R 500		R 500	
R 620		R 620		R 620	
R 740		R 740		R 740	
R 900		R 900		R 900	
R 1200		R 1200		R 1200	
R 1400		R 1400		R 1400	
R 1800		R 1800		R 1800	
R 2200		R 2200		R 2200	
R 2600		R 2600		R 2600	

The sketches above are only examples; appropriate drawings show the exact number of holes and their position.

Survey of types

Gasket groove; no choke				Gasket groove and choke	
Wave-guide	Flange	Wave-guide	Flange	Wave-guide	Flange
R 3	 Type D	R 3	 Type A	R 3	 Type A
R 4		R 4		R 4	
R 5		R 5		R 5	
R 6		R 6		R 6	
R 8		R 8		R 8	
R 9		R 9		R 9	
R 12		R 12		R 12	
R 14		R 14		R 14	
R 18		R 18		R 18	
R 22		R 22		R 22	
R 26		R 26		R 26	
R 32		R 32		R 32	
R 40		R 40		R 40	
R 48		R 48		R 48	
R 58		R 58		R 58	
R 70		R 70		R 70	
R 84	 Type C	R 84	 Type B	R 84	 Type B
R 100		R 100		R 100	
R 120		R 120		R 120	
R 140		R 140		R 140	
R 180		R 180		R 180	
R 220		R 220		R 220	
R 260		R 260		R 260	
R 320		R 320		R 320	
R 400		R 400		R 400	
R 500		R 500		R 500	
R 620		R 620		R 620	
R 740		R 740		R 740	
R 900		R 900		R 900	
R 1200		R 1200		R 1200	
R 1400		R 1400		R 1400	
R 1800		R 1800		R 1800	
R 2200		R 2200		R 2200	
R 2600		R 2600		R 2600	

The sketches above are only examples; appropriate drawings show the exact number of holes and their position.

Clause No.	Item
1	General
1.1	<i>Standardized types</i> The series of flanges for ordinary rectangular waveguides covered by this standard are shown in Table I to Table V and Figure 12C to Figure 12I. Flat flanges can be used with metal plate air seal gaskets or shims (an example is shown in Figure 12A).
1.2	<i>Flange designation</i> Waveguide flanges covered by this standard shall be indicated by a reference number comprising the following information: a) The number of the present IEC Publication (154). b) The letters "IEC". c) A dash. d) A letter relating to the basic construction of the flange, Flange style, viz: - P = a flange having a gasket groove but no choke groove (formerly called pressurizable). - C = a choke flange with a gasket groove (formerly called choke, pressurizable). - U = a flange having neither a gasket groove nor a choke groove (formerly called unpressurizable*). e) A letter for the flange type according to the drawing. Flanges with the same letter and of the same waveguide size can be mated. f) The letter and number of the waveguide for which the flange is designed. <i>Example:</i> 154 IEC — UDR 120 denotes a flange without a gasket groove of Type D, for use with rectangular waveguide 153 IEC — R 120. *All flat flanges shall have this designation, including those that can be made pressure tight by using gaskets as indicated in Sub-clause 1.1.
2	Mechanical requirements
2.1	<i>Dimensions</i>
2.1.1	<i>Alignment holes</i> Holes which are intended as alignment holes are clearly indicated in the drawings and shall be precision drilled. These alignment holes shall be those which are the nearest to the narrow side of the waveguide. Holes which are not intended as alignment holes may be less accurately located than are the alignment holes, but must be of correspondingly larger diameter to ensure mating of the flanges.
2.1.2	<i>Shank diameter of fixing bolts used for alignment</i> The basic values and deviations thereon are specified in Table I to Table V and Figure 12C to Figure 12I.

