5.1 Mirror coatings

Dielectric coatings

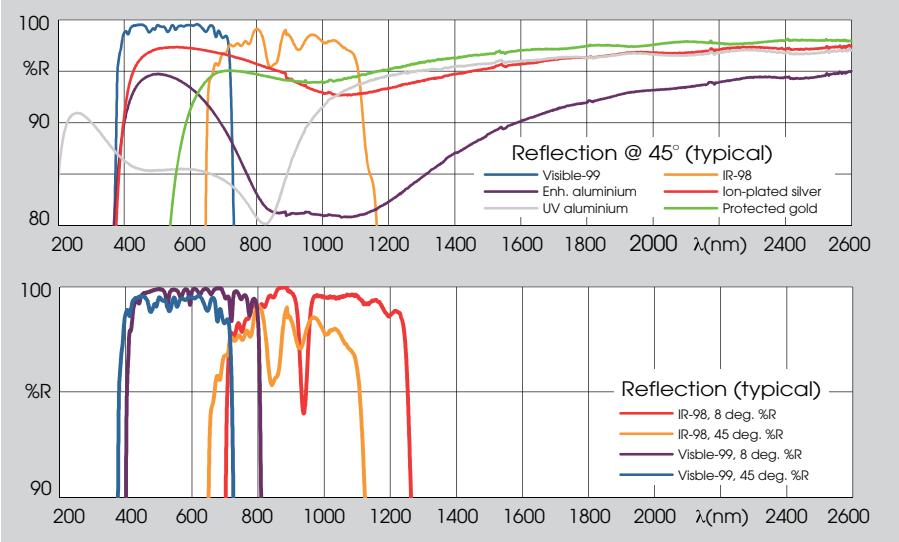
Dielectric mirror coatings are very hard and durable and, having negligible absorption, are suitable for high powers. Our coatings, being broad-band, are much more versatile than ordinary laser-mirror coatings; **Visible-99** has about 99% reflectance over 450-700nm, 0° to 45°. **IR-98** covers 700-1064nm with average reflectance of about 98.5% at 0° (97% at 45°); in particular, the reflectance at 1064nm is designed to be high for normal incidence.

Metal coatings

Metal coatings cover wider ranges than dielectrics and are lower in cost.

Ion-plated silver surpasses both aluminium and gold for reflectance over the range 420-1000nm, and is useful throughout the IR. The usual drawbacks of silver (softness and tarnishing) have been overcome by a hard dielectric coating applied by new technology, giving excellent chemical and mechanical protection.

Enhanced aluminium is a good general-purpose coating for the visible. The reflectance is considerably increased by the dielectric overcoat and peaks at about 94%. **Protected aluminium** (Al + SiOx), used on our elliptical and concave mirrors, is a versatile coating with 85-90% reflectance in the visible and also useful in the IR and UV.



UV aluminium is used for the UV (down to below 180nm) and **Protected gold** for the IR. Both these coatings are very delicate; to clean use an air-duster (p.85) or, if necessary, cotton-wool with acetone or other solvent.

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5.2 Precision plane mirrors

Customise

These mirrors of guaranteed flatness are suitable for interferometry and other demanding applications.

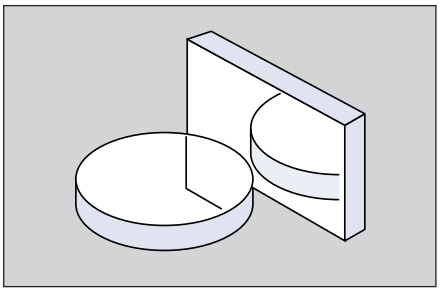
Low-expansion glass (LEBG, see p.2) is used for the λ/10 series to reduce thermal distortions.

Options available (see p.3)

- Cutting or edging to special sizes

Specification

Flatness:	
λ/4	over test area 90% of mirror dimension
λ/10	over entire area
Diameter	+0. -0.2mm
Length, width	±0.1mm
Thickness	+0.1, -0.3mm
Scratch-dig	40-20 (see p.2)



Circular mirrors (λ/10)

Catalogue No. Enhanced Al	Catalogue No. Visible-99	Dia. (mm)	Th. (mm)
25 MF 01	**25 MF 02**	25	6
40 MF 01	**40 MF 02**	40	9
63 MF 01	–	63	12
100 MF 01	–	100	15

Square mirrors (λ/4)

