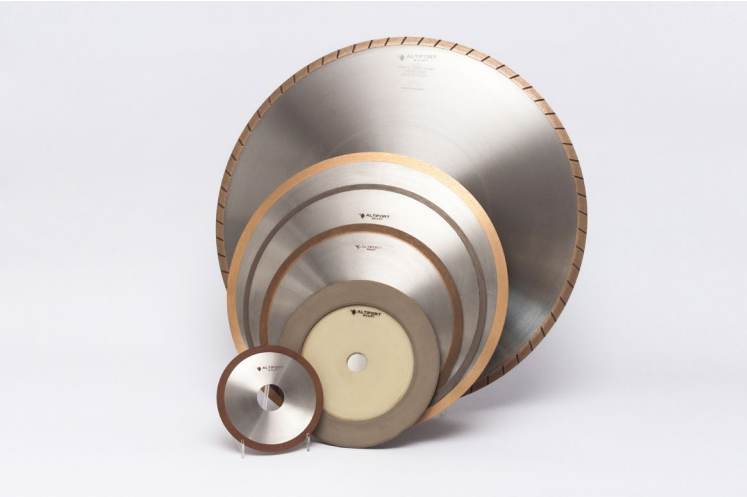
Metal and Resin Continuous Rim Cutting Discs



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Introduction

The sawing of glass is required either to cut pieces to obtain the required dimensions or simply to take the top off hollow objects which, for various economic or technical reasons, cannot be cut by means of the “crack-off” technique.

We distinguish three different fields of application:

- sawing of flat glass
- sawing of hollow glass
- sawing of optical glass

The Diamond Disc

According to the application, there are two types of diamond discs available:
- the **continuous rim** disc
- the **segmented** disc.

In the same way the application will determine the diamond specification (bond, diamond quality, grit and concentration).

A metal bond is recommended for the sawing of medium to thick glass, whether for segmented or continuous rim discs.
For the sawing of thinner glass *requiring a specific cutting quality*, we would recommend the use of continuous rim discs with a resin bond.

The continuous rim discs are available in diameters up to 500 mm whereas the segmented discs are available between 200 and 700 mm.

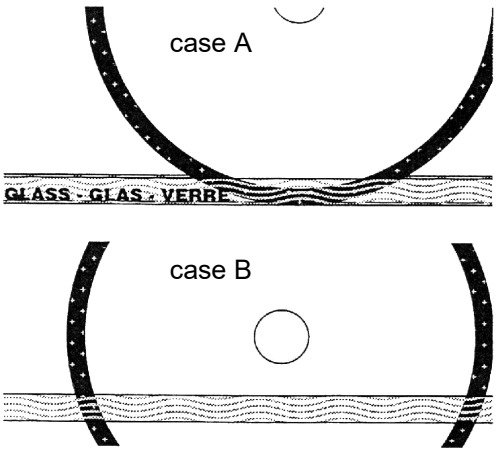


***Fig. 2** : Different ways of feeding in when sawing.*

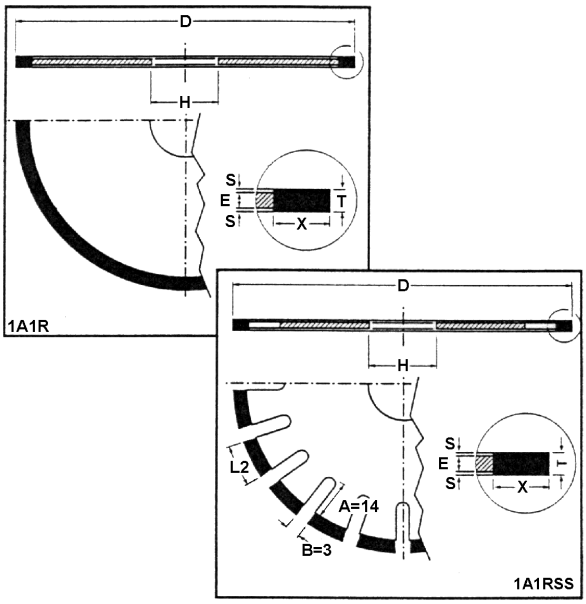


***Fig. 1** : Differences between continuous rim and segmented discs.*

Working instructions

The targeted cutting quality and the maximal chipping accepted determine the expected quality of the sawing operation plus the type of disc used together with the diamond specifications.

