Drilling Tools

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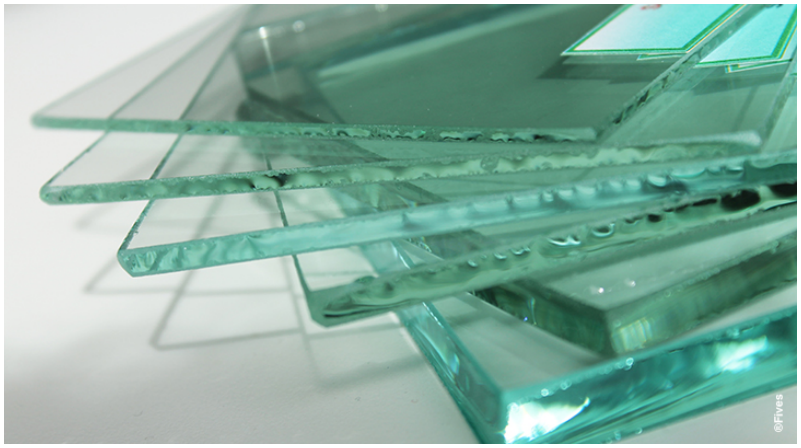


Introduction

In addition to surfacing and edging, particular applications in the glass industry often require the drilling of holes for fixing or fitting.

These holes are drilled by means of diamond core drills.
Contrary to the drills designed for wood and metal, the drills used for glass material consist of a thin cutting wall, which is mounted on a cylindrical tube.

The tool components are:

- a diamond core drill with continuous rim
- a metal tube
- a shank

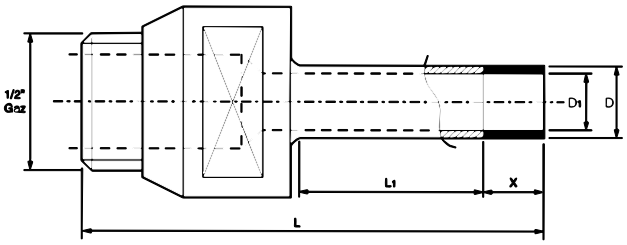
During the drilling operation the cutting wall performs a circular groove in the material and as it descends, it produces a core which will dissociate itself in the final stage.

Diamond Drills

Geometry

The drill is defined as follows:

- the diameters D, external, and D1, internal
- the diamond impregnated depth X
- the drilling depth L1
- the total length L
- the shank.



The diameters D and D1

The core drills manufactured by Altifort Boart guarantee a core drill thickness of 1 mm and inner and outer clearances of 0.2 mm.

These clearances are necessary to avoid any contact between the glass and the tube of the drill as this would cause chipping.
The diamond core drill is manufactured with a hole through its shank to allow coolant to flow through the centre of the drill.

The drilling depth (L1) and the diamond impregnated depth (X)

- The drilling depth L1 determines the maximum drilling depth without considering the diamond layer (X size) as it wears out during drilling work:
  L1 = 15 mm for D ≤ 8 mm
  L1 = 30 mm for D > 8mm.
  Other drilling depths L1 are available on request.

- The diamond layer depth (X) varies according to the diameter:
  X=5 for diameters D < 5 mm
  X =10 for diameters ≥ D5 mm.

The total length (L)

This dimension represents the total length of the core drill.
The standard lengths in the glass industry are L= 75 mm, L = 82 mm (for Janbac drilling machines) and L = 95 mm (for ADA and Forvet drilling machines).

The shank

The usual shank for the drilling of glass is the self-centring shank ½" Gaz, also called the "Belgian shank".

Types of drills

FC159: High-precision diamond core drill performing excellent edge quality.

FC161: Long-lasting and high-speed diamond core drill designed for semi-automatic and fully automatic machines.

Conditions of Use

The coolant system is very important, optimum results can only be obtained if the balance between the following parameters is reached:

- the water quantity
- the water pressure
- the coolant slots in the impregnation.

The following parameters should also be considered, as they are directly linked to the core drill used:

- the diameter and the specification of the core drill
- the peripheral speed
- the feed speed and specific pressure
- the cooling pressure.

Diameter and specification of the core drill

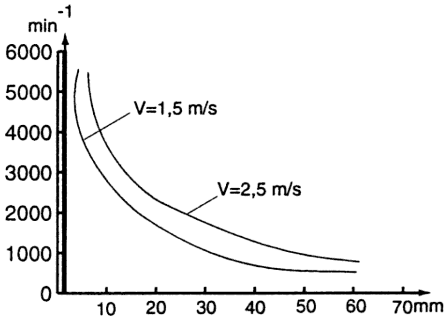
Compared to a grinding wheel, the diamond core drill is continuously in contact with glass. This means that the contact area for larger diameters is also greater and the down feed pressure on the core drill must be increased.

