TECHNICAL DATA

The technical data presented here refer mainly to the ELESA+GANTER Standard elements, made of engineering plastics and metal material.
The main technologies used for the manufacture of plastic products are:
– compression/transfer moulding for Duroplasts;
– injection moulding for Technopolymers.
This primary process may be followed by secondary operations such as machining, finishing, assembly, decoration to customize the product (tampoprinting), packaging to guardantee adequate protection during transportation and identification of the product.

1. Plastic materials

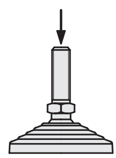
DUROPLASTS: phenolic based (PF) thermosetting plastics that harden during moulding due to irreversible polymerization.
TECHNOPOLYMERS: thermoplastic polymer materials for technical use in which the chemical composition of the molecular chain provides a wide range of mechanical, thermal, and technological properties. The transformation process is based on the melting and subsequent hardening by solidification of the material in the mould. The material itself has a low environmental impact because it can be recycled (reversible solidification).

The main technopolymers used by ELESA+GANTER						
PA Glass-fibre reinforced polyamide, with glass filler or glass micro-spheres or polyamidebased SUPER technopolymers	**PA-T** Special transparent polyamide	**PP** Glass-fibre reinforced polypropylene or with mineral fillers	**POM** Acetal resin	**PC** Special polycarbonate	**PBT** Special polyester	**TPE** Thermo-plastic elastomer

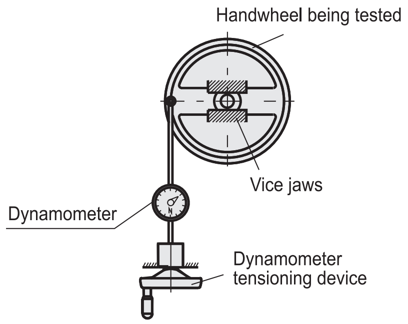
1.1 Mechanical strength

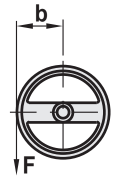
DUROPLASTS: the addition of mineral fillers, natural textile fibres and the optimum selection of the basic resin give this material an excellent mechanical strength, a high superficial hardness and a good impact strength.
TECHNOPOLYMERS: the rich selection of basic polymers available and the possibility of combining these with reinforcing fillers or additives of various kinds make a wide range of performance levels possible in terms of mechanical strength, impact strength, creep and fatigue.
The mechanical properties of a moulded plastic component may vary significantly according to its shape and the technological level of the manufacturing process. For this reason, instead of providing tables containing specific data on the mechanical strength of test pieces of various types of material, ELESA+GANTER has decided to inform designers of the forces which, in the most significant cases, may cause the component breakage. For most products, the mechanical strength values indicated in the catalogue are therefore loads at breakage.
The deformation under a load is not negligible for some products and may therefore jeopardise their performance, even before their breakage. Thus for these products, two load values are provided:
– **maximum working load** below which deformation DOES NOT jeopardise the component performance;
– **load at breakage** in accordance with the concepts outlined above.
In these cases, the "maximum working load" will be used as maximum design data to guarantee the correct performance, while the "load at breakage" will be used for safety tests.
Obviously, in both cases suitable safety coefficients must be applied.
Working stress has been taken into account (e.g. the transmission of torque in the case of a handwheel, the tensile strength in the case of a handle) as well as accidental stress (e.g. an impact with the component), in order to provide designers with a reference for determining suitable safety coefficients, according to the type and importance of the application.
All the strength values supplied were obtained from tests carried out in ELESA+GANTER Laboratories, under controlled temperature and humidity (23 °C – Relative Humidity of 50 %), under specific working conditions, and by applying a static load for a necessarily limited period of time.
The designer must therefore take into account adequate safety coefficients according to the application and specific operating conditions (vibrations, dynamic loads, working temperatures at the limits of the allowed temperature range). In the end, however, the designer is responsible for checking that the product is suitable for its intended purpose.
For some thermoplastics, for which the mechanical properties vary significantly in relation to the percentage of moisture absorbed (see chapter 1.5), the resistance tests on the component are carried out in compliance with ASTM D570, so that the moisture absorbed is in equilibrium with respect to ambient conditions of 23 °C and a RH of 50 %.

• **Compressive strength for levelling elements** (working stress)
The levelling element is assembled on its threaded metal stud and placed on special testing equipment. The element is then subjected to compressive stress with repeated and incremental loads until it breaks or undergoes a permanent plastic deformation of the plastic element.



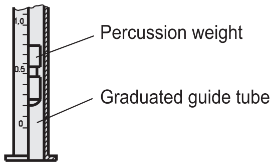
• **Resistance to transmission of torque** (working stress)
Use is made of an electronic dynamometer that applies increasing torque values as shown in the chart hereunder. The dynamometric system in the torque is shown in a traditional way to make the comprehension easier. The mean values of the torque C, obtained in the breaking tests, are shown in the tables for the various components and expressed in [Nm].

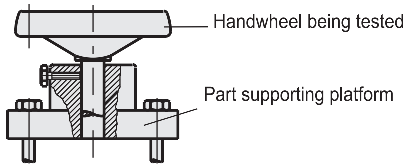




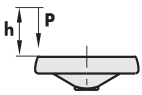
C [Nm] = F [N] • b [m]

• **Impact strength** (accidental stress)
The special equipment is used as shown in the chart.

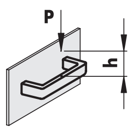




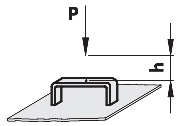
The mean values obtained in the breaking test, shown in the tables for the various models and expressed in [J], correspond to the breaking work L of the element subjected to repeated impacts, with the falling height (h) of the percussion weight (P) being increased by 0.1 m each time. Percussion weight (P): metal cylinder with a rounded ogival shaped end and weighing 0.680 kg (6.7N).



L [J] = P [N] • h [m]

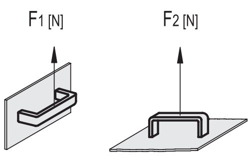


L_1 [J] = P [N] • h [m]



L_2 [J] = P [N] • h [m]

• **Tensile strength of U-shaped handles** (working stress)
This test entails fitting the handle to be tested on an electronic dynamometer, with two types of stress:
– perpendicular to the mounting screws (F1): here the stress on the handle is a mixed combination;
– parallel to the mounting screws (F2).
The load applied by the electronic dynamometer increases gradually in order to obtain a deformation of the tested element within a limit of 20 mm/min.