Clause No.	Item																	
2.1.3	<i>Relation between shank and alignment hole diameters</i> For each individual flange, the proper mating of two flanges is ensured by specifying: a) the location and basic diameters of the holes and the deviations thereon; b) the basic diameters of the shanks of coupling bolts with the appropriate fit. For practical reasons the following ISO fits are recommended: <table><tr><th>Type of flanges</th><th>Range of sizes</th><th>Fit</th></tr><tr><td rowspan="4">Rectangular flanges for type R waveguide</td><td>R 12 and larger</td><td>All</td></tr><tr><td>R 14 — R 32</td><td>A9</td></tr><tr><td>R 40 — R 70</td><td>B9</td></tr><tr><td>R 84 and smaller</td><td>C9</td></tr><tr><td>Circular flanges for type R waveguide</td><td>All</td><td>B9</td></tr></table> NOTE When electrical requirements make it necessary, the hole position tolerance may be reduced and the hole diameter fit to the shank should be improved accordingly. Actual values are shown in the respective drawings and tables.	Type of flanges	Range of sizes	Fit	Rectangular flanges for type R waveguide	R 12 and larger	All	R 14 — R 32	A9	R 40 — R 70	B9	R 84 and smaller	C9	Circular flanges for type R waveguide	All	B9		
Type of flanges	Range of sizes	Fit																
Rectangular flanges for type R waveguide	R 12 and larger	All																
	R 14 — R 32	A9																
	R 40 — R 70	B9																
	R 84 and smaller	C9																
Circular flanges for type R waveguide	All	B9																
2.1.4	<i>Overall dimensions and thickness of flanges</i> The values quoted are taken from established designs and it should be noted that these values are based in general on the use of brass, but for other materials other values might be more appropriate.																	
2.1.5	<i>Surface roughness of contact area of flat flanges</i> For subsequent study.																	
2.1.6	<i>Flatness of contact area</i> The flatness of contact area shall be better than the values given in the following table: <table><tr><th rowspan="2">Range of sizes</th><th colspan="2">Requirement</th></tr><tr><th>(mm)</th><th>(in)</th></tr><tr><td>R 12 and larger dimensions</td><td colspan="2">For subsequent study</td></tr><tr><td>R 14 — R 26</td><td>0.05</td><td>0.002</td></tr><tr><td>R 32 — R 180</td><td>0.02</td><td>0.0008</td></tr><tr><td>R 220 and smaller dimensions</td><td colspan="2">For subsequent study</td></tr></table>	Range of sizes	Requirement		(mm)	(in)	R 12 and larger dimensions	For subsequent study		R 14 — R 26	0.05	0.002	R 32 — R 180	0.02	0.0008	R 220 and smaller dimensions	For subsequent study	
Range of sizes	Requirement																	
	(mm)	(in)																
R 12 and larger dimensions	For subsequent study																	
R 14 — R 26	0.05	0.002																
R 32 — R 180	0.02	0.0008																
R 220 and smaller dimensions	For subsequent study																	
2.1.7	<i>Perpendicularity of the axis of the holes</i> The perpendicularity of the axis of the holes to the contact area of the flange shall be $90 \pm 1/4^{\circ}$.																	

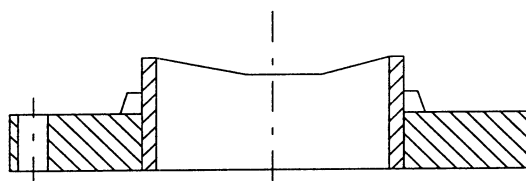
Clause No.	Item
2.2	<i>General requirements for assemblies</i>
2.2.1	<i>Positioning of the holes</i> Positioning of the holes shall be based on the theoretical symmetry lines of the inside cross-section of the waveguide unless otherwise indicated.
2.2.2	<i>Perpendicularity of the contact area</i> The perpendicularity of the contact area of the flange to the axis of the waveguide shall be $90 \pm 1/4^\circ$.
2.3	<i>Additional requirements for unmounted flanges</i>
2.3.1	<i>General</i> The drawings shown are for mounted flanges. In the individual drawings, one or more methods are shown by way of example for the mounting of flanges to the waveguide. This, however, does not exclude socket or through-type methods of mounting if the actual dimensions allow this. For flanges having a choke groove, the socket type method should be used. In the case of flange sizes PDR 3 to PDR 12 inclusive and UDR 3 to UDR 12 inclusive, the particular cross-section of the flanges to be used is left to the discretion of the individual user. For the grooved flanges, a rectangular gasket is employed. An example is shown in Figure 12B. The dimensions of the grooves and gaskets for flange sizes PDR 3 to PDR 12 inclusive have been left for subsequent study. The flanges are designed for copper alloys, aluminium alloys and magnesium alloys. The particular type of alloy and finish is to be specified by the user. Unless otherwise specified, means shall be provided to reduce to a minimum galvanic or other corrosive action. The particular type of gasket and gasket material is to be specified by the user. NOTE For pre-drilled flanges the positioning of the holes should be based on the theoretical symmetry lines of the flange aperture.
2.3.2	<i>Shape of aperture</i> The requirements for the dimensions of the aperture in the flange only apply to that part which effects mating between the flange and the waveguide. The basic dimensions of the flange aperture shown in Table I are equal to the basic outside dimensions of the tubes according to IEC Publication 153-2. The deviations for the dimensions of the aperture will depend on the materials and assembly methods and shall, therefore, be determined by agreement between purchaser and manufacturer. NOTE For socket-types, the front aperture shall have dimensions within the deviations specified for the inside cross-section of the appropriate size of waveguide.
2.3.3	<i>Ordering information</i> When ordering unmounted flanges, an allowance should be made on certain of the specified dimensions to cover the effects of possible machining after mounting.

