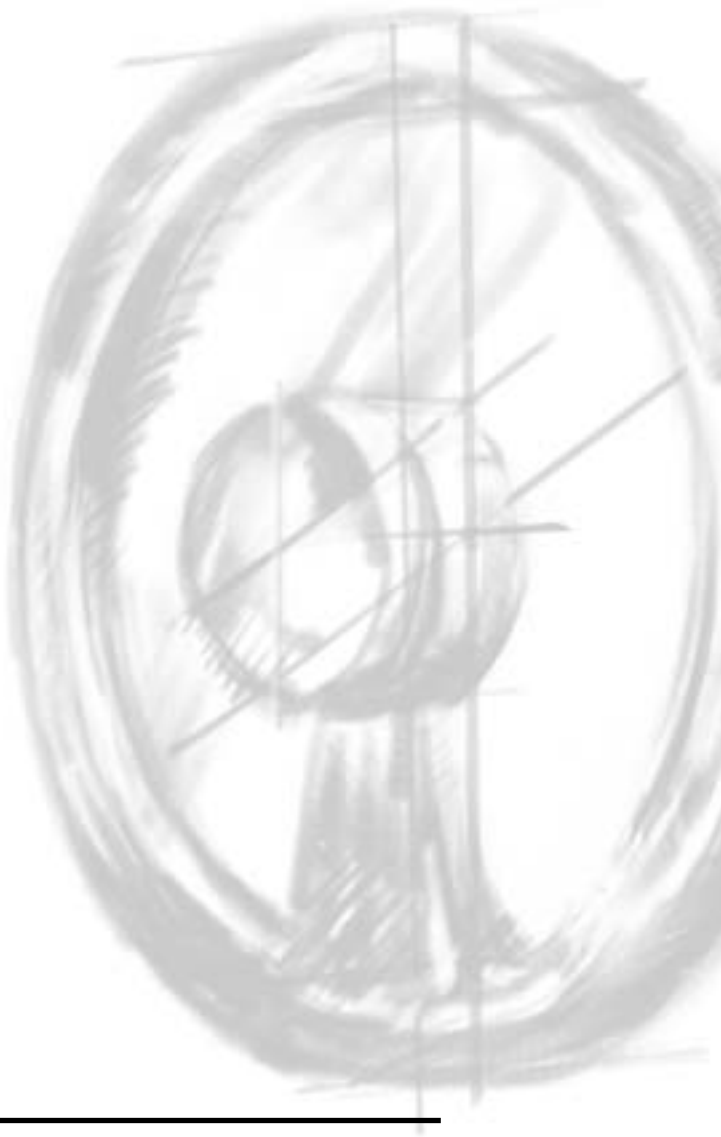


Polycarbonate Safety Windows

VISIPORT Spin Windows

EAGLEVISION
integrated Spin Window

Safety glass

The manufacturers of machining centres are demanding safety regulations and product liability.

A special focus of attention are the safety risks of safety windows testified in recent years. The replacement of unprotected polycarbonate panes is recommended by VDMA (Association of German machine and plant manufacturers) after only two years of use.

Polycarbonate safety glass with stainless steel frame

Overview

Where should polycarbonate safety panes be used?

Application of safety pane	Safety panes provide to the user effective protection against ...
turning ...	Broken chuck components and machined parts
milling ...	Hot chips, broken tools and machined parts
grinding ...	Pieces of broken grinding discs

Background information

Background information on the topic of safety glass

Safety glass is a restraining protective device on machining centres. It prevents tools, machined parts and broken particles being thrown out of the working space of the machinery and protects persons from injuries. Statistics show that workers being hit is still a common cause of industrial accidents.

Viewing panes at machining centres, ideally combined with a spin window system, provide a good view to the operator and transparency to the manufacturing process. Viewing panes within the trajectory path of parts must show a sufficient strength.

According to the latest empirical tests polycarbonate is the material best suited for safety glass. This is due to the high energy absorption of the material. The restraint capability of a polycarbonate pane of 8 mm thickness is about the same as of a 3mm St 12.03 steel sheet. A disadvantage of the polycarbonate is its sensitivity to scratching and it will be damaged by the impact of hot chips and sparks. Furthermore it has low resistance against the effects of coolants, grease and oil which will result in embrittlement of the polycarbonate. By this process the restraint capability can be reduced within a few years.

Polycarbonate safety glass manufactured by HEMA/BSA is protected permanently and efficiently from these external influences by its encapsulation and sealing.

Polycarbonate safety glass (standard design)

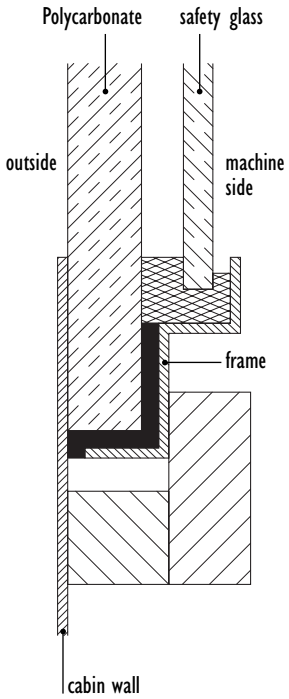
Safety glass

Any safety glass showing damage from external mechanical impact, for example cracks or deep scratches or deterioration resulting from exposure to chemicals must be exchanged because its protective functioning is no longer guaranteed.

At present there exist three technical standards for metal cutting tools: DIN EN 12415 (for turning machines), DIN prEN 13128 and DIN prEN 12417 (for milling machines and machining centres). These standards form the basis for our safety glass and spin window systems. You may determine the relevant safety classification and the corresponding minimum thickness of the polycarbonate from the tables on the following pages. The influential factors are the mass of the tool and of the machined part and the speed and rotation.