1.2 Thermal resistance

The use of thermosetting materials and reinforced thermoplastic polymers with a high Thermal resistance enables ELESA+GANTER to obtain products with great thermal stability and a limited variation in their mechanical properties at both high and low temperatures. The recommended operating temperature range for each plastic product in this catalogue is indicated by the symbol, which is shown here on the left. Within this temperature range:
– the material is stable and no significant degradation takes place:
– the user does not normally encounter any problem with the basic performance of the product.

The mechanical strength, impact strength, maximum torque and maximum working pressure values indicated in the catalogue were obtained from tests carried out under laboratory conditions (23 °C – Relative Humidity of 50 %). These values may vary over the working temperature range indicated. Customers are therefore responsible for checking the product's actual performance in their specific thermal working conditions. A very general indication, as to the working temperature range for the various types of plastics, is given in the table below.

Material	Working temperature range
Duroplasts (PF)	from -20 °C to 100°/ 110 °C
Special, high-resistence polypropylene based (PP) technopolymers	from 0 °C to 80°/ 90 °C
Glass-fibre reinforced polypropylene based (PP) technopolymers	from 0 °C to 100 °C
Polyamide based (PA) technopolymers	from -20 °C to 90 °C
Glass-fibre reinforced polyamide based (PA) technopolymers	from -30 °C to 130°/ 150 °C
Glass-fibre reinforced polyamide based (PA) technopolymers for high temperatures	from -30 °C to 200 °C

1.3 Strength and surface hardness

DUROPLASTS: the high surface hardness of the material and its glossy finish, obtained by the mould, enable the surfaces to be kept in perfect condition, even after prolonged use in the presence of metal machining residues or in abrasive environments, as for example, in metal machining applications with machine tools.
TECHNOPOLYMERS: the surface hardness values are lower than those of Duroplast, but are still within the 60 – 98 Rockwell range, M scale. Technopolymers are however tougher and have a greater impact strength than Duroplasts.

1.4 Resistance to chemical agents

The tables in Chapter 10 (see page A15) describe the resistance of the plastic materials used for ELESA+GANTER products, at an ambient temperature of 23 °C, in the presence of the various chemical agents they may come into contact with, in an industrial environment (acids, bases, solvents, lubricants, fuels, and aqueous solutions) and indicate 3 classes of resistance:
– good resistance = the product functional and aesthetic properties remain unchanged;
– fair resistance = effects on the functional and/or aesthetic properties, depending on the type of product and the working conditions with some limitations of use according to the specific application;
– poor resistance = product susceptible to chemical aggression. Not recommended for use.
As a general rule, chemical resistance decreases as the working temperature and mechanical stresses, to which the product is subjected, increase. The presence of high temperatures and high levels of mechanical stress together require to the product resistance to chemical agents be tested.

1.5 Resistance to atmospheric agents and UV rays

In most cases, ELESA+GANTER plastic Standards are used for "indoor" applications. In any case, due to the properties of the materials and the measures taken during the design stage, these products may also be used for "outdoor applications", where they are exposed to particular atmospheric conditions:
• **rapid changes in temperature:** within the working temperature range recommended for each product, rapid changes in temperature do not create problems due to the impact strength of the materials used;
• **the presence of water or moisture:** may result in processes of hydrolysis and the absorption of a certain percentage of the water/moisture until a state of equilibrium is reached. This may alter some of the material's mechanical properties.
Examples of materials that absorb water include polyamides (PA), transparent polyamides (PA-T, and PA-T AR) and duroplasts (PF).
Products made of these materials may undergo slight changes in size due to the absorption of water, which may affect dimensional tolerances. During the design stage, ELESA+GANTER normally takes these possible variations into account in order to minimise their effects and to guarantee compliance with the technical specifications.
The absorption of water results in a significant increase in impact strength. The following polymers do not absorb water: polypropylene (PP), thermoplastic elastomers (TPE), and acetal resin (POM). Occasional contact with rainwater followed by "drying" does not generally pose any problems in terms of the strength of the product. When used in "outdoor" applications, it is advisable to prevent water accumulating on the product by adopting suitable assembly conditions.
• **Exposure to the sunlight and UV rays** in particular.
Specific resistance tests have been carried out using specific equipment for accelerated ageing testing, in accordance with the ISO 4892-2 standard, and setting the following parameters:
– radiation power: 550 [W]/[m]2;
– internal temperature (Black Standard Temperature, BST): 65°C;
– OUTDOOR filter that simulates exposure to the open air, with low shielding against UV rays;
– relative humidity: 50 % U.R.

The relation between the hours of testing and the hours of actual exposure to an outdoor environment ("Equivalent Hours") obviously depends on the weather conditions of each geographic area. Taking the Average Radiant Exposure per Day (ARED) as a basis for comparison, the reference values adopted on an international scale include:

– Miami Equivalent Hours = high intensity exposure, typical of countries with a tropical or equatorial climate (ARED = 9.2 MJ/m^2);
– Central Europe Equivalent Hours = mean intensity of exposure, typical of continental climates (ERMG = 2 MJ/m^2).

At the end of prolonged tests carried out at the ELESA+GANTER laboratories, the variation in mechanical strength was measured (tensile/compression breaking, and impact breaking) was measured. In general, the results show that the mechanical strength of polyamide (PA), polypropylene (PP) and Duroplast (PF) products is not significantly reduced by exposure to UV rays.
As to the aesthetic appearance of samples exposed to the action of the UV rays, in some cases a slight variation in the surface appearance of the product was found, on completion of the tests.
For further details on UV ageing tests on specific products, contact the ELESA+GANTER Technical Department.

1.6 Flame resistance

The universally recognised classification used to describe the reaction of plastics to flames is obtained from two tests defined by UL (Underwriters Laboratories, USA). These tests are called: UL-94 HB and UL-94 V.
They define four main types of reaction to flames: HB, V2, V1 and V0 with progressively increasing levels of flame resistance.