Experience shows that a segmented disc with a coarse grit and a hard bond generates lots of chipping. A continuous rim disc with a fine grit and a resin bond, on the other hand, minimises the production of chips during the sawing process.

The right choice of cutting conditions as well as manufacturing tolerances of the discs are also important factors.

In the same way the position of the disc relative to the piece to saw has an impact on the chipping volume. Figure 2 shows two extreme cutting positions. Experience shows that it is preferable to clear the disc out on the smallest possible diameter (case B).

The difference in thickness between the diamond layer and the metal body (fig. 1) is called "protrusion" (S) and will regulate the cutting results obtained. If it is too small, there may be contact between the metal sheet and the sawn part, which will cause chipping on it as well as heating and stress-relieving of the metal sheet, putting the disc out of use. The protrusion must also be sufficient so that, given the lateral wear of the disc, it can be used completely.

Sawing of Flat Glass

Two possibilities can be figured out:
- simple glass or **one-layer** glass
- **multi-layer** glass, also called **"laminated glass".**

One-layer glass

In the case of one-layer glass a diamond cutting disc will only be used when the conventional cutting technique is not feasible, whether for economical or technical reasons.

The continuous rim cutting disc is broadly used and offers the best quality cut. The segmented discs are more appropriate for thicknesses from 15 to 19 mm.

Machines

They are either portable or fixed

Instructions for use

- Peripheral speeds: 25-35 m/s
- Cutting speeds: 150-200 cm²/min

Laminated glass

The increase in criminality, the evolution in architectural requirements and statutory regulations strongly increased the need for laminated glass.
In this category we will make the distinction between safety glass and fire-proof glass.

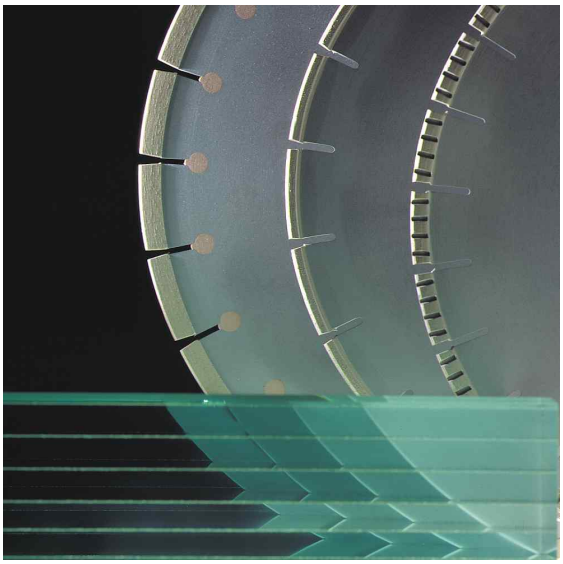


Fig. 3 : *Different types of discs for the sawing of safety glass*

Safety glass

This type of glass is an anti-crime and bullet-proof glass composed of alternating layers of plastic and glass, of which the number and thickness vary according to the required security level.
Safety glass is produced in large sheets which are then cut to the required dimensions. This is generally done by means of segmented discs to avoid the clogging of the diamond by the melting of the polymer. Segmentation does indeed produce a specific cutting effect on the plastic, the latter being eliminated in chips and not through abrasion. This allows for optimum cooling. **Altifort Boart** offers a range of discs adapted to a wide variety of existing glass types (fig. 3). Disc type B-Turbo, for instance, can be considered as a universal disc which could be used even for the most sophisticated products.

Machines

Safety glass can be cut on both vertical and horizontal machines.

Instructions for use

- peripheral speeds: 45-55 m/s
- abundant cooling with multiple nozzles.