Type de bride
Flange type A

154 IEC — .AR 32-40

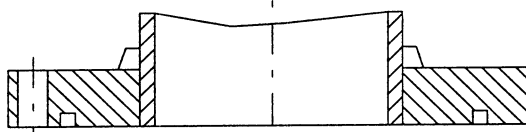
Figure 1

Bride modèle U
154 IEC - UAR 32-40
Section transversale A-A

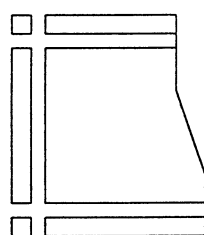
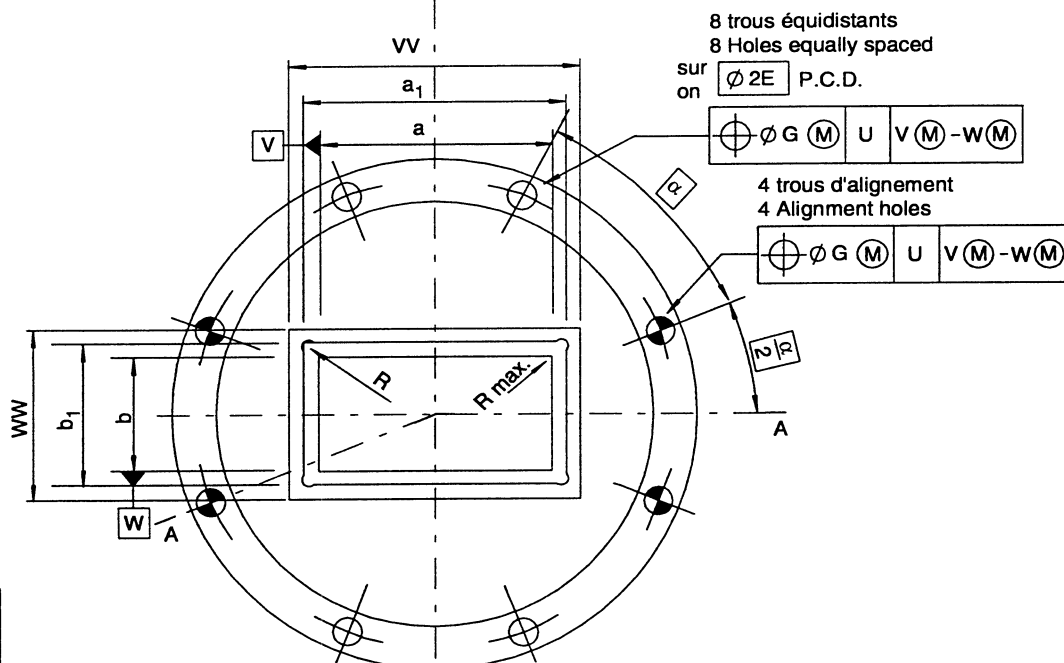