The restraint capability of safety glass not only depends on the thickness of the polycarbonate but also on the sheet metal design of its containment. Clamps or bonding or an adequate frame are best suited for the mounting. The joints should be well covered to prevent the screen from being pushed through the frame if hit by an impact of parts.

cross-section: safety window with metal frame



Safety glass ... the solution.

- Manufactures of turning, milling and grinding machines have trusted for many years in the quality of HEMA's business partner BSA Luftfahrt- und Sicherheitstechnik GmbH & Co.
- BSA is a partner of the European machine construction and aviation industry delivering excellent certified quality at prices in line with market requirements.
- Only certified quality panes made of polycarbonate with an efficient surface coating providing protection against chemicals, abrasion and scratching are used.
- Polycarbonate panes from renowned manufactures such as GE Plastics, B.V. or Makroform are used
- The polycarbonate panes can be supplied at any marketable thickness. The basic material consists of panes from 4 to 15 mm thickness.
- They are protected on the machine side by an additional single or multiple layer safety glass pane. According to customer specifications the structure may comprise polycarbonate, foils and glass.
- As standard we use laminated glass which has a low risk of injury when damaged due to its splinterproof properties and also reduces time for cleaning and machine standstill.
- The edges of the panes are completely sealed and resistant to coolants. In addition they can be fitted with an aluminium or stainless steel frame for optimal mounting.
- Panes and their components are tested by the IWF institute in Berlin according to EN 12415, restraint categories A1 to C3, and to safety standards CEN/TC 143/WG3.
- The customer will receive a 5-year warranty on the encapsulated and sealed safety pane (according to our warranty conditions).
- The integration of modern intelligent spin window solutions such as VISIPORT or EAGLEVISION is possible without any safety risk or additional mounting expenditure.

Technical data and performance

Classification according to EN DIN 12415 tested on standard windows 500 x 500 mm

Material / classification	A1	A2	A3	B1	B2	B3	C1	C2	C3
Mass of projectile in kg	0,625	0,625	0,625	1,25	1,25	1,25	2,50	2,50	2,50
Kinetic energy [Nm]	320	781	2000	1562	2480	4000	3124	4960	8000
PC 6 mm	+			+					
PC 8 mm	+	+		+	+		+		
PC 10 mm	+	+	+	+	+		+	+	
PC 12 mm	+	+	+	+	+	+	+	+	
PC 15 mm	+	+	+	+	+	+	+	+	+
PC 19 mm laminated	+	+	+	+	+	+	+	+	+

Appendix:

+ test passed by polycarbonate panes tested by BSA at IWF according to DIN EN 12415

Safety classification for turning machines

Calculation of the safety classification and the required thickness of polycarbonate for turning machines

Impact energy and speed may be calculated by the following data:

1. DIAMETER OF ROTATION
= maximum outer diameter of the clamping jaw at the machine
2. ROTATIONAL SPEED OF THE SPINDLE
= maximum speed of the machine according to the manufacturer
3. MASS OF CLAMPING JAW
= mass of one clamping jaw (classification according to proposed standard)

As a special service we offer you the calculation with a PC program to verify current pane systems and to design future solutions.

Deployment testing device at the IMF, Berlin.
Impulse test according to EN DIN 12415 passed in classification C3

max. diameter of clamping jaw (mm) from	max. diameter of clamping jaw (mm) up to	circumferential speed v (m/s)	Projectile dimensions D x a (mm x mm)	Projectile mass m (kg)	impact speed v (m/s) up to	impact energy (Nm) up to	safety classification*	minimum thickness of polycarbonate (mm)
	130	25 40 63	30 x 19	0,625	32 50 80	320 781 2.000	A1 A2 A3	6 6 8
130	250	40 50 63	40 x 25	1,250	50 63 80	1.562 2.480 4.000	B1 B2 B3	6 8 12
250		40 50 63	50 x 30	2,500	50 63 80	3.124 4.960 8.000	C1 C2 C3	8 10 15
500				2,500	89	10.000	PK 1	15
500				5,000	63 69	10.000 12.000	PK 2 PK 3	15 19
500				8,000	55 59	12.000 14.000	PK 4 PK 5	19 19

*A1 to C3 = classification according to EN 12415; PK1 to PK5 = classification according to VDW

Safety classification for milling machines

Calculation of the safety classification and the required thickness of polycarbonate for milling machines according to prEN1247

Impact energy and speed may be calculated by the following data:

As a special service we offer you the calculation with a PC program to verify current pane systems and to design future solutions.

1. DIAMETER OF ROTATION
= maximum outer diameter of the cutting tool unit at the machine concerned
2. ROTATIONAL SPEED OF THE SPINDLE
= maximum speed of the machine according to the manufacturer
3. MASS OF CUTTING TOOL
= defined for 100 g only according to proposed standard

Projectile mass m (kg)	impact speed v (m/s) up to	impact energy (Nm) up to	minimal thickness of Polycarbonate (mm)
0,100	85	361	4
0,100	100	500	6
0,100	120	720	8
0,100	145	1063	10
0,100	150	1125	12
0,100	170	1445	15
0,100	>170	>1445	19

Our application counselling is not binding. Responsibility for application and deployment of our products lies with the purchaser, also regarding potential claims of third parties. Technical data relating to the safety panes are standard values. Final design and calculation will be performed by BSA.

Unprotected? Current results relating to safety glassing

Exposed polycarbonate panes may lose their safety restraining properties partly or completely after only a few months of use. This was impressively demonstrated by tests at the BIA Institute. Systematic research showed that polycarbonate panes splashed with coolant possessed a retaining potential of only 60% after nine months of exposure.

But how can exposure be defined and the necessary protection realised?

According to our definition safety glass may be considered exposed as long as it is not completely encapsulated by an additional glass layer or a special foil. This encapsulation and sealing can only be verified by specialised companies.