• UL-94 HB (Horizontal Burning)

The test consists of putting a set of three standardized samples of the plastic (in a horizontal position set at an angle of 45° with respect to their own axis) each one in contact for 30 seconds with a flame applied at their bottom free edge.
Two marks are present on the samples at standardized distances from the free end.
A material may be classified HB if, for each of the three samples, the following conditions are applicable:

– the speed of burning between the two marks does not exceed a given standardized value that depends on the thickness of the samples being tested;
– the flame is extinguished before the fire reaches the furthest mark from the free edge (that is, from the point of application of the flame).

• UL-94 VB (Vertical Burning)

The test entails putting a set of five standardised samples of the plastic (in a vertical position) into contact each one twice for 10 seconds with a flame applied at their bottom free edge. A sheet of cotton wool is placed underneath the samples.
The following parameters are measured:

– the time required to extinguish each individual sample each time the flame is applied;
– the sum of times required to extinguish the five samples (considering both flame applications specified);
– the post-incandescence time of each individual sample after the second flame application;
– whether any material drips from the sample onto the cotton wool set underneath it with a risk of igniting it.

UL Classification of plastic materials				
UL-94 HB	For each of the three samples, the speed of combustion between the two marks does not exceed the standardized speed that depends on the thickness of the samples. For each of the three samples, the flame is extinguished before it reached the further mark from the point of application of the flame.			
UL-94 V		V2	V1	V0
	Time required to extinghuish each individual sample after each flame application.	≤ 30 s	≤ 30 s	≤ 10 s
	Sum of times required to extinghuish the five samples (considering both flame applications specified).	≤ 250 s	≤ 250 s	≤ 50 s
	Post-incandescence time of each individual sample after the second flame application.	≤ 60 s	≤ 60 s	≤ 30 s
	Presence of any material dripping from the sample onto the cotton wool beneath it with the risk of igniting it.	YES	NO	NO

The variables that determine the reaction to the flame include the thickness of the samples and the colouring of the material, in fact, there may be differences between materials with their natural colour and those with an artificial colour and differences depending on the variation in thickness of the sample with the same colour.

Yellow Card: this is a document issued by the Underwriters Laboratories that certifies the reaction of a plastic to flames, following laboratory testing. This constitutes an official recognition of the product's flame resistance.
The "Yellow Card" indicates the trade name of the product, the manufacturer and related ID number, known as a UL File Number. The flame resistance is certified for specific material thickness and colour.
Some material manufacturers carry out flame resistance tests in independent laboratories, using the same test methods as the Underwriters Laboratories.
In such cases, a declaration of conformity but no "Yellow Card" is issued by the manufacturer.
Most of the other ELESA+GANTER products for which no specific indication is given in this regard belong to the UL94-HB category.
There are groups of ELESA+GANTER Standards with UL-94 V0 classification, identified as AE-V0 by the symbol shown in the title.
ELESA+GANTER products identified as AE-V0 are made of environment-friendly plastics and are free of PBB (Polybromine Biphenyl), PBDE (Polybrominediphenyl Ether) and in particular of Penta-BDE (Pentabromodiphenyl Ether) and of Octa-BDE (Octabromodiphenyl Ether).

1.7 Electrical properties

ESD

Plastics are generally good electrical insulators. This is particularly useful in certain applications in the electromechanical field, making plastic products preferable to similar metal products.
The extent of a material insulating properties is determined by:
- **its surface resistivity**
- **its volume resistivity.**

The table below classifies the materials on the basis of their surface resistivity [Ω]:

Conductive material	Semi-conductive material	Dissipative material	Anti-static material	Insulating material
10^{-1} Ω	10^{5} Ω	10^{9} Ω	10^{12} Ω	> 10^{12} Ω

Due to an increase in the performance of the electronic products and the diffusion of their use in different applications, there has been a rise in the market demand for thermoplastic products which may satisfy the requirements of standard conductivity for the ESD (Electro Static Discharge) applications.
The ESD product line developed by ELESA+GANTER uses materials with a reduced surface resistivity (conductive), marked with the symbol of ESD-C protection indicated in the title.
Typical values, for a few of the plastics used by ELESA+GANTER, are:

Material	Property	Measuring Method	State of material	Value
PA 30 % glassfibre	Surface Resistivity	IEC93, 23 °C	Dry	10^{13} Ω
			Conditioned (50 % RH equil.)	10^{11} Ω
	Volume Resistivity		Dry	10^{15} Ω •cm
			Conditioned (50 % RH equil.)	10^{11} Ω •cm
PP 20 % mineral filler	Surface Resistivity	ASTM D257	Conditioned (50 % RH equil.)	10^{13} Ω
PA ESD	Surface Resistivity		Dry	10^{3} Ω
			Conditioned (50 % RH equil.)	10^{3} Ω
	Volume Resistivity		Dry	10^{3} Ω •cm
			Conditioned (50 % RH equil.)	10^{3} Ω •cm

1.8 Surface finish and cleanability

In moulding technopolymers, it is technically easier to make products with a rough matte surface finish, which hides any aesthetic defect such as shrinkage cavities, flow marks, or joining marks caused by non-optimum moulding processes.
However, a rough matte finish makes it more difficult to clean the component, especially if made out in light colours, and its handling for a long use.
ELESA+GANTER technopolymer Standards have a very fine matte finish so that the product remains easy to clean in time, and it is easier for the user to handle it.
Some groups of technopolymer products have recently been developed with a completely glossy finish, so that they remain clean for a long time.

1.9 Compliance with international standards

Over the past few years, the national and international regulatory authorities have laid down a series of regulations for the control of substances that are harmful to man or the environment and for the environment safety management in the industrial field.