Fire-proof glass

Fire-proof glass is also made up from a combination of glass sheets and organic interlayers, foam among others, so that the side opposite to the flames remains cold for some time. The thickness of these glass types varies from 10 to 50 mm.

Machines

Both vertical and horizontal machines are used for the sawing.

Instructions for use

- Optimum peripheral speeds: 50-55 m/s

Sawing of Hollow Glass

The most popular applications are the sawing of lighting equipment and the cutting of moils in the tableware industry. Hollow glass products are mostly designed with thin walls in different types of glass such as soda, crystal, opal etc.
For lighting equipment, the cut-off surface is generally hidden in an installation and thus does not require any finishing operation, as opposed to the tableware articles. The quality of cut obtained after the sawing process should therefore strictly respect the application requirements.

Cutting discs used

The thin thicknesses of the wall encountered as well as the required chipping levels lead to the use of continuous rim discs, the usual diameters of which range from 200 to 500 mm.

Instructions for use

- Peripheral speeds: 25-35 m/s.

Working processes

- infeed cutting
- rotational cutting.

Infeed cutting is possible when the shape of the glass part is quite regular and when its height is up to 120 mm. During the rotational sawing process, the workpiece is turned against the cutting disc with a feed depth identical to the thickness of the wall and of the workpiece being rotated.

Therefore, this technique allows to cut workpieces of almost all shapes and dimensions. Most of the time two cutting discs opposite by 180° are used simultaneously on vertical machines (Fig. 4) to speed up the process.

Machines

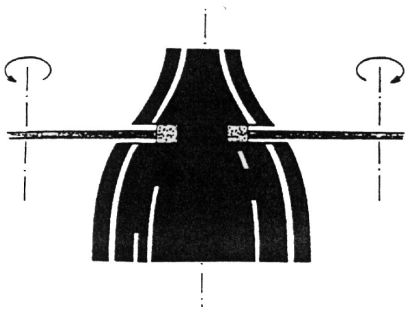


Fig. 4 : *Sawing process with two opposite discs*

There are manual or automatic sawing machines. Today manual sawing needs to be performed on precision machines for quality reasons. To this end, **Altifort Boart** has developed the **DV27** machine on which diamond saw blades with a diameter from 300 to 500 mm can be mounted. The precision of engineering, the table design and a choice of rotation speeds are all factors which provide a superior sawing quality and high performances. To ensure the stability of the workpiece during sawing, it is maintained in a wooden or plastic jig set on the machine table.

CNC machines and double head systems are used more and more frequently. They reach high performances and allow the most sophisticated forms to be sawn.

Sawing of Tubes

In many applications, sawing tubes by cutting wheel tracing is excluded. Whether for laboratory equipment, the manufacture of lamps or tubes for the chemical industry, diamond sawing has proved essential. While it is not always the most economical, it certainly is the most flexible and least restrictive on a production line.

Cutting discs used

The choice of a disc depends on the thickness of the tube. For small diameters and thin walls, resin bond continuous rim discs are preferred because they guarantee an almost scratch-free cutting and a very good edge quality. For larger thicknesses it is recommended to rather use a metallic bond disc.

Instructions for use

Altifort Boart recommends the following for the resin bond discs:
• peripheral speeds: 25-30 m/s
• flange size: 4/10 of the disc diameter.

To avoid early disc wear and minimise chipping, watering must be controlled in quality, quantity and distribution. With such discs, manual sawing is prohibited because lateral movements of the tubes can cause the diamond rim to break. In any case, the parts will be fixed correctly, possibly glued. If necessary, these discs will be sharpened exclusively with SiC sticks with fine grit and a resin bond.

Machines

When it developed its automatic tube cutting machine **DB150**, **Altifort Boart** was the pioneer in making the sawing process a really economical system. With this machine it was possible to automatically cut tubes of a diameter from 5 to 25 mm and a length of 5 to 150 mm. The second machine was the **DB400,** followed by the current **ARTM**. This third-generation top tech machine offers a precision and a unique ease of operation thanks to its modern components and CNC.