Catalogue No. Enhanced Al	Length x width (mm)	Thickness (mm)
10 MX 10	10 x 10	3
16 MX 16	16 x 16	4
25 MX 25	25 x 25	6
40 MX 40	40 x 40	6
50 MX 50	50 x 50	8

Rectangular mirrors (λ/4)

Catalogue No. Enhanced Al	Length x width (mm)	Thickness (mm)
16 MX 10	16 x 10	3
25 MX 16	25 x 16	4
40 MX 25	40 x 25	6
63 MX 40	63 x 40	8

Circular mirrors (λ/4)

Catalogue No. Visible-99	Catalogue No. IR-98	Catalogue No. Enhanced Al	Catalogue No. Ion-plated silver	Catalogue No. UV aluminium	Catalogue No. Protected gold	Diameter (mm)	Thickness (mm)
–	–	**10 MX 01**	–	–	–	10	3
16 MX 02	**16 MX 05**	**16 MX 01**	**16 MX 06**	**16 MX 04**	**16 MX 03**	16	3
25 MX 02	**25 MX 05**	**25 MX 01**	**25 MX 06**	**25 MX 04**	**25 MX 03**	25	6
40 MX 02	**40 MX 05**	**40 MX 01**	**40 MX 06**	**40 MX 04**	**40 MX 03**	40	6
50 MX 02	**50 MX 05**	**50 MX 01**	**50 MX 06**	**50 MX 04**	**50 MX 03**	50	9
–	–	**63 MX 01**	–	–	–	63	9
–	–	**100 MX 01**	–	–	–	100	15

5.3 Optical flats

Customise

These uncoated flats are used for checking the flatness of other surfaces from the interference fringes (Newton's rings) seen when the surfaces are in contact, in monochromatic light. They are also useful as substrates for special mirrors.

Options available (see p.3)

- Special mirror and other coatings
- Cutting or edging to special sizes

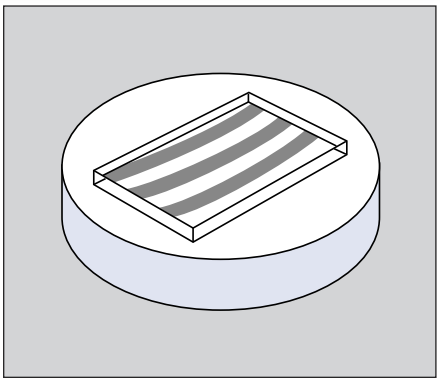
See also:

Double-sided substrates p.32

Specification

Flatness	λ/10 (front face) 1λ (rear face)
Diameter	+0, -0.2mm
Thickness	±0.1mm
Material	LEBG (see p.2)
Scratch-dig	40-20 (see p.2)

Catalogue No.	Diameter (mm)	Thickness (mm)
25 MF 00	25	6
40 MF 00	40	9
63 MF 00	63	12
100 MF 00	100	15



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5.4 Elliptical mirrors

Customise

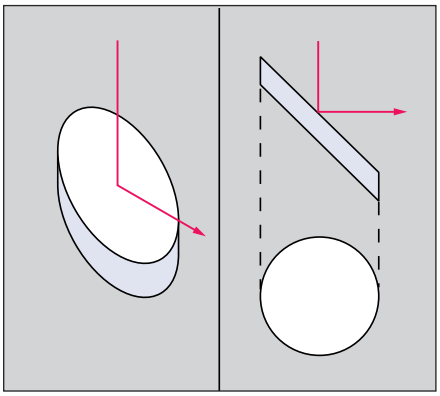
When used at 45°, these mirrors present a circular cross-section, with no obscuration from the edges beyond the mirror aperture.

They are used as secondary mirrors in Newtonian telescopes. Another possible use is for mounting in a tube, where the maximum possible aperture is required.

Catalogue No.	Diameter (minor axis) (mm)	Major axis (mm)	Thickness (mm)
25 MD 00	25	35	6
40 MD 00	40	57	10
50 MD 00	50	71	10

Specification

Flatness	λ/4
Diameter (minor axis)	+0, -0.25mm
Thickness	±0.15mm
Coating (see p.24)	Protected aluminium
Material	Float glass (see p.2)
Scratch-dig	40-20 (see p.2)



5.5 Plane mirrors (1λ over 25mm)

Customise

These mirrors of guaranteed flatness are available in a wide range of sizes at very reasonable prices, made possible by bulk preparation of the material.