Flange type U
154 IEC - UAR 32-40
Cross-section A-A

Bride modèle P
154 IEC - PAR 32-40
Section transversale A-A

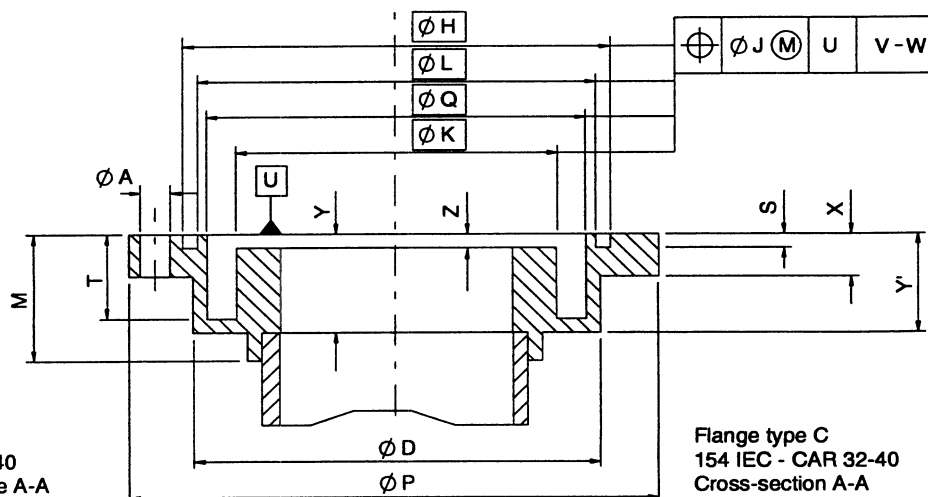


Flange type P
154 IEC - PAR 32-40
Cross-section A-A



Option pour l'usinage arrière
Alternative backslot construction

Bride modèle C
154 IEC - CAR 32-40
Section transversale A-A



IEC 804/97

Mode de projection: premier dièdre
First angle projection



Documents

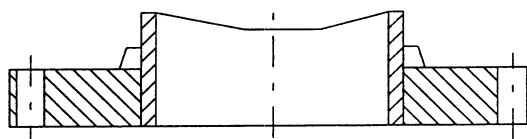
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Type de bride
Flange type A

154 IEC — .AR 48

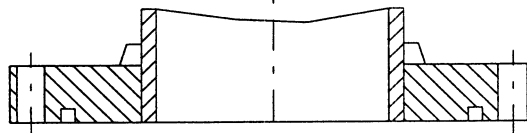
Figure 2

Bride modèle U
154 IEC - UAR 48
Section transversale A-A

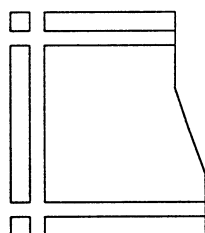
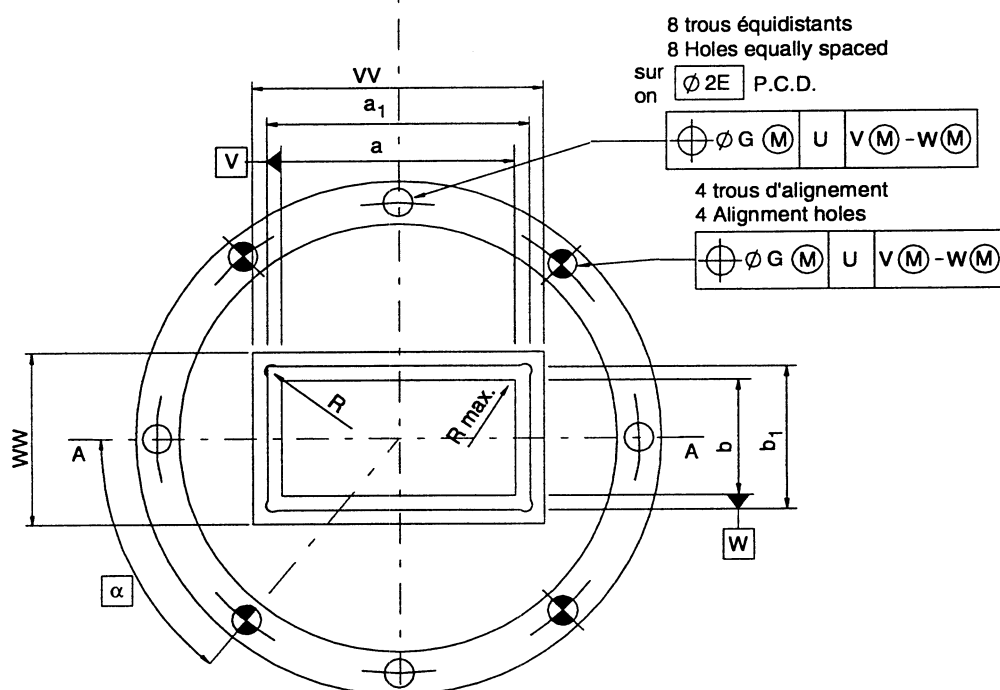