Sawing of Optical Glass

The peculiarity of this application lies in the high cost of the material to be cut, which requires a process minimising the loss of glass. Moreover, the size of the workpieces, the large varieties of glass types and hardness are among the numerous challenges of sawing. The glass hardness can indeed be as low as SF16 and as high as Zerodur.

Cutting discs used

For the reasons described above, the characteristics of the discs to use are very specific. The high cutting depths will require the use of discs with diameters ranging from 350 to 700 mm and thicknesses of 1.3 to 3.2 mm to limit sawing marks. A large-diameter disc mounted with reduced flanges, low diamond thicknesses and therefore very thin sheets are all parameters that limit the stability of the disc during sawing and increase the difficulty of use. As a result, the choice of specifications, the precision of execution, the lateral runout and the tension on the disc will be essential factors for the final quality of the work.

Instructions for use

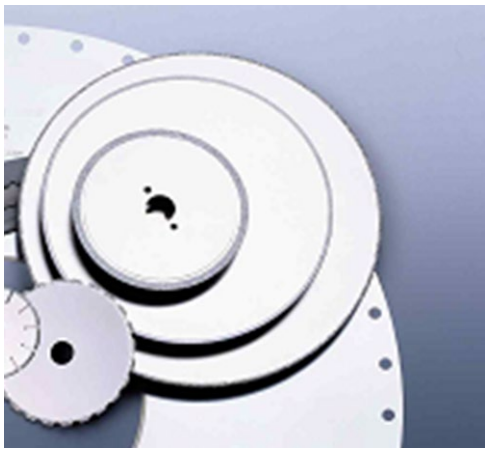
- optimum peripheral speed: 27 m/s
- material removal (according to glass type): 30 to 100 cm^2/min
- tool life (according to glass type): from 25 to 75 m^2

Machines

Optical glass sawing is mostly done with manual machines. However, when the thickness of the workpieces becomes too large, sawing will be processed on automatic precision machines.

Two different sawing methods are commonly used. The first is **multi-pass pendulum sawing** whereby the disc gradually sinks into the material pass after pass. The second is **single pass sawing** consisting in a vertical sinking of the disc over the entire thickness at first, followed by a length feed.

Galvanic Discs



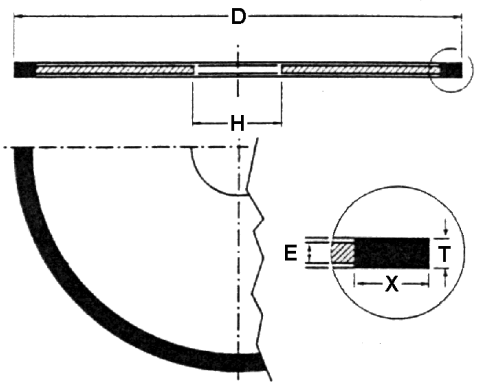
To cut reinforced plastic materials such as GRP (glass fibre) or CFRP (carbon fibre), for instance, the use of discs with galvanic bond is required. Metal or resin bond discs are not recommended for such materials because of their poor content of glass, which prevents the self-sharpening of the bond. Moreover, the intermediate layers such as the epoxy-resin seal these bonds.
On the other hand, the one-layer structure of galvanic discs allows to bring a higher protrusion of the diamond rather than in the case of metal or resin bond discs. In addition, these discs can also be used dry.
When segmented, these same tools have the property to eliminate the sawing particles, to improve the cooling and thus improve the cutting power and the lifetime of the tool.

For particularly narrow high-precision cuts, **Altifort Boart** offers multi-layer galvanic discs of which the minimum width is 0.15 mm.