- **European Directive 2002/95/CE RoHS (Restriction of Hazardous Substances)** applicable to the field of electrical and electronic equipment. This provides for a gradual reduction in the heavy metals (Pb, Cd, Hg, and Cr6) and halogens (PBB and PBDE) present in the components used in the electrical and electronic industries.
  In the data sheet of each product the "RoHS compliance" is indicated by the green symbol. The presence of this symbol means that all the technical problems related to the materials used for the chosen product have been solved out in compliance with the European irective 2002/95/CE. In practice, it could happen that the stock rotation process has not been completed yet: anyway, on ELESA+GANTER website www.elesa-ganter.com it is possible to make a check.
  ELESA+GANTER Technical Department is always at the customer's disposal for any kind of assistance.
- **European Regulation n.1907/2006 - REACH (Registration, Evaluation, Authorisation and restriction of Chemicals)**, applicable to all the chemical substances circulating in the European Community, aiming at improving the knowledge of the dangers and risks arising from the existing chemical substances and from the new ones.
- **European Directive 2000/53/CE - ELV (End Life of Vehicles)**, applicable to the automotive field. This provides for a gradual reduction in the heavy metals Pb, Cd, Hg, and Cr6, resent in vehicles.
- **RAEE (WEEE) Directive**, Waste of Electrical and Electronic Equipment.
- **ATEX Directive 94/9/CE - ATEX**, effective since the 1st of July 2003, refers to work environments with explosion risks and classifies the zones where a potentially explosive atmosphere may occur. ATEX marking (together with the declaration of conformity) certifies that the item, on which it is applied, was manufactured in compliance with all the requirements and provisions of the European Union Directive 94/9/EC (mandatory since 1st of July 2003) and that it was submitted to the procedures for conformity assessment. In accordance with this directive, certification is compulsory for all the equipment and protection systems, for the components (which are necessary for operating in safe conditions) that will be used in potentially explosive atmospheres (either pneumatic, hydraulic, electrical, mechanical) and for all safety, control and adjustment devices needed for the safe operation of the equipment and the protection systems, installed out of the potentially explosive atmosphere, but having the function of protection against explosion risks.

Hazardous zones (are classified according to the frequency and duration of the occurrence of a potentially explosive atmosphere):
- **zone 0** area in which a potentially explosive atmosphere, consisting of a mixture of air and flammable substances in the form of gas, vapour or mist, is present always, for long periods or often (at least 1000 hours/year);
- **zone 1** area in which, during normal operations*, a potentially explosive atmosphere, consisting of a mixture of air and flammable substances in the form of gas, vapour or mist, is occasionally present or with a small frequency (more than 10 hours and less than 1000 hours/year);
- **zone 2** area in which, during normal operations*, a potentially explosive atmosphere, consisting of a mixture of air and flammable substances in the form of gas, vapour or mist, is present only for a short time or seldom (less than 10 hours/year);
- **zone 20** area in which a potentially explosive atmosphere in the form of a cloud of combustible dust in air is present always, often or for long periods (at least 1000 hours per year);
- **zone 21** area in which, during normal operations*, a potentially explosive atmosphere, in the form of a cloud of combustible dust in air is occasionally present or with a small frequency (more than 10 hours and less than 1000 hours/year);
- **zone 22** area in which, during normal operations*, a potentially explosive atmosphere, in the form of a cloud of combustible dust in air is present only for a short time or seldom (less than 10 hours/year).

* normal operations means the situation in which installations are used within their design parameters.

The directive identifies two groups of equipment (I and II), in accordance with the environment in which it is used:
- **group I** comprises equipment intended for use in the underground parts of mines, and/or in the surface parts of such mines;
- **group II** comprises equipment intended for use in environments other than those specified for group I.

Within group II, the devices subject to the provisions of ATEX directive are subdivided into categories according to the combination of explosion hazard zones and equipment groups:
- **category 1** comprises equipment and protection systems in this category are intended for use in areas in which explosive atmospheres are present for long periods or often (1000 hours or more/year), ensuring a very high level of protection;
- **category 2** comprises equipment and protection systems in this category are intended for use in areas in which, during normal operations, explosive atmospheres are present, with a small frequency or occasionally (10 – 1000 hours/year), ensuring a high level of protection;

Technical Data

- **category 3** comprises equipment and protection systems in this category are intended for use in areas in which, during normal operations, explosive atmospheres are present only for a short period or seldom (less than 10 hours/year), ensuring a normal level of protection.

ZONE	0 G (gas)	20 D (dust)	1 G (gas)	21 D (dust)	2 G (gas)	22 D (dust)
Explosive atmosphere	High probability, continuously or frequently		Average probability, sometimes, occasionally		Low probability, seldom, almost never	
CATEGORY in accordance to ATEX 94/9/EC Directive	**1**		**2**		**3**	

The directive also specifies the Groups of substances, classifying the substances that create potentially explosive atmospheres with air based on their hazardousness.
The hazardousness depends on the gas ignition temperature.
The table below shows some examples of gases with their related classification.

Gas	**Group**
Propane	IIA
Ethylene	IIB
Acetylene	IIC

Equipment with IIB marking are suitable also for applications that require equipment of explosion group IIA, those marked with IIC are suitable also for applications that require equipment of explosion groups IIA and IIB.
The table below shows the temperature classes, that indicate the max surface temperature (detected on the surface of the piece into contact with air), that must not be exceeded, to prevent ignition.

Max surface temperature	**Temperature class**
450 °C	T1
300 °C	T2
200 °C	T3
135 °C	T4
100 °C	T5
85 °C	T6

ELESA+GANTER products are components necessary for the safe operating of equipment and protection systems included in Group II (environments other than mines).
The following table shows the related categories:

Zone	**2 (20)**	**1 (21)**	**2 (22)**
Group II environments other than mines	**Category 1** presence of explosive atmosphere > 1000 h/year	**Category 2** presence of explosive atmosphere > 10 and < 1000 h/year	**Category 3** presence of explosive atmosphere > 10 and < 10 h/year

The following example shows the ATEX classification of an ELESA+GANTER product, (a breather cap of the SFP series): CE II 2GD IIB T6 where:

CE – marking CE
Ex – protection against explosion symbol
II – indicates the equipment group
2 – indicates the category it belongs to (and therefore the protection level ensured)
G e D – indicate the type of potentially explosive atmosphere where the component can operate (G = gas, D = dust). They can be present alternatively or simultaneously (like in this case)
IIB – indicates the substance group type (gas, vapours or mists)
T6 – indicates the temperature class

'k' protection factor: most of ELESA+GANTER products included in the line of accessories for hydraulic systems are also certified according to EN 13463-8 standard (Protection by liquid immersion 'k'): the equipment protection is based on the presence of a liquid that prevents the formation of sparks and other causes of ignition.
The following example shows the ATEX classification of a certified ELESA+GANTER product, e.g. a plug of the TN series, according to EN 13463-8 standard, in which "k" is evidently present: CE Ex II 2GD k T5.