Flange type U
154 IEC - UAR 48
Cross-section A-A

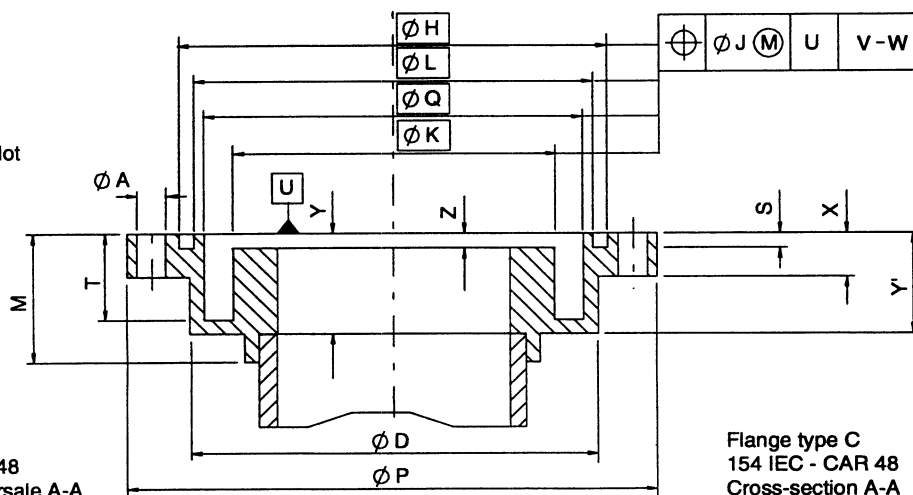
Bride modèle P
154 IEC - PAR 48
Section transversale A-A



Flange type P
154 IEC - PAR 48
Cross-section A-A



Option pour
l'usinage arrière
Alternative backslot
construction



Bride modèle C
154 IEC - CAR 48
Section transversale A-A

Flange type C
154 IEC - CAR 48
Cross-section A-A

IEC 805/97

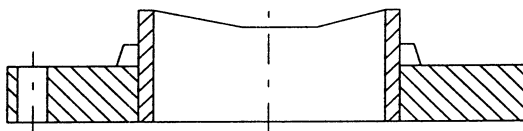
Mode de projection: premier dièdre
First angle projection