Despite manufacturers of milling/drilling machines having lower safety classification requirements and pane thickness of less than 6 mm polycarbonate still buy their panes directly from the manufacturer. This pane thickness will correspond to the safety classification of the machine but panes are unprotected, i.e. not encapsulated or sealed. But polycarbonate panes for machines should be protected against chemical attacks to guarantee their long term safety functioning.

Safety glass

Retrofit for CNC-machining centres and machines

We offer complete solutions with and without lacquered and drilled frames and also as replacements for products.

The safety glass fulfils the valid recommendations of VDMA and guarantees a restraint safety classification from A1 to C3. It is non-ageing, resistant against coolant and oil and heavy impact.

The increasing import of machining centres from low-cost countries always means a safety risk, the legal requirements not always being met by these products. By retrofitting these inexpensive machines according to the required European safety standards a safe operation can be realised.

Even if the original equipment was not manufactured by Hema/ BSA we can easily offer a cost effective solution to meet your safety regulations.

Complete solutions – machine panes with integrated spin window

Many customers nowadays wish to have a good view to the working space of the machine. Despite high quality coating of the machine panes they need a "windscreen wiper", the spin window cleaned by centrifugal forces.

We offer the integration of the most modern intelligent spin window solutions such as VISIPORT or EAGLEVISION without additional mounting expenditure. You will get demand orientated, cost optimised solutions directly from the manufacturer. The systems may be configured in such a way that it only needs to be mounted and connected. All systems fulfil the relevant safety requirements.

Features and advantages

- Non-ageing according to the latest technology by all around protection of the build-in polycarbonate pane.
- Fulfils EN 12415, prEN 12417 and prEN13128.
- By use of multiple layer glass we have short delivery times for small batches and highly improved shatter resistance.
- Optimal solutions adapted to the space requirements of the customer.
- Optimisation of the work conditions of the operator by noise level reduction and sight improvement.
- Reduced down times of the machine due to quick replacement of the pane.
- Individual retrofit for imported machines possible, fulfilling the standards.
- 5 years warranty on the integral strengh (according to the warranty regulations).
- Retrofit possible for all common turning and milling machines.
- Integration of spin window systems EAGLEVISION and VISIPORT at HEMA factory.
- Inscription and labelling of the panes according to the recommendations of VDW – Additional customer specific data as required.
- Attractive cost-performance ratio.

VISIPORT SPIN WINDOWS – the eye for your CNC machine

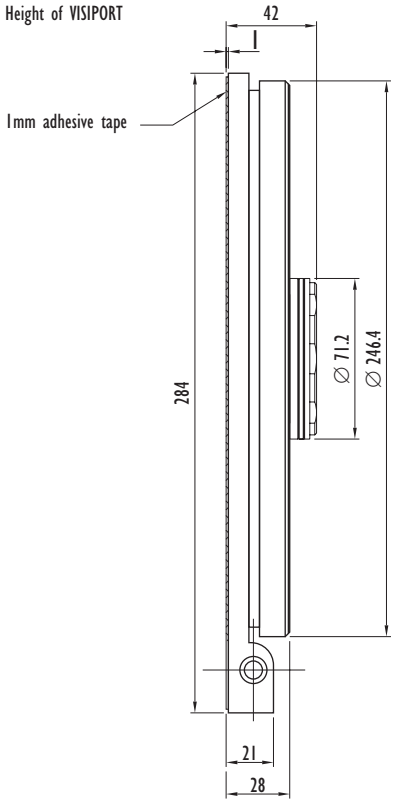
As manufacturer of machines you are exposed to global competition and try to offer your customers optimally adapted, use-oriented machines. Your products are characterized by a high degree of innovation, safety and differentiation from the competition. You follow the trend of visualization and creating transparency in your operations and processes. Your company will be an enthusiastic user of VISIPORT Spin Windows. VISIPORT systems have already been for several years in hard everyday continuous use among leading international manufacturers.

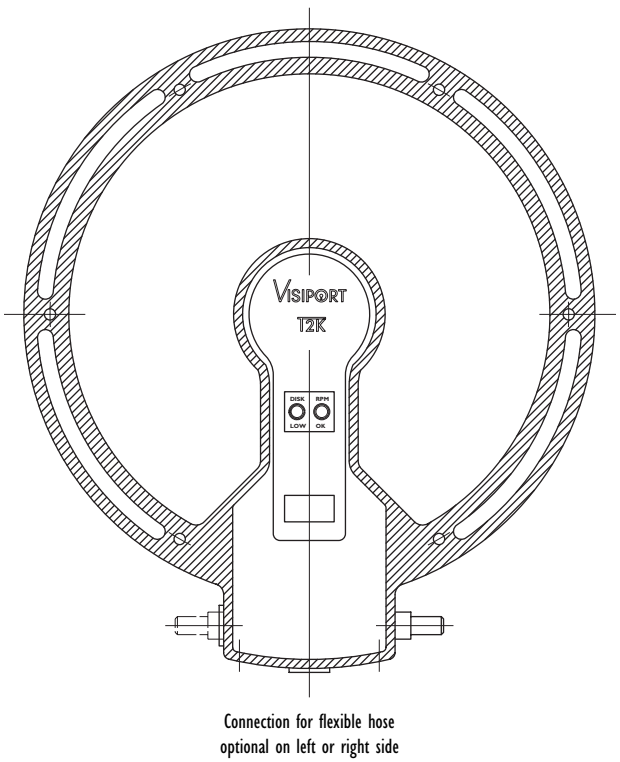
We give suitable eyes to your machine

You optimize your processes and improve your working ergonomics and productivity in that you can observe the actual machining process in the machine without your view being impaired by coolant or chips. The electrically driven Visiport Spin Windows are suitable for all types of CNC milling machines, lathes and machining centres both in original equipment and for subsequent installation.