Code	Description	Classification ATEX	See page
58296-EX	TN-3/8-EX	CE ex II 2GD kT5 1146	1665
58297-EX	TN-1/2-EX	CE ex II 2GD kT5 1146	1665
58298-EX	TN-3/4-EX	CE ex II 2GD kT5X 1146	1665
54001-EX	SFP.30-3/8-EX	CE ex II 2GD IIB T6 1170	1706
54011-EX	SFP.30-3/8+a-EX	CE ex II 2GD IIB T6 1171	1706
54022-EX	SFP.30-3/8+F FOAM-EX	CE ex II 2GD IIB T6 1170	1706
54101-EX	SFP.30-1/2-EX	CE ex II 2GD IIB T6 1170	1706
54111-EX	SFP.30-1/2+a-EX	CE ex II 2GD IIB T6 1171	1706
54122-EX	SFP.30-1/2+F FOAM-EX	CE ex II 2GD IIB T6 1170	1706
54201-EX	SFP.40-3/4-EX	CE ex II 2GD IIB T6 1170	1706
54211-EX	SFP.40-3/4+a-EX	CE ex II 2GD IIB T6 1171	1706
54222-EX	SFP.40-3/4+F FOAM-EX	CE ex II 2GD IIB T6 1170	1706
14441-EX	HGFT.10-3/8-EX	CE ex II 2GD kT6X 1188	1725
14461-EX	HGFT.13-1/2-EX	CE ex II 2GD kT6X 1188	1725
14481-EX	HGFT.16-3/4-EX	CE ex II 2GD k IIBT6X 1188	1725
10851-EX	HCFE.12-3/8-EX	CE ex II 2GD kT6 1204	1746
10901-EX	HCFE.15-1/2-EX	CE ex II 2GD kT6 1204	1746
11001-EX	HCFE.20-3/4-EX	CE ex II 2GD k IIBT6 1204	1746
–	GN 743.6-11-M16x1.5	CE ex II 2GD TX 1194	1732
–	GN 743.6-14-M20x1.5	CE ex II 2GD TX 1194	1732
–	GN 743.6-18-M26x1.5	CE ex II 2GD TX 1194	1732
–	GN 743.6-18-M27x1.5	CE ex II 2GD TX 1194	1732
–	GN 743.6-18-M27x2	CE ex II 2GD TX 1194	1732
–	GN 743.6-11-G3/8	CE ex II 2GD TX 1194	1732
–	GN 743.6-14-G1/2	CE ex II 2GD TX 1194	1732
–	GN 743.6-18-G3/4	CE ex II 2GD TX 1194	1732

In an industrial environment, i.e. where ATEX Group II products are used, it is the user's responsibility to classify the zones in relation to the "potential" presence of gases, vapours and explosive dusts, identifying the relevant work places and working activities where explosion risks are present or could trigger, according to his/her risks assessment.
The manufacturer provides all the necessary information related to the Groups and Categories of the product, in order to allow the user to decide in which zone the ATEX product can safely operate, even if he/she is not able to foresee where and how it will actually operate.

1.10 Competence of ELESA+GANTER Technical Department

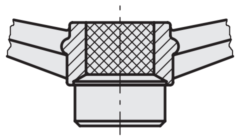
Ongoing research and experimentation with new materials that offer increasingly high levels of performance are parts of the principles of continuous improvement on which ELESA+GANTER Quality System is based. Our partnership with the leading plastics manufacturers in the world and the use of mechanical and process simulation programs allow us to offer the material that best suits the Client's specific application.

2. Metal materials

Most of ELESA+GANTER plastic elements contain inserts or functional components made of metal. The tables (Stainless steel – Carbon steels, Zinc alloys, Aluminium and Brass – Duroplasts) describe the chemical composition and mechanical strength values as per the reference standards for the metals used.
Surface treatments for metal inserts and parts: the surface of metal inserts or functional parts is generally treated to ensure the maximum protection against environmental agents, in order to maintain the product's aesthetic and functional qualities.
The protective treatments normally used include:
– burnishing of steel bosses and hubs;
– zinc-plating of threaded studs (Fe/Zn 8 in compliance with the UNI ISO 2081 standard);
– matte chromium plating of lever arms and revolving handles shanks.
Metal parts made of brass or stainless steel do not normally require surface treatment.
On request and for sufficient quantities, inserts subjected to other types of protective surface treatment may be supplied: black zinc-plating, nickel-plating, Niploy-Kanigen process, chromium plating, anodising and other, heat treatments like nitriding, hardening and case-hardening.

2.1 Properties of metal inserts

The diamond knurling, of a shape, pitch and depth suited to the stress to be applied, is normally adopted, aiming at ensuring the most effective anchoring of the metal inserts to the plastic material and the best mechanical operation of the element. This type of knurling ensures both axial anchoring (that contrasts axial tensile stress) and radial anchoring (to avoid rotation during the transmission of torque).



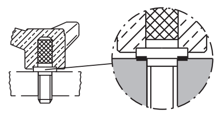
For threaded studs, instead of using a common screw available on the market, they use specially shaped threaded insert which protrudes a few tenths of mm from the plastic body so as to form a metal face on the screwing plane, thus freeing the plastic material of all stresses.

2.2 Clamping knobs with threaded inserts (Types of assembly)

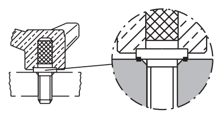
Types of assembly that create optimum clamping conditions

The plastic base on the clamping knob should never rest on the clamping surface. In this way the metal inserts (threaded stud or tapped boss) are never subjected to abnormal twisting ("corkscrew" effect) when axial tensile stress is applied. Thus, the anchoring of the metal insert to the plastic material is stressed in the correct way, that's to say it is only subject to the torque applied to the knob for tightening it.

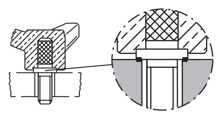
1. Threaded hole, without any chamfer or countersinking.



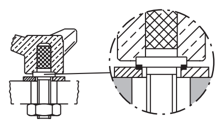
2. Threaded hole with chamfered edge or countersinking of a smaller diameter than that of the face on the stud, in order to ensure an adequate overlap between the metal insert and the clamping surface.