Specification

Flatness	1λ over any 25mm dia.
Diameter	+0, -0.2mm
Length, width	±0.2mm
Thickness	±0.25mm (3mm) +0, -0.5mm (6mm)
Scratch-dig	60-40 (see p.2)

See also:

Coating data p.24
More sizes p.26

Options available (see p.3)

- Cutting or edging to special sizes
- Larger sizes available from stock sheets

Circular mirrors

Catalogue No.	Diameter (mm)	Thickness (mm)
Visible-99		
25 MJ 00	25	3
Enhanced aluminium		
10 MQ 00	10	3
16 MQ 00	16	3
25 ME 00	25	6
40 ME 00	40	6
50 ME 00	50	6
63 ME 00	63	6
100 ME 00	100	6

Square mirrors

Catalogue No.	Length x width (mm)	Thickness (mm)
Visible-99		
16 MJ 16	16 x 16	3
25 MJ 25	25 x 25	3
Enhanced aluminium		
10 MQ 10	10 x 10	3
16 MQ 16	16 x 16	3
25 ME 25	25 x 25	6
40 ME 40	40 x 40	6
50 ME 50	50 x 50	6
63 ME 63	63 x 63	6

Rectangular mirrors

Catalogue No.	Length x width (mm)	Thickness (mm)
Visible-99		
16 MJ 10	16 x 10	3
25 MJ 16	25 x 16	3
40 MJ 25	40 x 25	3
Enhanced aluminium		
16 MQ 10	16 x 10	3
25 MQ 16	25 x 16	3
40 ME 25	40 x 25	6
63 ME 40	63 x 40	6
100 ME 63	100 x 63	6

5.6 General-purpose plane mirrors

≡Customise

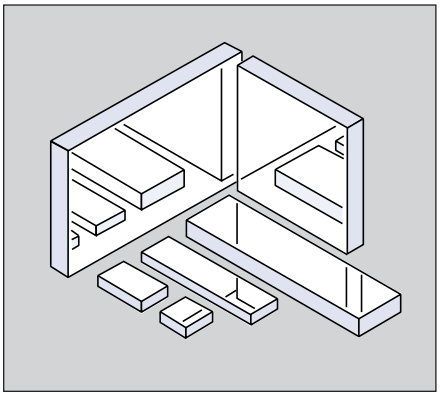
These mirrors, generally on float glass substrates, have a wide range of uses. 1.1mm thick mirrors are useful for their low inertia in scanning systems. 3mm and 6mm mirrors have better flatness and are useful for camera, microscope or projector systems, illumination, sensing etc. Special sizes of all materials are readily available.

Options available (see p.3)

- Cutting or edging to special sizes
- Larger sizes available from stock sheets

Specification

Flatness (typical):	
1.1mm thick	1λ over Ø10mm
3mm/6mm thick	2λ over Ø25mm
Diameter	+0, -0.25mm
Length, width	±0.3mm (≤80mm) ±0.5mm (>80mm)
Thickness	±0.25mm (≤3mm) +0, -0.5mm (6mm)
Coating data	see p.24
Scratch-dig	60-40 (see p.2)