Simple installation and optimum maintenance due to modular design reduce the costs. With their low weight and a generous visible surface, VISIPORT adapt optimally to the design of your machines. Additional electronic safety features complete the perfect impression.

VISIPORT 215A





VISIPORT SPIN WINDOWS

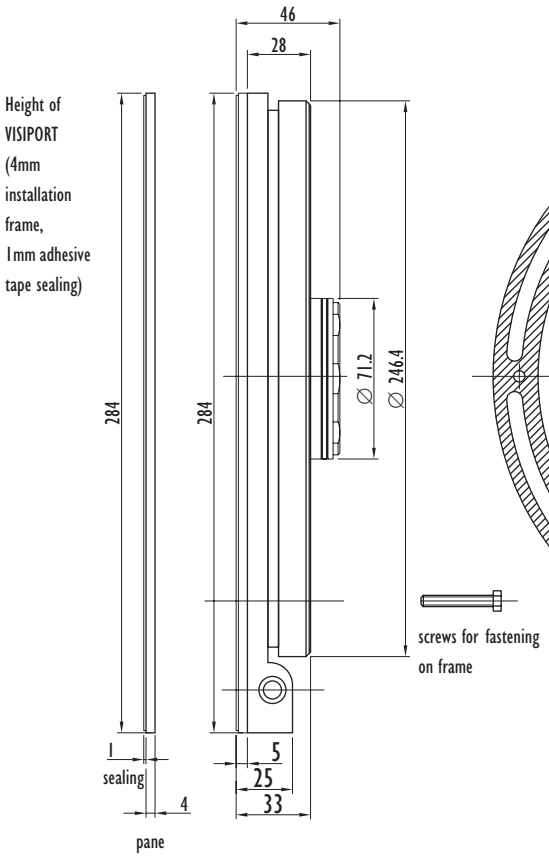
Technical properties

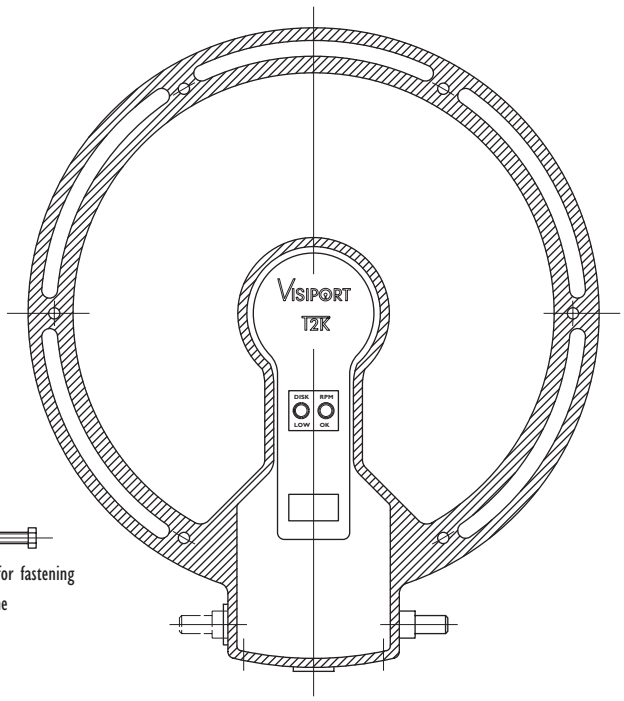
Advantages

- VISIPORT means taking active safety precautions: Without VISIPORT, the operator can be tempted to bypass the safety circuit of the machine to see what is happening in the machine. This implies a danger potential for severe accidents. With regard to product liability and safety regulations, a glance at the safety advantages of VISIPORT can pay.
- Our system is suitable for CNC high-speed milling/grinding machines. It is also the system suitable for lathe applications. The VISIPORT is suitable for OEM first equipment and retrofitting.
- The flat construction enables the VISIPORT to be adapted to widely differing door and window designs. VISIPORT is also suitable for fastening tosliding doors with limited intermediate space.
- No hole has to be drilled in the machine cabin. The unit is either fastened on the bonded mounting plate or bonded directly to the window. When the mounting plate is used (only model 220A and DiscAir 230), fast replacement of the VISIPORT unit is possible.
- Subsequent installation is also simple and fast. Low space requirements enable it to be used for most window configurations on new and also older machines, a through-hole installation is also possible.

VISIPORT 215A and 220A:

- Spinning disk mounted on the machine side, giving clear vision to the process by its high rotation speed (> 2000 rpm)
- Integrated electronic control unit giving protection against reverse voltage and overvoltage
- Driven by integrated brushless DC-motor, power supply 24 V, minimum 4 A continuous current required
- Fulfils CE standards on low tension voltage
- Standby current without coolant load: 500 mA
- Rotor bearing by precision ball bearings
- Balanced rotating disc made form hardened glass, 3 mm thickness
- Waterproof steelflex connecting hose or metal tubing system
- Connection box with on/off/reset switch
- Power supply cable with standard length of 10 m, safety classification 300/ 500 V





VISIPORT 220A

Technical data VISIPORT 215A and 220A

- Low weight (1,7 kg for model 215-A, 2 kg for model 220-A)
- Outer diameter 253 mm

Mounting by bonding

Easy mounting of the VISIPORT is done by a high-tech adhesive sheet (adhesive based on closed cellular acrylic foam). Simply remove the protective foil on the rear side of the VISIPORT and bond the VISIPORT to the desired position on the pane which should have been cleaned thoroughly before. The optimal setting time is 72 hours.

Afterwards it is practically impossible to separate the VISIPORT from the surface it is bonded to, provided the surface had been cleaned sufficiently before. As soon as the adhesion to the surface has reached 80% of its maximum value, a safety factor of 20 or better will be attained according to our calculations. In other words, the adhesive power is no problem at all. The adhesion is extremely strong and insoluble. On demand there is an additional fastening by screws available.