3. Plain cylindrical hole of a smaller diameter than that of the face on the stud, in order to ensure an adequate overlap between the metal insert and the clamping surface.



4. Plain cylindrical hole of a larger diameter than that of the face on the stud, setting in between a steel washer whose hole has a smaller diameter than that of the face of the stud. This guarantees an adequate overlap between the metal insert and the clamping surface, thanks to the washer.

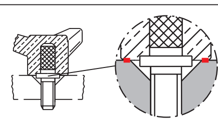


Incorrect types of assembly

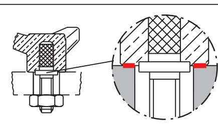
When the plastic base of the clamping knob rests directly on the clamping surface, the threaded stud or tapped boss are also subject to an axial load ("corkscrew" effect), which could jeopardize its anchoring to the plastic material.

The values of this force are always higher, with a broad safety margin, than those that may be applied by normal operations performed by hand, but designers who wish to take into account cases of improper use should avoid the situations illustrated in cases 5-6-7.

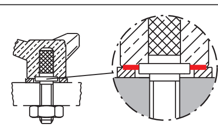
5. Threaded hole and champfer or countersinking with a larger diameter than that of the face on the stud.



6. Cylindrical through hole with a larger diameter than that of the face on the stud.



7. Threaded hole without any chamfer or countersinking, setting in between a steel washer whose hole has a diameter larger than that of the face on the stud.

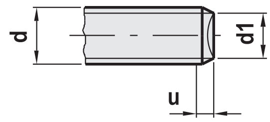


2.3 Pass-through holes

For knobs in which pass-through holes (FP type) have to be made, the insert is set in such a way that the machining of the hole or the broaching of a keyway only affects the metal part, without the plastic material having to be machined in any way.

2.4 End of threaded studs

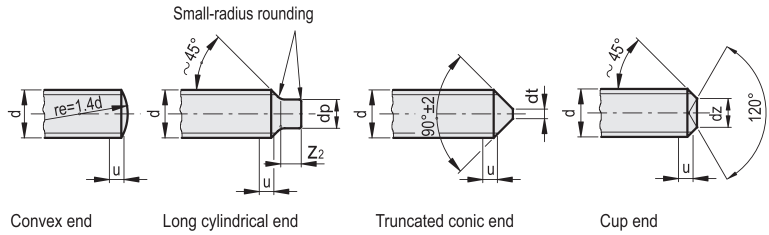
All threaded studs of the ELESA+GANTER elements have a chamfered flat end in compliance with ISO 4753.



Chamfered (rolled) end

d1 = Ø thread minor diam.
P = pitch
u = 2P incomplete threads

On request and for sufficient quantity, studs with different kinds of ends may be provided. These ends may be of the types shown hereunder, as indicated in the ISO 4753 table for "Fixing elements: ends of elements with ISO metric outside threading".



P = pitch
u = 2P incompleted threads

d	dp h14	dt h16	dz h14	Z2 +IT 14* 0
4	2.5	0.4	2	2
5	3.5	0.5	2.5	2.5
6	4	1.5	3	3
8	5.5	2	5	4
10	7	2.5	6	5
12	8.5	3	7	6
14	10	4	8.5	7
16	12	4	10	8

* IT = International Tolerance

2.5 Seizure risk with stainless steel threaded couplings

The stainless steels generally used for fasteners are:
– A2 (similar to AISI.304 steel)
– A4 (similar to AISI.316 steel)
An indelible marking always identifies the steel type and the mechanical strength class.
The tightening torque is dependent upon:
– The nominal diameter of the threading
– The mechanical strength class of stainless steel (50-70-90)
– The friction coefficient.
A high friction leads to the dissipation of a large amount of energy. The stainless steel thermal conductivity is about half that of carbon steels, therefore the tightening of the screw and nut, both made out of stainless steel, increases the heat generated towards the plastic deformation of the material thus creating a potential locking condition (seizure) of the coupling. In the case of disassembly and reassembly of the coupling, the seizure risk increases considerably. In practice, to avoid this risk, it is recommended to lightly lubricate both the threading and the nut under head with MoS2 paste or simply use some anti-corrosive grease.

3. Other materials

GASKETS

ELESA+GANTER normally uses gaskets made of synthetic nitrile butadiene rubber (NBR) or acrylonitrile butadiene rubber (BUNA N) for its products, with hardness values ranging from 70 to 90 SHORE A depending on the type of product considered.
The working temperature range for continuous use is -30 °C to +120 °C. Where a higher chemical and thermal resistance is required, that is, for products in the HCX-SST, HCX-SST-BW and HGFT-HT-PR series, gaskets made of FKM fluorinated rubber are used.
For chemical resistance values, see the table in chapter 10 (on pages A30, A31 and A32).
The working temperature range is from -25 °C to +210 °C.
On request and for sufficient quantity, flat washers and O-rings made of special materials such as EPDM, silicone rubber, or others may be supplied.

AIR FILTERS for filler breather caps (SFC., SFN., SFP., SFV., SFW., SMN. and SMW. series):
– TECH-FOAM type filters polyester-based polyurethane foam mesh, degree of filtration 40 microns, recommended for temperatures of between -40 °C and +100 °C for continuous use, and brief peak temperatures of +130 °C. This material does not swell in contact with water, petrol, soap, detergents, mineral oils or grease. Some solvents may cause slight swelling of the foam (benzene, ethanol, and chloroform);
– TECH-FIL type filters made of zinc-plated iron wire (quality as per DIN 17140-D9-W.N.R 10312, zinc-plated as per DIN 1548), degree of filtration 50 – 60 microns.