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Catalogue No. Visible-99	Catalogue No. IR-98	Catalogue No. Enhanced Al	Catalogue No. Ion-plated silver	Catalogue No. UV aluminium	Catalogue No. Protected gold	Dimensions (mm)
Circular mirrors						
06 MH 00	–	06 MV 00	06 MP 00	–	–	Ø6.3 x 1.1
10 MH 00	10 MI 00	10 MV 00	10 MP 00	–	–	Ø10 x 1.1
25 MH 00	–	25 MV 00	–	–	–	Ø25 x 1.1
10 MG 00	–	10 MT 00	–	–	–	Ø10 x 3
16 MG 00	16 MI 00	16 MT 00	16 MP 00	–	–	Ø16 x 3
25 MG 00	25 MI 00	25 MT 00	25 MP 00	25 MK 00	25 MN 00	Ø25 x 3
40 MG 00	–	40 MT 00	40 MP 00	40 MK 00	40 MN 00	Ø40 x 3
50 MG 00	50 MI 00	50 MT 00	50 MP 00	–	–	Ø50 x 3
–	–	50 MC 00	–	–	–	Ø50 x 6
–	–	100 MC 00	–	–	–	Ø100 x 6
Square mirrors						
06 MH 06	–	06 MV 06	–	–	–	6.3 x 6.3 x 1.1
10 MH 10	10 MI 10	10 MV 10	10 MP 10	–	–	10 x 10 x 1.1
16 MH 16	–	16 MV 16	–	–	–	16 x 16 x 1.1
25 MH 25	–	25 MV 25	–	–	–	25 x 25 x 1.1
–	–	40 MV 40	–	–	–	40 x 40 x 1.1
10 MG 10	–	10 MT 10	–	10 MK 10	10 MN 10	10 x 10 x 3
16 MG 16	16 MI 16	16 MT 16	16 MP 16	16 MK 16	16 MN 16	16 x 16 x 3
25 MG 25	25 MI 25	25 MT 25	25 MP 25	25 MK 25	25 MN 25	25 x 25 x 3
40 MG 40	–	40 MT 40	40 MP 40	–	–	40 x 40 x 3
50 MG 50	–	50 MT 50	50 MP 50	50 MK 50	50 MN 50	50 x 50 x 3
63 MG 63	–	63 MT 63	63 MP 63	–	–	63 x 63 x 3
–	–	50 MC 50	–	–	–	50 x 50 x 6
–	–	63 MC 63	–	–	–	63 x 63 x 6
–	–	80 MC 80	–	–	–	80 x 80 x 6
–	–	100 MC 100	–	–	–	100 x 100 x 6
–	–	160 MC 160	–	–	–	160 x 160 x 6
–	–	250 MC 250	–	–	–	250 x 250 x 6
Rectangular mirrors						
10 MH 06	10 MI 06	10 MV 06	–	–	–	10 x 6.3 x 1.1
16 MH 10	–	16 MV 10	–	–	–	16 x 10 x 1.1
25 MH 16	–	25 MV 16	–	–	–	25 x 16 x 1.1
16 MG 10	16 MI 10	16 MT 10	–	16 MK 10	16 MN 10	16 x 10 x 3
25 MG 16	25 MI 16	25 MT 16	25 MP 16	25 MK 16	25 MN 16	25 x 16 x 3
40 MG 25	–	40 MT 25	40 MP 25	40 MK 25	40 MN 25	40 x 25 x 3
63 MG 40	–	63 MT 40	63 MP 40	63 MK 40	63 MN 40	63 x 40 x 3
–	–	40 MC 25	–	–	–	40 x 25 x 6
–	–	63 MC 40	–	–	–	63 x 40 x 6
–	–	100 MC 63	–	–	–	100 x 63 x 6
–	–	160 MC 100	–	–	–	160 x 100 x 6
–	–	250 MC 160	–	–	–	250 x 160 x 6

5.7 Quality concave mirrors

Customise

Compared to lenses, spherical mirrors have the advantages of perfect achromatism, considerably lower spherical aberration (see box) and wide wavelength coverage.

Catalogue No.	FL (mm)	Dia. (mm)	Radius (mm)
16 SQ 25	16	25	32
25 SQ 25	25	25	50
40 SQ 25	40	25	80
63 SQ 25	63	25	126
100 SQ 25	100	25	200
160 SQ 25	160	25	320
25 SQ 40	25	40	50
40 SQ 40	40	40	80
63 SQ 40	63	40	126
100 SQ 40	100	40	200
160 SQ 40	160	40	320

Specification

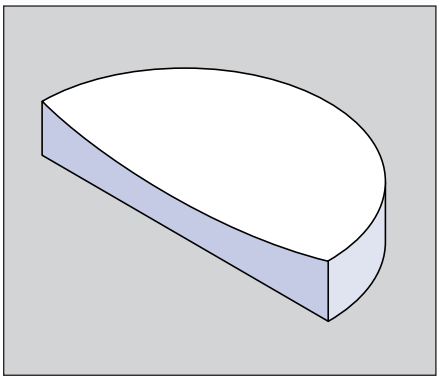
Focal length	±2%
Diameter	+0, -0.2mm
Coating	Al/SiO_x (visible reflectance 85-90%)
Scratch-dig	40-20 (see p.2)

Alternative items available

Mirror coatings (see p.3) can easily be applied to lenses (pp. 4, 10 etc.) to form convex or concave mirrors

Options available (see p.3)