Standard, Order Example

Continuous rim saws with metal bond

ALTIFORT-BOART Form
L18A-D-T-X-Specification-H/E - FEPA 1A1R



D: Diameter in mm
T: Diamond thickness in mm
X: Layer depth in mm
H: Bore in mm
E: Body thickness in mm

Standard:

D	T	X	E	Grit	Concentration	Bond
30	0.5	5	0.3	D46-D151	C20-C25-C30-C40-C50	Metal
50	0.6	5	0.5	D46-D151	C20-C25-C30-C40-C50	Metal
75	1.0	5	0.8	D46-D252	C20-C25-C30-C40-C50	Metal
100	0.5	5	0.4	D46-D151	C20-C25-C30-C40-C50	Metal
125	0.5	5	0.4	D46-D151	C20-C25-C30-C40-C50	Metal
150	1.0	5	0.8	D46-D252	C20-C25-C30-C40-C50	Metal
150	1.0	10	0.8	D46-D252	C20-C25-C30-C40-C50	Metal
175	1.2	5	0.9	D46-D252	C20-C25-C30-C40-C50	Metal
200	1.2	5	0.9	D46-D252	C20-C25-C30-C40-C50	Metal
250	1.5	5	1.1	D46-D252	C20-C25-C30-C40-C50	Metal
300	1.8	10	1.4	D46-D252	C20-C25-C30-C40-C50	Metal
350	1.8	10	1.4	D46-D252	C20-C25-C30-C40-C50	Metal
400	2.2	10	1.7	D46-D252	C20-C25-C30-C40-C50	Metal
450	2.5	10	2.0	D46-D252	C20-C25-C30-C40-C50	Metal
500	3.0	10	2.4	D46-D252	C20-C25-C30-C40-C50	Metal

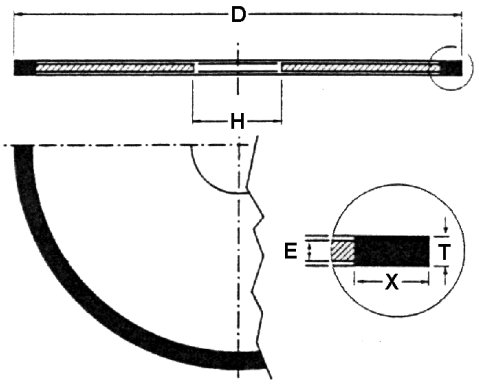
Bore diameter H to be specified.

Order example

L18A-300-1.8-10-D181-MG20J-16/E=1.4

Continuous rim saws with resin bond

ALTIFORT-BOART Form
K18A-D-T-X-Specification-H/E - FEPA 1A1R



D: Diameter in mm
T: Diamond layer thickness in mm
X: Diamond layer depth in mm
H: Bore in mm
E: Body thickness in mm

Standard:

D	T	X	E	Grit	Concentration	Bond
75	0.8	5	0.5	D46-D181	C40-C50-C60-C75	Resin
100	1.0	5	0.7	D46-D252	C40-C50-C60-C75	Resin
125	1.0	5	0.7	D46-D252	C40-C50-C60-C75	Resin
150	1.0	5	0.7	D46-D252	C40-C50-C60-C75	Resin
150	1.0	10	0.7	D46-D252	C40-C50-C60-C75	Resin
200	1.2	7	0.9	D46-D252	C40-C50-C60-C75	Resin
250	1.2	7	0.9	D46-D252	C40-C50-C60-C75	Resin
300	1.2	7	0.9	D46-D252	C40-C50-C60-C75	Resin
400	1.5	7	1.2	D46-D252	C40-C50-C60-C75	Resin
400	1.5	10	1.2	D46-D252	C40-C50-C60-C75	Resin
500	2.2	10	1.9	D46-D252	C40-C50-C60-C75	Resin

Bore diameter to be specified.