Type de bride
Flange type A

154 IEC — .AR 58-70

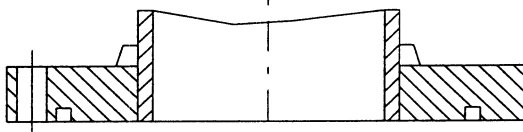
Figure 3

Bride modèle U
154 IEC - UAR 58-70
Section transversale A-A

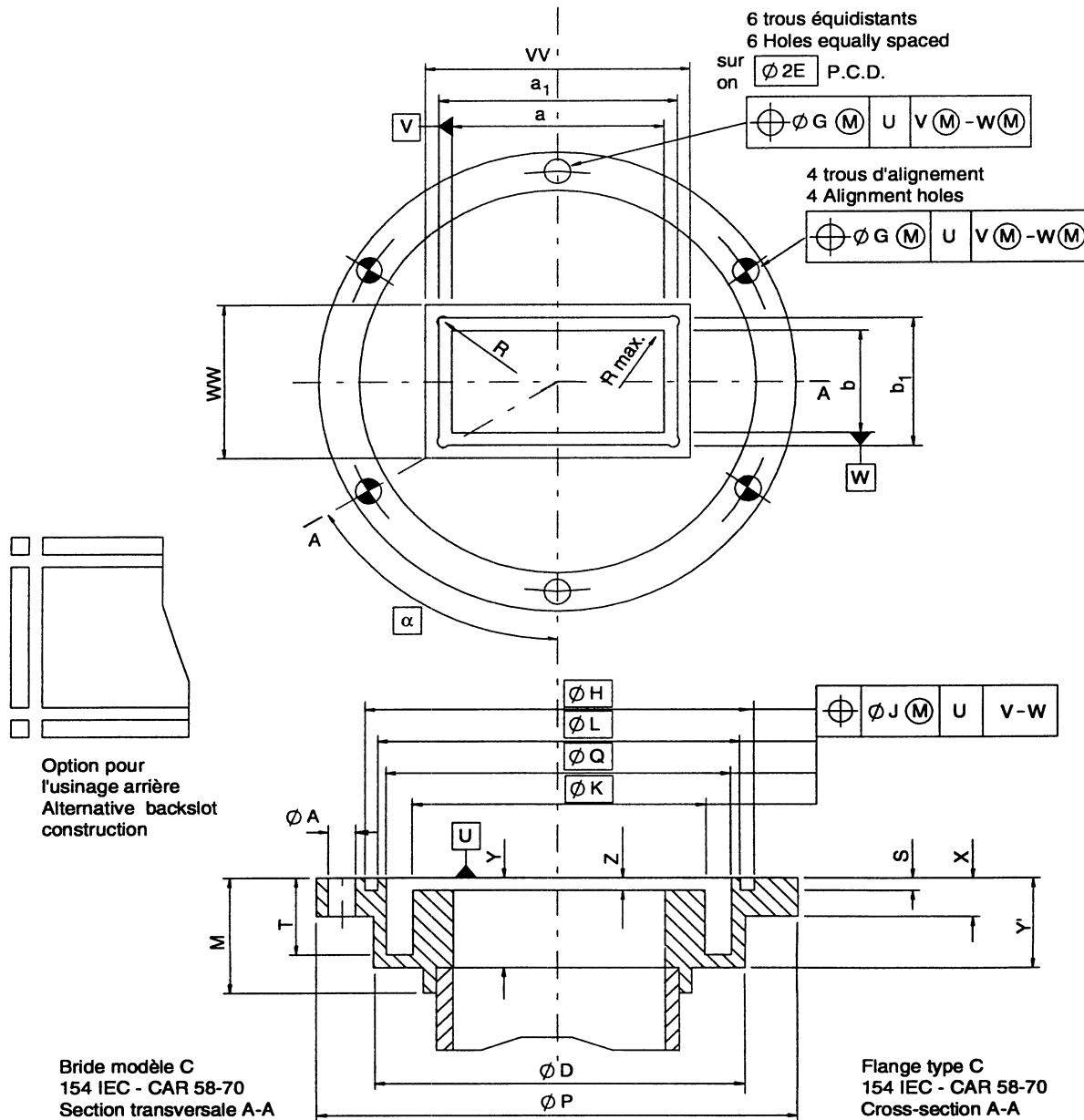


Flange type U
154 IEC - UAR 58-70
Cross-section A-A

Bride modèle P
154 IEC - PAR 58-70
Section transversale A-A



Flange type P
154 IEC - PAR 58-70
Cross-section A-A



Mode de projection: premier dièdre
First angle projection

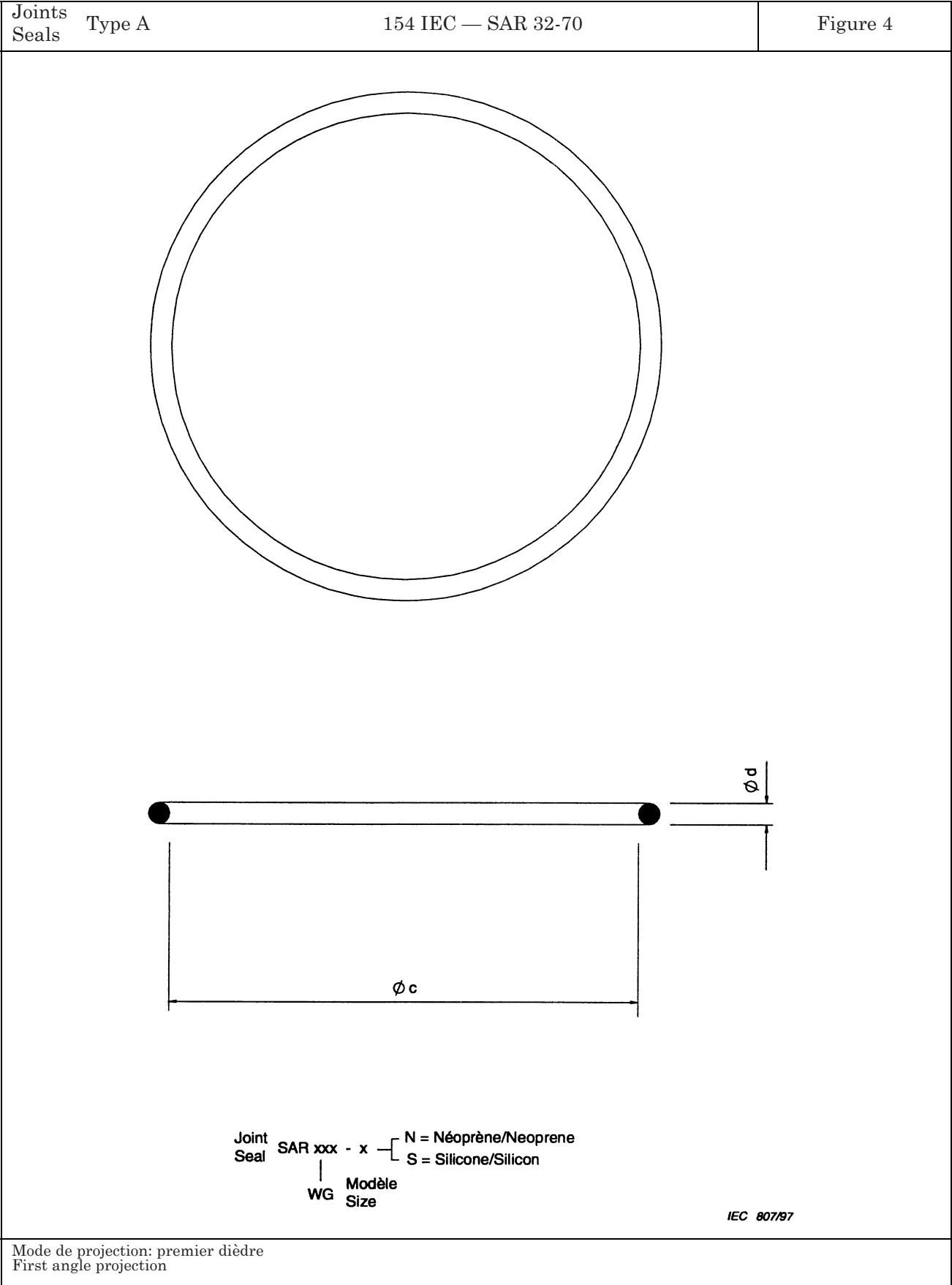


Table 1 — Flange type A

Table 1a — Dimensions of type A flanges for ordinary rectangular waveguides

Dimensions en millimètres/Dimensions in millimetres

Type PAR — sans rainure piège mais comportant une rainure pour joint without choke; with gasket groove																			
Type UAR — sans rainure piège ni rainure pour joint without choke or gasket groove																			