In the case of VISIPORT models with installation frame an artificial vacuum can be generated by a special small vacuum pump reducing the bonding time to a few hours and giving additional strength to the bonding.

Product quality

All VISIPORT models come with a twelve month guarantee ex works. Wearing parts are excluded. Many components are made of high-grade aluminium. The ball bearings are lubricated for life and replaceable. The flexible metal connecting hose or the tube system are temperature resistant up to 300° C. The electronic components were specifically developed for the VISIPORT. Ambient influences are excluded by the optimum installation position and sealing. All parts and components of the VISIPORT are tested for quality of material and life endurance.

VISIPORT complete installation to polycarbonate pane ex works

Thorough cleaning of the polycarbonate pane

Preparing the VISIPORT for installation

VISIPORT SPIN WINDOWS

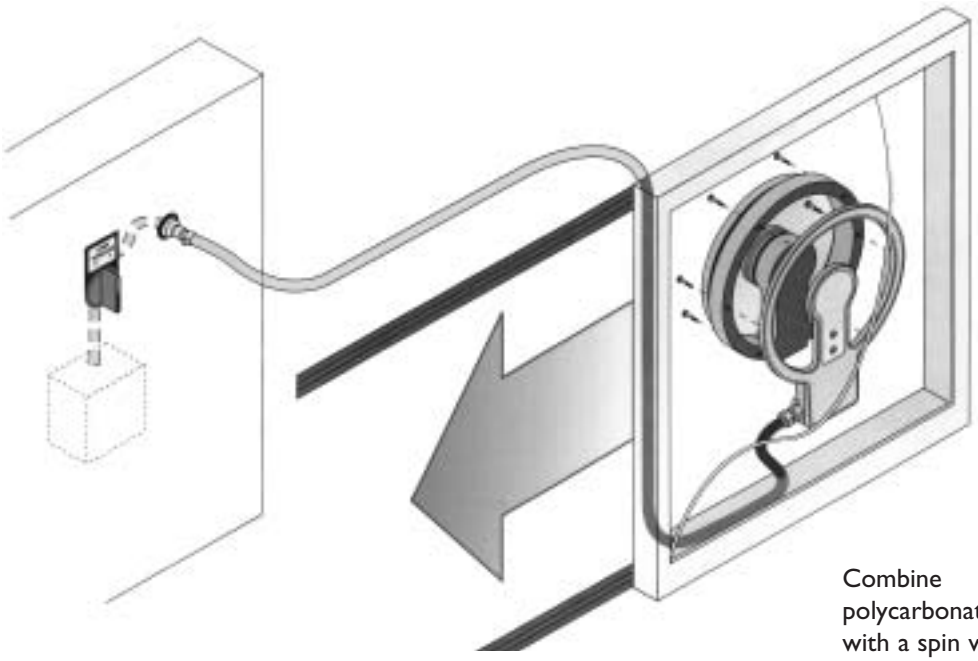
Ventilation and aeration of the VISIPORT

VISIPORT has a patented system whereby the required quantity of air for interior ventilation of the VISIPORT is guaranteed by the flexible hose supplied separately. The flexible hose protects the wire harness between the VISIPORT and the connecting box. The air circulation was specially important in the development of the flexible hose. If you wish to use a different connection for certain reasons please consult our engineers about this. Ventilation should always be guaranteed.

Installation

The VISIPORT can be installed vertically or up to 30° from the vertical. It is best installed to a fixed (permanently closed) window. The VISIPORT will function best with waterbased coolants and with mineral oils. High Viscous oil impairs the functionning.

Basic drawing



Combine polycarbonate pane with a spin window!

Installation and bonding of the VISIPORT

Sealing and protection of the adhesive sealing foil

Installation of the protective cap

VISIPORT DiscAir SPIN WINDOWS

Air-driven VISIPORT DiscAir models

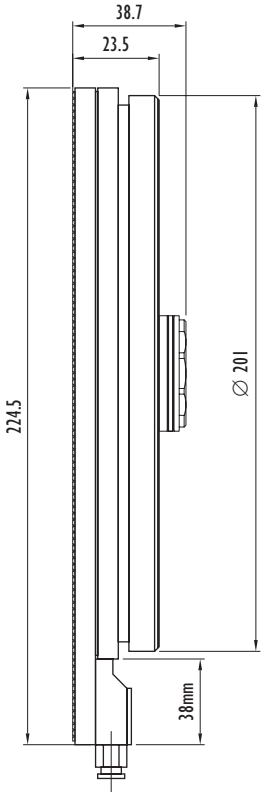
Beside the electrically operated VISIPORT models development was also made for different forms of drive. The DiscAir models are driven by compressed air available at almost every machine or at every workshop. Its operation is possible by simply connecting the VISIPORT DiscAir to the compressed air supply. – without costly electric wiring. It is fastened similarly to the electric VISIPORT by simple bonding technique directly onto the machine pane.

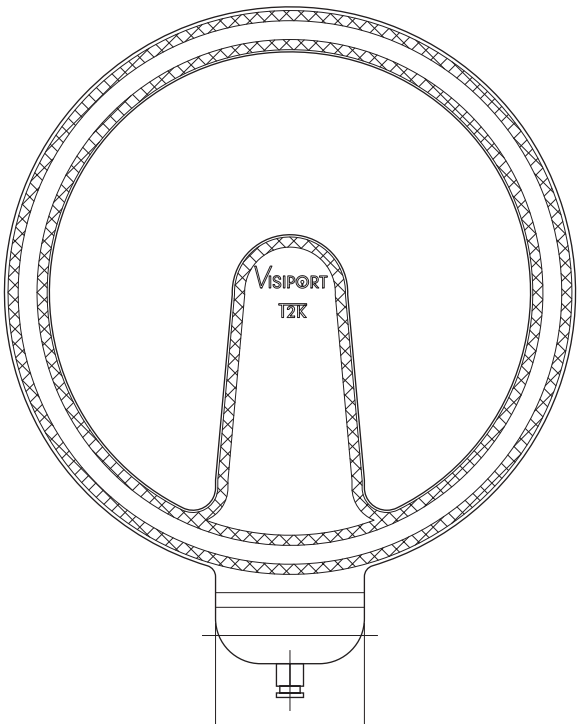
The air consumption is between 51 and 170 l/min. Due to design and drive the DiscAir models generate more noise than the extremely low noise electrical VISIPORTS. Due to an optimum designed air circulation system as well as highly precise manufacturing process the DiscAir models are silent and fulfil the legal directives. Therefore very little difference may be discerned compared to the running noise of the machine when the cabin door is closed.