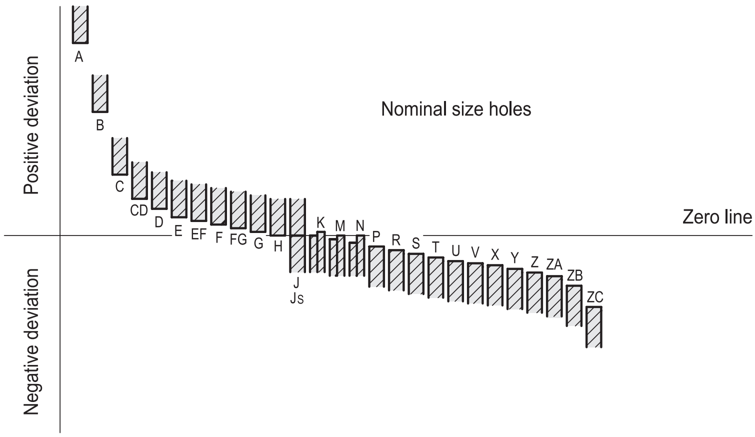
4. Machine tolerance

The reference tolerance system is the: ISO System - Basic hole

TOLERANCES OF THE METAL INSERTS

Plain holes in the bosses and hubs of knobs and handwheels

For the most widely used models, there are various kinds of standardized holes available so the user has a wide selection and is saved the costly task of remachining the hole on assembly. The tolerance of these holes is normally grade H7, but in a few cases it is grade H9. The degree of tolerance is always indicated in the tables of each article, in the hole size column. For cases in which it is more difficult to propose a standardization of the holes that satisfies the broadest range of assembly needs, either a pre-drilled hole with a simple roughing tolerance (hole with a smaller diameter than that of the shaft on which it is expected to be assembled), or a hub with no hole (not drilled) is used.



Holes diameter mm	H7	H9
over 3 to 6	+0.012 0	+0.030 0
over 6 to 10	+0.015 0	+0.036 0
over 10 to 18	+0.018 0	+0.043 0
over 18 to 30	+0.021 0	+0.052 0

• Threaded holes in the bosses and threads of the studs

Machining in accordance with the ISO metric threads for a normal screwing length (see table in chapter 10, page A24).
– Tapped holes of built-in metal bosses = tolerance 6H.
– Metal studs or ends of shanks for revolving handles = tolerance 6g.

TOLERANCES OF HOLES AND THREADS IN THE PLASTIC MATERIAL

• Plain holes (for handles with a through hole for assembly in an idle condition on pins). Despite the considerable difficulties encountered in maintaining the tolerances in a machining process in which numerous factors influence the end result, the size of the diameter of the axial hole is normally respected with a tolerance of C11. The handles may therefore also be assembled on pins made from normal drawn parts. If the pin is obtained by turning from a bar with a greater diameter, a machining process with a tolerance of h11 is recommended, as this gives a suitable free coupling, with the advantage of a quick, simple and inexpensive machining process.
• Inside threads (for handles with no metal bushing to be screwed in and fixed to threaded pins). They are normally kept undersized so that assembly is slightly forced at ambient temperature.
• Outside threads (for filler breather caps or level indicators with a threaded connector). In this case, for reasons related to the process technology and the type of plastic, which may absorb small amounts of moisture from the outside environment, the tolerances must be interpreted taking this into account though the tightening of the component assembled is never actually jeopardized in practice.

5. Fixed handles
(Types of assembly)

Various kinds of couplings are used for securing fixed handles to the shaft:
- handles with brass boss or nutscrew moulded into the plastic material for screwed assembly on a threaded shaft;
- handles with built-in self-locking boss made of special technopolymer (ELESA Original design) for push-fit assembly on a plain shaft (unthreaded) made from a normal drawn rod (ISO tolerance h9). This solution prevents spontaneous unscrewing in time due to the vibrations to which the lever is subjected or the rotary forces exerted inadvertently by the operator's hand while handling the lever itself;
- handles with threaded hole obtained from moulded plastic material.

For executions with threaded holes obtained from moulded plastic material, the measure of keeping the thread undersized with respect to the specifications laid down in the standards has been taken. This enables the threads of the nut screw to adapt slightly to the screw, when tightening at ambient temperature, thus creating a coupling with an elastic reaction that gives an effective locking effect. Even better results may be obtained by hot assembly: the handle is heated to 80÷90 °C before being screwed onto the threaded pin. This method of assembly initially facilitates the screwing operation in that the thread of the nut screw is expanded when screwed in and subsequently enables an extremely efficient locking effect to be obtained from shrinkage on cooling, due to the slight roughness of the surface of the thread on the shaft.
The solution with a self-locking bushing made of special technopolymer (Fig.1) is, in any case the most effective against spontaneous unscrewing in that the elastic coupling is not susceptible to any vibrations or rotary forces exerted by the operator's hand.

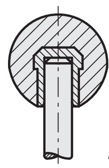


Fig.1

The lock is also such as to ensure that the handle does not come out even when subjected to a normal pulling action along its axis. In relation to this, the results of the research work and tests carried out at the ELESA+GANTER laboratories are provided and they confirm the technical validity of the coupling with self-locking bushings made of special technopolymer (Fig. 2 and 3).
The graph in Fig. 2 shows the variations in axial translation effort expressed in [N] as a function of the variations in diameter of the shaft (mm), dry and degreased with trichloroethylene. The two curves represent the minimum and maximum values in hundreds of tests conducted on a type of self-locking handle with a hole having a O 12 mm. The area A contains the values that refer to shaft with a commercial diameter of 12 mm (tol. h9).
The graph in Fig. 3 shows the variations in axial translation effort (mean values) as a function of the surface area of the shaft. As may well be imagined, the presence of lubricating or emulsifying oil on the surface of the shaft lowers the handle removal effort. It may however be readily noted that, even in this unfavourable condition, the axial effort required to slide the handle out is always such as to ensure that this cannot actually happen in practice.
The use of this kind of handle ensures a considerable saving in that it does not entail machining thread on the end of the shaft. The self-locking bushing made of special technopolymer enables an elastic coupling to be obtained and the handle itself maintains all its surface hardness and wear resistance typical of thermosetting materials.
Assembly instructions: fit the handle onto slight chamfered shaft end and push as far as possible by hand or by means of a small press. Alternatively it is possible to tap the handle with a plastic or wooden mallet until firmly in place. In this case we strongly recommend to use a cloth or other suitable soft material over the product to avoid any surface damage.