Désignation de type de bride pour guide d'ondes 154 IEC-... Type designation of waveguide flanges 154 IEC-...	A utiliser avec guide d'ondes 153 IEC-... To be used with waveguide 153 IEC-...	F i g u r e	Trous d'alignement Alignment holes				1)	1)											
			Diamètre A nom Diameter A basic	Ajustement ISO ISO fit	Ecart Deviation		a_1	b_1	+ 0,40 Ø P	± 0,127 X	$R_{\max}$	α	Ø 2E	Ø G	± 0,05 Ø L	± 0,05 Ø H	Tolérance de position Ø J	± 0,10 S	
					Inférieur Lower	Supérieur Upper													
CAR	} { 32 40 48 58 70	R 32	1	6,350	B9	+ 0,150	+ 0,186	76,20	38,10	134,9	7,9	1,0	45°	120,65	0,10	100,66	112,95	0,10	4,42
		R 40	1	6,350	B9	+ 0,150	+ 0,186	61,42	32,33	115,6	7,9	1,0	45°	101,38	0,10	81,41	93,67	0,10	4,42
PAR		R 48	3	5,000	B9	+ 0,140	+ 0,170	50,80	25,40	92,2	6,4	0,8	45°	82,55	0,10	68,15	76,17	0,10	2,87
		R 58	5	5,000	B9	+ 0,140	+ 0,170	43,64	23,44	85,9	6,4	0,8	60°	76,20	0,10	59,92	68,55	0,10	2,87
UAR		R 70	5	5,000	B9	+ 0,140	+ 0,170	38,10	19,05	79,5	6,4	0,8	60°	69,85	0,10	51,08	60,63	0,10	2,87