The air outlet has been designed in such a way that it gives a supportive protection against the intrusion of coolant and chips.

The VISIPORT DiscAir models round off the VISIPORT line of products to the bottom end and represent an excellent offer with regard to their price-performance ratio. They enable every CNC machine operator to adopt the spin window technology at a price considerably lower than that of electrical models.

VISIPORT DiscAir 175





Product properties

specification	VISIPORT-model DiscAir 175	DiscAir 225	DiscAir 230
required air pressure	6.2 - 7.3 bar	6.2 - 7.3 bar	6.2 - 7.3 bar
nominal speed at 6 bar	2600 rpm	2400 rpm	2400 rpm
air consumption	51 l/min	170 l/min	170 l/min
noise level*	74 dB	74 dB	74 dB
outer diameter	201 mm	253 mm	253 mm
visual field	199 cm^2	288 cm^2	288 cm^2
weight	0.7 kg	1.53 kg	1.78 kg
height	40 mm	40 mm	44 mm
thickness of spin disk	2 mm	3 mm	3 mm

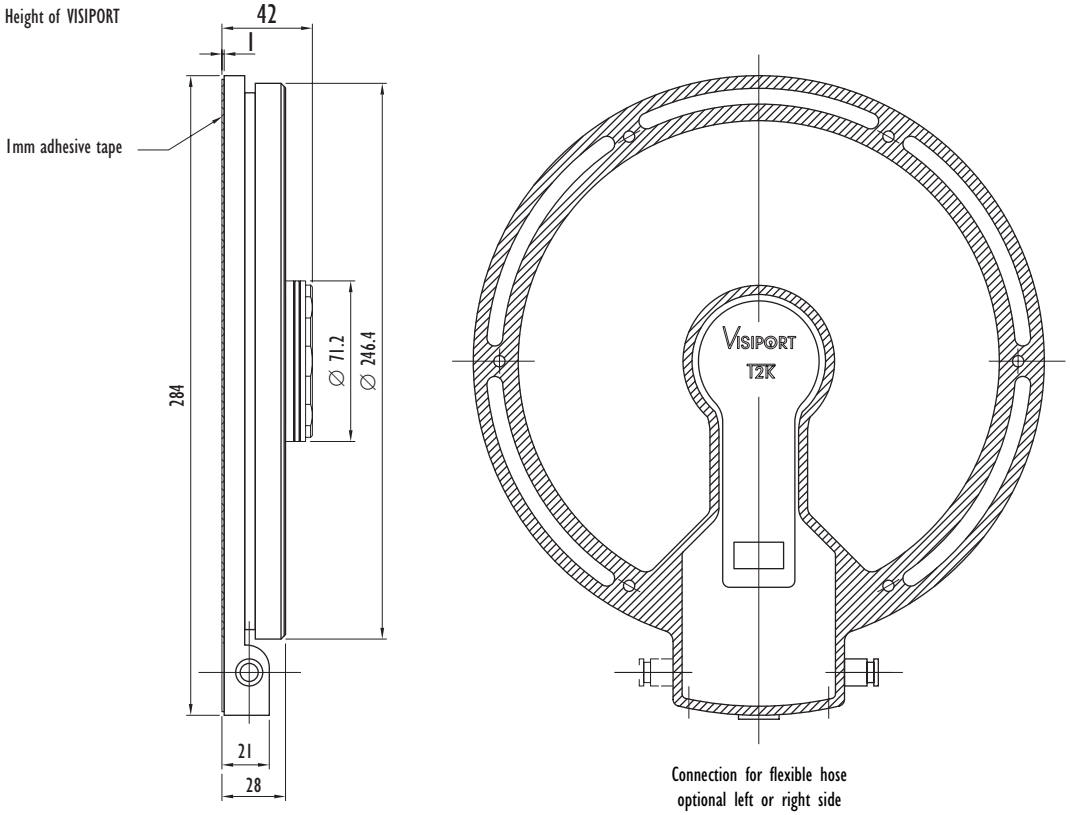
* without housing at a distance of 3 m

Technical properties

VISIPORT DiscAir 175, 225 and 230:

- Spin disk located on the machine side, giving clear vision of the machining by its high rotating speed (> 2000 rpm)
- Driven by purified compressed air, no electrical connection required
- Suitable for use with intermittent coolant spraying
- Rotor mounted on precision ball bearing
- Connection of the air hose by plug-in socket
- Patented high efficient turbine ring

VISIPORT DiscAir 225



Overview on the VISIPORT models

VISIPORT 220A
installed on a Polycarbonate safety window

VISIPORT 220A installed on machining center

MODEL	Diagonal dimension of viewing area in mm	Speed rpm	Application	Installation
215A (electric drive)	215	2,100	standard version, cost saving, universal application, very silent, flat design	directly mounted onto the machine pane
220A (electric drive)	215	2,100	multiple shift operation, high flexibility, easily detachable, very silent, minimum down time	Installation frame (4mm) directly mounted onto the machine pane, VISIPORT on installation frame
DiscAir 175 (air drive)	175	2,600	basic model, cost effective, ideal for retrofitting	same as 215A
DiscAir 225 (air drive)	215	2,600	same as DiscAir 175	same as 215A
DiscAir 230 (air drive)	215	2,600	same as 220A	same as 220A

VISIPORT repair and spare part service

Test of motor and balancing

Test/replacement of spin disk

Test of the electronics

Replacement of rotor

Special Disks

Special disks – ideal for aluminium processing and coolant containing oil

Machining of aluminium or magnesium creates chips which condense like a film on the pane and the spin disk. This problem leads to obsured vision after only a short time.