- Cutting or edging to special sizes



Aberration calculation (see p.2)

k = 0.00781

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5.8 Concave lamp reflectors

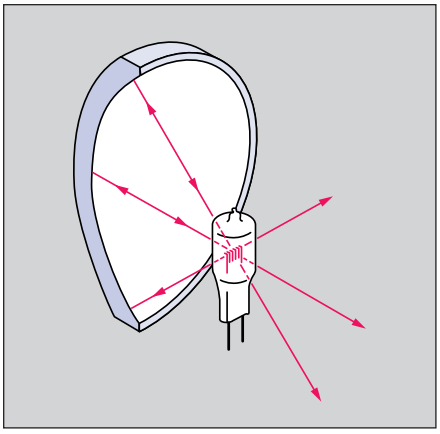
Customise

These spherical front-surface reflectors of very wide aperture are mainly intended as back reflectors for lamphouses. They are positioned with the lamp at the centre of curvature and form a same-size image which can be superimposed on the source or positioned just beside it.

Specification

Focal length	±1mm
Diameter	±0.25mm
Coating	Protected Al

Catalogue No.	Focal length (mm)	Diameter (mm)	Radius of curvature (mm)	Source to rim plane clearance (mm)
08 SR 25	8	25	16	11.1
10 SR 33	10	32.5	20	13.8
14 SR 40	14	40.0	28	20.6
14 SR 50	14	50	28	14.4



5.9 Cube beamsplitters

Customise

Cube beamsplitters, although more expensive than plates, have the advantages of stability, ease of mounting, equality of optical paths and absence of a second-surface ghost image. This range has hybrid coatings with considerably smaller polarising effect than the common all-dielectric types.

Catalogue No.	Dimensions (mm)
06 JQ 01	6.3 x 6.3 x 6.3
10 JQ 01	10 x 10 x 10
16 JQ 01	16 x 16 x 16
25 JQ 01	25 x 25 x 25
40 JQ 01	40 x 40 x 40
50 JQ 01	50 x 50 x 50

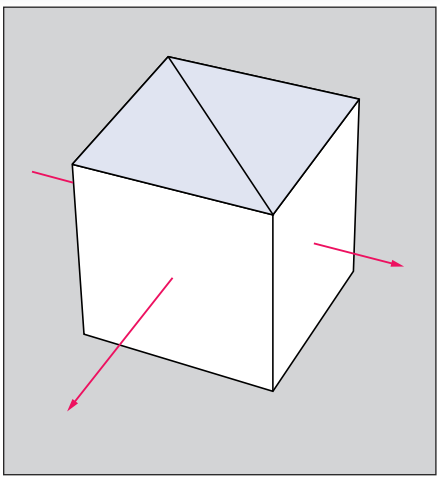
Specification

Wavelength range	450-700nm
Reflectance*	45 ±5%
Transmittance*	45 ±5%
Polarisation ratio	R_S/R_P = 1.25 approx.
Outer face coatings	Multilayer AR
Material	BK7 (see p.2)

*Average over wavelength range

See also:

Polarising cube beamsplitters p.42
Cube connectors p.59
Clevis mounts p.59



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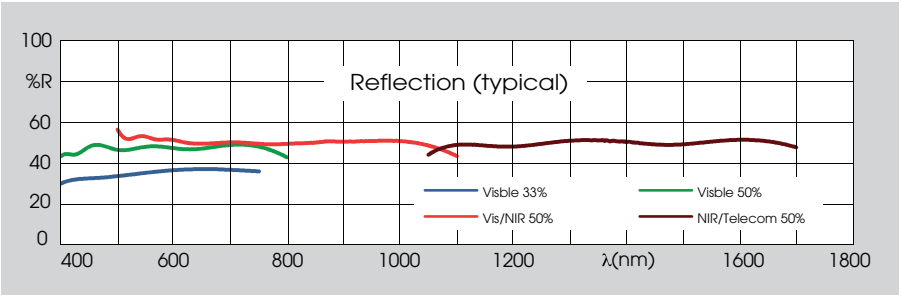
5.10 Plate beamsplitters

Customise

Plate beamsplitters are considerably lighter and cheaper than the traditional cubes, and avoid the problem of stray light back-reflected from the entry and exit faces. Our **Precision** and **Standard** ranges both have dielectric multilayer coatings giving excellent durability and neutrality and much less affected by temperature changes than ordinary evaporated coatings. The spurious reflection from the back surface is almost eliminated by multilayer AR coating.

The Precision range has optically polished BK7 substrates flat to λ/4. The Standard range is prepared as large sheets, allowing us to offer a wide range of satisfactory quality for most purposes at a very reasonable cost. We can also cut special sizes at short notice. The **Economy** range has a single-layer dielectric (TiO_2) beamsplitting coating, without AR, and offers very large sizes at low cost.