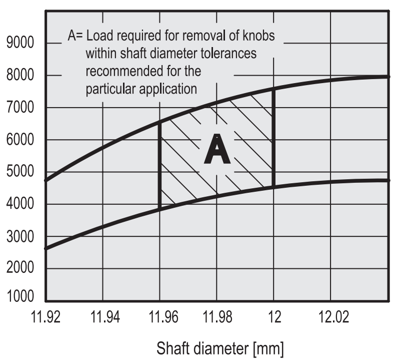


Fig.2

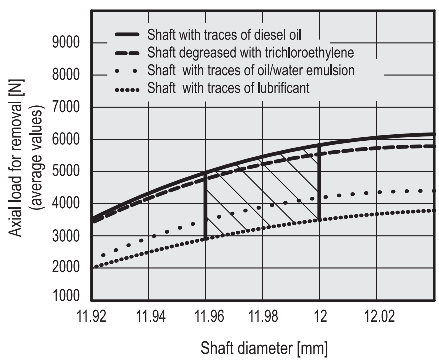


Fig.3

6. Assembly measures

Plastic is a poor conductor of heat and has a different thermal expansion coefficient from that of the metal inserts so measures must be taken, while remachining the hole, to stop the hubs and bosses from overheating: in fact, the heat produced is not dissipated and the metal parts expand and create stress inside the body of the plastic which has a damaging effect on the strength of the assembly (Duroplasts).
In addition, for thermoplastics (Technopolymers), temperatures close to their softening point could be reached with the risk of the metal insert coming loose.
It is therefore always necessary to adopt cutting and feed rates that do not produce marked localized heating and to cool intensively when the holes have a large diameter and depth with respect to the size of the bushing.
To conserve maximum gloss of the surfaces, we recommend, once machining has been completed, to avoid leaving the plastic wet for a long time, by removing all residual emulsified water from the surfaces; use oil only, if possible.
The machining processes commonly required for the assembly of handwheels or knobs are:

- **remachining of axial hole in the bosses (blind hole)**
  When remachining the hole of a built-in metal boss, always avoid operating as shown in Fig.4, because both during the drilling operation and during the insertion of the small shaft, an area of the plastic covering may be subjected to stress, with the risk of cracking or detaching the part indicated with cross shading. The operation shown in Fig. 5 is the most rational.

Note that in the ELESA+GANTER parts, remachining of the axial hole may be performed under the correct conditions indicated above in that the length of the built-in bosses is always indicated in the table of each article so, for the depth of the hole, reference should simply be made to the basic plan.

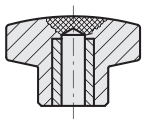


Fig.4

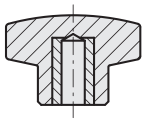


Fig.5

- **remachining of the axial hole in the bosses (case of a pass-through hole)** If the drilling operation affects not only the metal boss but also a layer of the covering material, the handwheel must be centred carefully and drilling should be started from the plastic side otherwise, chipping may occur when the tool is removed.
- **transversal threading in the boss for grub-screw** To be performed in accordance with the instructions given above. Avoid threading both the metal and the plastic: it is better to drill the hole in the plastic part and thread the metal part only.

Drilling or threading operations to be performed entirely in the plastic are exceptional. Bear in mind that the difficulty with which the heat produced locally is dissipated, also through the abrasive action of the plastic on the tool, worsens considerably the latter's working conditions, resulting in a rapid wear of the cutting edges (use hard metal tools).

7. Special executions

The range of ELESA+GANTER elements is extremely broad and offers designers valid alternatives as regards designs, properties and performance of materials, sizes..., to satisfy the most different applicational needs. The customer may however need to ask for changes to the standard part or have it made in different colours to adapt it to particular applications. In these cases, ELESA+GANTER engineers are at the customer's full disposal to satisfy these requests for special executions which must be required in sufficient quantities for the modifications they may entail to the moulds.

8. Colours

In addition to black, which represents the most commonly used colour for plastic components, a large number of standard elements are available in the following colours:

Colours in RAL

	7021		3000		7030
	2004		6001		7040
	7035		9006		7042
	1021		9005		3002
	5024		7031		9002

As the RAL tables refer to the colour of paints and are therefore colours with a glossy surface, the RAL code is indicated indicatively because the tone of the colour of the moulded part may differ slightly, depending on various factors such as the colouring of the polymer pigments (polyamide or polypropylene), the glossy or matte finish, the thickness and the shape of the product.

9. Test values

All the information about the test values are based on our experience and on laboratory tests conducted under specific standard conditions and in a necessarily limited time.
Any indicated value must therefore be taken only as a reference for the designer who will apply adequate safety coefficients to them according to the product application. The designer and the purchaser are responsible for checking the suitability of our products for their final use under the actual operating conditions.

10. Technical tables

The units contained in the present catalogue, are those of the International System (S). Conveniently, here under there is a list of the parameters converted into the units currently used or into the British ones.

10.1 Conversion tables

Conversion table of the major parameters

Parameter	To convert	in to	multiply by
Force	N	kg	0.1
Couple	Nm	kg-m	0.1
Work	J	kg-m	0.1
Parameter	**To convert**	**in to**	**multiply by**
Length	mm	inches	0.039
Force	N	lbf	0.224
Couple	Nm	lb ft	0.737
Work	J	ft lb	0.737
Weight	g	lb	0.002
Temperature	°C	°F	(°C 9/5) + 32

Conversion table of some temperature values from °C to °F
°C = (°F -32) 5/9 °F = (°C 9/5) +32

°C	°F	°C	°F	°C	°F
-50	-58	+50	+122	+150	+302
-45	-49	+55	+131	+155	+311
-40	-40	+60	+140	+160	+320
-35	-31	+65	+149	+165	+329
-30	-22	+70	+158	+170	+338
-25	-13	+75	+167	+175	+347
-20	-4	+80	+176	+180	+356
-15	+5	+85	+185	+185	+365
-10	+14	+90	+194	+190	+374
-5	+23	+95	+203	+195	+383
0	+32	+100	+212	+200	+392
+5	+41	+105	+221	+205	+401
+10	+50	+110	+230	+210	+410
+15	+59	+115	+239	+215	+419
+20	+68	+120	+248	+220	+428
+25	+77	+125	+257	+225	+437
+30	+86	+130	+266	+230	+446
+35	+95	+135	+275	+235	+455
+40	+104	+140	+284	+240	+464
+45	+113	+145	+293	+245	+473
+50	+122	+150	+302	+250	+482