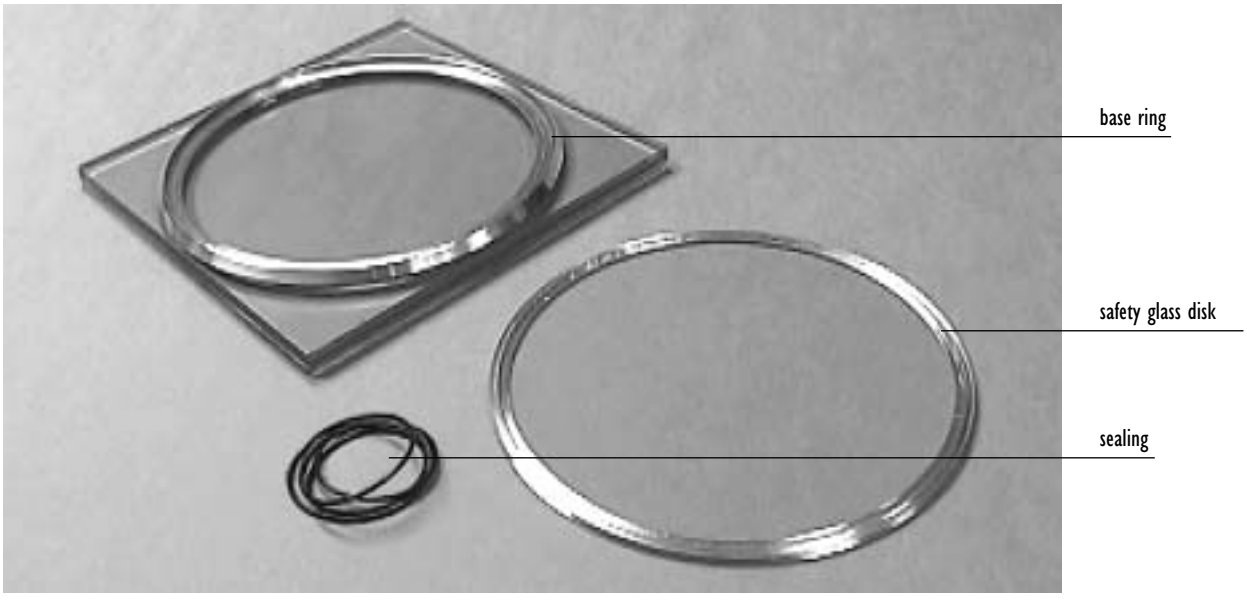
We offer two innovative and efficient solutions for the VISIPORT spin disk. After comprehensive testing for 18 months under severe conditions in the mechanical production at Boeing in Seattle, T2K has now released the new "Golden Eye", a diamond-hard coating of the disk with a gold coloured tint. In addition we offer a low cost alternative, the "BSA non-stick coating".

Both varieties may be retrofitted or directly ordered with the main unit for the models VISIPORT 215A and 220A.

PERMAPORT – additional protection for polycarbonate panes

Protective system PERMAPORT PR260

- A round base ring is bonded by proven VISIPORT adhesive technology onto the pane.
- A round safety glass pane in an aluminium turnable mounting is screwed to the basic frame.
- The pane is protected against scratching from dry and wet machining. Optimum protection of a section of the machine pane (e.g. made from polycarbonate) by an additional safety glassing which can be exchanged at any time and is scratch proof and chemical resistant.
- Exchange of the complete pane due to scratches and lack of visibility no longer necessary.
- Round safety glass made of VISIPORT material may be replaced within minutes at minimal cost.
- High flexibility and optimum serviceability



EAGLEVISION – making innovation visible

We give an insight to your machine

Keeping an eagle eye on everything, this expression applies more than ever today in our world of constantly tighter safety regulations and high speed processing.

In addition to the VISIPORT spin windows now being deployed for more than 10 years we offer you with EAGLEVISION an integrated solution for your vision and safety problem as part of the HEMA range of products.

EAGLEVISION – the integrated solution in spin windows

Optimise your processes, improve your ergonomics and productivity by being able to watch the ongoing work process within the machine without your view being impaired by coolant or chips. The electrically or hydraulically driven EAGLEVISON spin window solutions are suitable for all machining centres with compact cabin dimensions and high safety requirements.

Advantages

top: view from operator's side; bottom: view from machine side

Due to the surface flatness on the machine side and a generous area of view EAGLEVISON will optimally adapt to the design of your machine (e.g., mounting to a sliding door with wipers is possible without any problem). Additional safety features make the perfect impression complete.

1. Tested certified safety

- EAGLEVISION stands for tested certified safety. Safety requirements by employer's liability insurance associations and by legal demand from the manufacturer of working machines to proof and safeguard the safety requirements of the relevant security classification. By its integrated application EAGLEVISION offers a comprehensive solution to this problem: a spin window integrated into the multiple layer safety glass! You will receive a system impact tested according to the current regulations and standards complete with all the documentation necessary for verification. The spin window does not cause any weakening of the pane due to our patented solution developed by us. With EAGLEVISION we fulfil the requirements of all safety classifications up to C3. If required we will calculate the safety classification applicable to your machine.