- Highly efficient, hard, all-dielectric coatings
- All (except Economy range) multi AR coated on the back surface



See also:

Metallic neutral filters (can be used as beamsplitters) p.35
Dichroic beamsplitters p.39
Fresnel beam dividers p.30
Cube connectors p.59

Options available (see p.3)

- Mounting in camera filter rings (see p.80)
- Cutting or edging to special sizes
- Larger sizes available from stock sheets

Coating specification

Angle	45°
Visible 50%:	
Reflectance	50 ± 5%
Wavelength	450-700nm
AR coating	R < 1.2% average
Visible 33%:	
Reflectance	33 ± 5%
Wavelength	450-700nm
AR coating	R < 0.6% average
VIS/NIR 50%	
Reflectance	50 ± 6%
Wavelength	530-1070nm
AR coating	R < 0.9% average
NIR/Telecom 50%	
Reflectance	50 ± 5%
Wavelength	1070-1650nm
AR coating	R < 0.6% Average
Economy:	
Reflectance	40% nom. (visible)
Polarisation ratio	R_s/R_p = 2 (approx. for all types)

Substrate specification

Precision range:	
Flatness (both sides)	λ/4 over 90% of aperture size
Diameter	+0, -0.1mm
Length, width	±0.1mm
Thickness	±0.1mm
Scratch-dig	60-40 (see p.2)
Material	BK7 (see p.2)
Standard and Economy ranges:	
Flatness (typical):	
1mm thick	0.5-1.5λ over Ø10mm
3mm thick	1-2λ over Ø25mm
Diameter	+0, -0.2mm
Length, width	±0.3mm (≤100mm) ±0.5mm (>100mm)
Thickness	±0.2mm
Scratch-dig	60-40 (see p.2)
Material (see p.2)	B270 (NIR range) Float glass (others)

Precision range

Catalogue No. Visible 50%	Catalogue No. VIS/NIR 50%	Catalogue No. NIR/Telecom 50%	Size (mm)	Thickness (mm)
Circular				
25 BQ 00	25 BI 00	25 BX 00	Ø25	4
50 BQ 00	50 BI 00	50 BX 00	Ø50	6
Rectangular				
16 BQ 10	16 BI 10	16 BX 10	16 x 10	3
25 BQ 16	25 BI 16	25 BX 16	25 x 16	4
40 BQ 25	40 BI 25	40 BX 25	40 x 25	6
63 BQ 40	63 BI 40	63 BX 40	63 x 40	8

Standard range

Catalogue No. Visible 50%	Catalogue No. Visible 33%	Catalogue No. VIS/NIR 50%	Catalogue No. NIR/Telecom 50%	Size (mm)	Thickness (mm)
Circular					
25 BV 00	–	25 BJ 00	25 BW 00	Ø25	1.1
25 BA 00	25 BD 00	25 BN 00	25 BL 00	Ø25	3
40 BA 00	–	–	–	Ø40	3
50 BA 00	–	–	–	Ø50	3
Rectangular					
10 BV 06	–	10 BJ 06	10 BW 06	10 x 6.3	1.1
16 BV 10	–	16 BJ 10	16 BW 10	16 x 10	1.1
25 BV 16	–	25 BJ 16	25 BW 16	25 x 16	1.1
40 BV 25	–	40 BJ 25	40 BW 25	40 x 25	1.1
63 BV 40	–	–	–	63 x 40	1.1
100 BV 63	–	–	–	100 x 63	1.1
10 BA 06	10 BD 06	10 BN 06	10 BL 06	10 x 6.3	3
16 BA 10	16 BD 10	16 BN 10	16 BL 10	16 x 10	3
25 BA 16	25 BD 16	25 BN 16	25 BL 16	25 x 16	3
40 BA 25	40 BD 25	40 BN 25	40 BL 25	40 x 25	3
63 BA 40	63 BD 40	63 BN 40	63 BL 40	63 x 40	3
100 BA 63	100 BD 63	100 BN 63	100 BL 63	100 x 63	3
160 BA 100	–	–	–	160 x 100	3

Economy range

Catalogue No.	Size (mm)	Thickness (mm)
100 BT 63	100 x 63	3
160 BT 100	160 x 100	3
250 BT 160	250 x 160	3

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