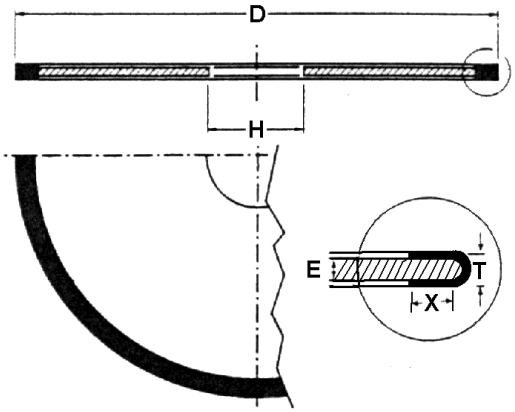
Order example

K18A-400-1.5-7-D126-BG50S-25/E=0.9

Galvanic discs

One-layer galvanic discs with continuous rim:

ALTIFORT-BOART Form
M18A –D-T-X-Grit-GN333-H/E - FEPA 1A1R



D: Diameter in mm
T: Diamond layer in mm
X: Diamond layer depth in mm
H: Bore in mm
E: Body thickness in mm

*

Standard:

D	X	E	Grit	Bond
50	1.0	0.3	D46-D602	Galvanic
75	1.0	0.5	D46-D602	Galvanic
100	1.0	0.5	D46-D602	Galvanic
125	1.5	0.5	D46-D602	Galvanic
150	1.5	0.5	D46-D602	Galvanic
175	1.5	0.5	D46-D602	Galvanic
200	1.5	0.7	D46-D602	Galvanic
225	1.5	1.0	D46-D602	Galvanic
250	1.5	1.0	D46-D602	Galvanic
300	2.5	1.2	D46-D602	Galvanic
350	2.5	1.5	D46-D602	Galvanic
400	2.5	1.5	D46-D602	Galvanic
450	2.5	2.0	D46-D602	Galvanic
500	2.5	2.0	D46-D602	Galvanic
550	2.5	2.5	D46-D602	Galvanic
600	2.5	2.5	D46-D602	Galvanic

Bore diameter H to be specified.

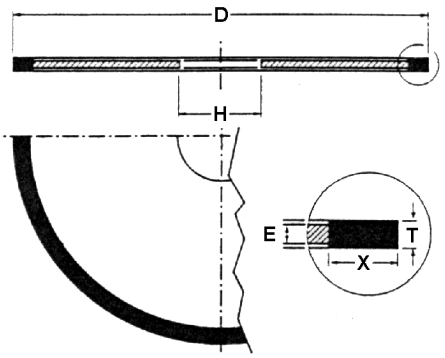
Layer thickness T depends on the grit size chosen.

Order example

M18A-100-0.8-1-D126-GN333-25/E=0.5

Multi-layer galvanic discs with continuous rim:

ALTIFORT-BOART Form
M18A –D-T-X-Grit-GN666-H/E-CMG - FEPA



D: Diameter in mm
T: Diamond layer thickness in mm
X: Diamond layer depth in mm
H: Bore in mm
E: Bore diameter in mm

Standard:

D	T	X	E	Grit	Bond
30/40/50/60/75/100/125/150	0.15	1.0	0.10	D46-D64	Galvanic
30/40/50/60/75/100/125/150	0.20	2.0	0.15	D46-D64-D91-D126	Galvanic
30/40/50/60/75/100/125/150	0.25	2.0	0.20	D46-D64-D91-D126-D151	Galvanic
30/40/50/60/75/100/125/150	0.30	2.0	0.25	D46-D64-D91-D126-D151-D181	Galvanic
30/40/50/60/75/100/125/150	0.40	2.0	0.30	D46-D64-D91-D126-D151-D181-D252	Galvanic
30/40/50/60/75/100/125/150	0.50	2.0	0.40	D46-D64-D91-D126-D151-D181-D252	Galvanic
30/40/50/60/75/100/125/150	0.60	2.0	0.50	D46-D64-D91-D126-D151-D181-D252	Galvanic
30/40/50/60/75/100/125/150	0.70	2.0	0.60	D46-D64-D91-D126-D151-D181-D252	Galvanic
30/40/50/60/75/100/125/150	0.80	2.0	0.70	D46-D64-D91-D126-D151-D181-D252	Galvanic
30/40/50/60/75/100/125/150	1.00	2,0	0.80	D46-D64-D91-D126-D151-D181-D252	Galvanic

Bore diameter H to be specified.

Order example

M18A-100-0.15-1-D64-GN666-25/E=0.10-CMG