2. Active safety precaution

- EAGLEVISON means active safety precaution: Without EAGLEVISON the operator might be tempted to bypass the safety circuit of the machine to see what is happening inside the machine. This may lead to serious accidents. In regard to product liability and safety regulations a look at the safety advantages of the EAGLEVISION might well pay off. The large viewing area (about 575 cm^2) with its diagonal view of about 300 mm is optimally designed and does not show any blind spots within the viewing area.

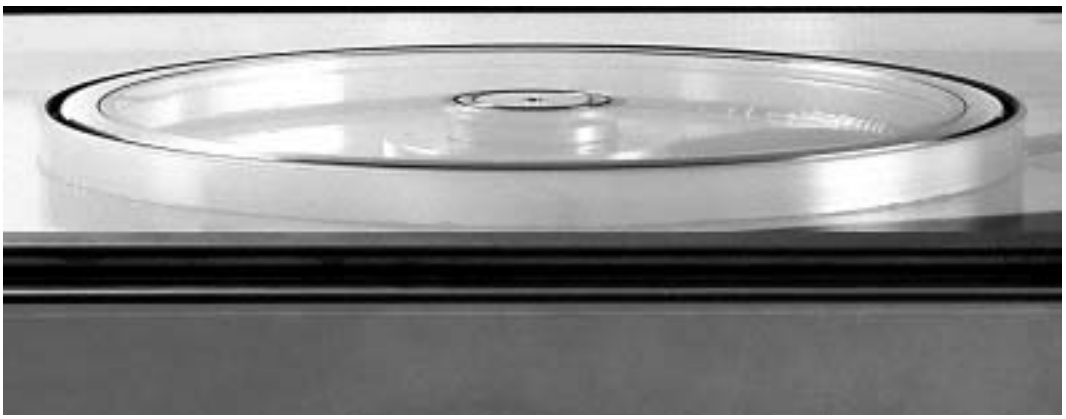
EAGLEVISION advantages

3. Complete surface flatness

- EAGLEVISION means little space requirement. Our system is suited for machining centres with little space available within the cabin (e.g. high speed CNC turning, milling or grinding machines). By the complete surface flatness on the machine side of the EAGLEVISION chips may be wiped off by wiper systems from the inside of the door. From outside you can only see the intelligent "cap", the housing containing the electronic control unit (in case of electric drive) as well as the motor (electric or hydraulic drive). It is designed to meet highest safety standards, still being capable of being integrated in a compact way into the exterior design of the cabin. The flat design provides adaptation possibilities to different door and window designs. The electronic control unit is integrated in an easily serviceable and space saving way.

changeable spin disk consists of chemically hardened single safety glass with a thickness of 3 mm. Upon demand a coating may be applied providing high resistance against bombardment by aluminium chips and an even better spin off effect for coolant containing oil. The spin disk of the EAGLEVISION rotates at a speed of > 2000 rpm and has a high rate of accelerating. In this way clear vision is created quickly. Impacting particles are flung off by centrifugal forces. Furthermore the disc can be cleaned easily and is quickly replaced in case of damage.

impact test successfully passed at safety classification C3



4. Security of investment

- The risk of operation, installation or improper handling is reduced and the cost spiral is cut. The unit is delivered completely ready for installation and installed into the cabin like any regular pane. We give a 5-year warranty on the restraint safety of the polycarbonate pane. This is possible by completely encapsulating and sealing the polycarbonate pane, which is sensitive to chemical exposure, from both sides by foil and safety glass in a costly process. The ex-

5. Quality of product

- All EAGLEVISIONS come with a twelve month guaranty ex works. Exempted from that are parts typically subjected to wear like the spin disk itself. Many of the components, e.g. spin disk, rotor or electronic control unit, are exchangeable. All repair work with the exemption of changing the spin disk will be undertaken by us.
- Many components are manufactured from high grade stainless steel. The ball bearings have life

lubrication and are exchangeable. The electronic control unit was designed specifically for the EAGLEVISION. By the optimum installation position environmental influences are excluded.

- All parts and components of the EAGLEVISION are tested for quality of material and life cycle endurance.
- The drives are manufactured by companies with many years of experience in special drives.

Model "Hydra"

Electrically driven EAGLEVISION – the model "Elektra"

The connection is directly to the 24 V DC power supply of the machine (direct current). The drive consists of an electronically commutated brushless DC-motor (24 V, power consumption maximum 5 A, nominal power 105 W). Power consumption is about 800 mA without coolant load at continuous operation. The integrated electronic control unit is supplied with an overload and reverse voltage protection. The operation is extremely silent. The noise level remains clearly below the legal demands.

EAGLEVISION driven by fluid – the model "Hydra"

Besides the electrically driven EAGLEVISION, developments with alternative drive systems were carried out. The fluid driven EAGLEVISION models are powered by the coolant of the machine by directly connecting it to the coolant pump. Careful design of the turbine system as well as the precise manufacturing processes ensures, that the fluid driven EAGLEVISION models are very silent, their noise level remaining below legal requirements. They are quieter than the operating noise of the machine. The coolant outlet is directly into the bottom of the machine. The speed of the fluid driven EAGLEVISON models may be determined by the intake pressure of the coolant and is more than 2000 rpm.

The intake pressure must be between 7 and 10 bar. If necessary, the intake pressure has to be regulated to the correct value by a pressure reduction valve available as an accessory. The maximum permissible size of particles contained within the coolant is 200 µm. That is about twice the value valid for most coolant pumps.

The fluid driven EAGLEVISION model needs minimum service and is lower priced than the electrical version.

At the end – the highlights

- Flat surface on the machine side allowing its use on sliding doors with wipers; specially suitable for turning centres due their small height.
- Safety design: the multiple layer safety glass guarantees impact resistance up to the highest safety classification C3. The polycarbonate pane showing only a small relief for the motor housing. The broad supporting surfaces of the housing and the screwed connection ensures an even distribution of impact forces.
- EAGLEVISON is offered as a completely assembled multiple layer system which only has