To compensate for this increased pressure, the specifications of the diamond layer (grit size, concentration, and bond) can be optimised to feature a softer bond and to obtain the required abrasiveness.

Peripheral speed

The optimum peripheral speed ranges from 1.5 to 2.5 m/sec. Please note that numerous machines cannot achieve the high rotational speeds necessary for small diameter core drills.

A lower peripheral speed increases the sharpness of the drill, a higher speed conversely increases the abrasiveness.



Optimum Peripheral Speed Ranges for the diamond core drills, in accordance with diameters:

Diameter (mm)	Speed (RPM)
3 – 5	9000
6 – 10	4500
11 – 20	2500
21 – 25	2000
26 – 35	1250
36 – 50	1000
51 – 100	600
101 – 150	300

Feed speed and specific pressure

Feed speed is also an essential parameter in the quality of the drilling:

- If the feed speed is too low, the diamond “dulls”, and the impregnation loses its abrasive power.
- If the feed speed is too high, the diamonds are submitted to much stress and plucked out of the impregnation.

Working experience recommends a feed speed between 50 and 80 mm (according to the diameter used). This feed speed will determine a given specific pressure; the tool will operate in self-sharpening conditions without early wear.

Coolant pressure

Coolant supply should also be studied thoroughly.
If the pressure is too low, the glass swarf cannot be removed out of the groove.
If the pressure is too high, the core is being ejected before the drill comes out of the glass and chipping becomes too important.

It is thus highly recommended to use the appropriate pressure, according to the diameter of the drill used:

Table of recommendations

Diameter (mm)	Speed (RPM)
2 – 5	5- 3
6 – 10	3 – 2
11 – 20	2 – 1
21 – 40	1 – 0.5
41 – 120	0.5 – 0.2

The Machines

Types of machines

The type of machine ranges from a simple drill press to double-spindle and multiple-spindle CNC machines.

Basically there are two types:

- Single-spindle (drilling from one side)
- Double-spindle (drilling from both sides of the glass).

Single-spindle machine

Principle:

Drilling is performed from the top side of the glass, completely though the thickness of it.

In some cases this technique leads to chipping at the bottom side when the drill is removed.
As the drill exits the remaining glass is so thin that it does not counterbalance the drilling pressure and tends to break, thus producing chips.
Therefore we recommend to decrease the feed rate at entrance and exit of the glass, or to turn over the working piece halfway.

Double-spindle machine

Principle:

Two drills work from the opposite sides of the glass, each of them through half the thickness of the glass.

This is the only method that ensures drilling with limited chipping because it prevents glass from breaking at the end of the operation.
Furthermore, this kind of drilling also promotes a shorter working cycle.

In addition to the double-spindle drilling machines, the market also offers multi-spindle automotive machines drilling several holes (with different diameters) at the same time.
The advantages are high precision and a replicability of the holes as well as the consistency of distance between the holes.
These machines are particularly suited to multiple drilling in series (car glass, door panels, …).

Even more flexible are the new double-spindle indexing type CNC drilling machines. Their Révolver heads can accept up to 8 drills with different diameters.
This type of machine provides an increased level of productivity and flexibility.

Machine requirements

The performance of a drill will depend on the parameters of the machine.
Attention needs to be drawn to the following:

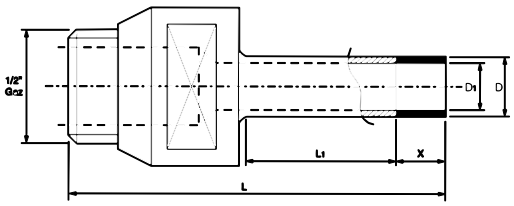
- a solid and vibration-free construction
- a vibration-free running
- a variable spindle rotational speed
- a precision hollow spindle.

If the machine is not equipped with a hollow spindle for coolant, it may be fitted with an injection system type MINI TI/12 or type TICM3/10/1/4.

Standard

Drills

Drill type: FC159, FC161



The high-performance stainless-steel drill used in the automotive and flat glass construction industries.

D 3 -> 150 mm
L 75, 82 mm or 95 mm (max 200 mm)
L_1 15 mm (Ø <8 mm)
30 mm (Ø ≥ 8 mm)
X 5 mm (Ø < 5mm)
10 mm (Ø ≥ 5 mm)
Self-centering fitting R 1/2
Other dimensions and fittings on request.

Order example

FC159 D15 L82 R1/2"