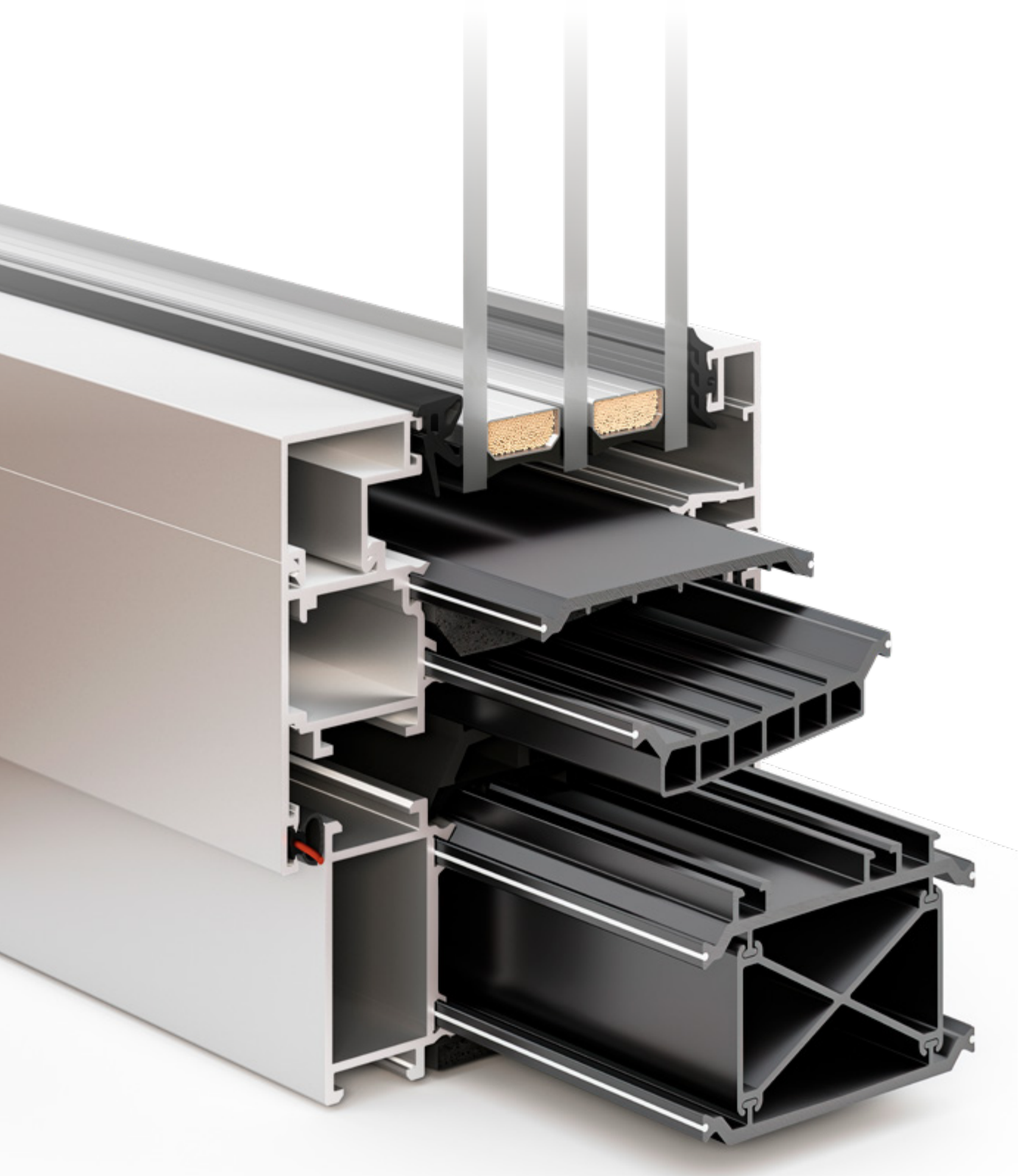
STAC

TECHNICAL MANUAL

POLYAMIDE PROFILES



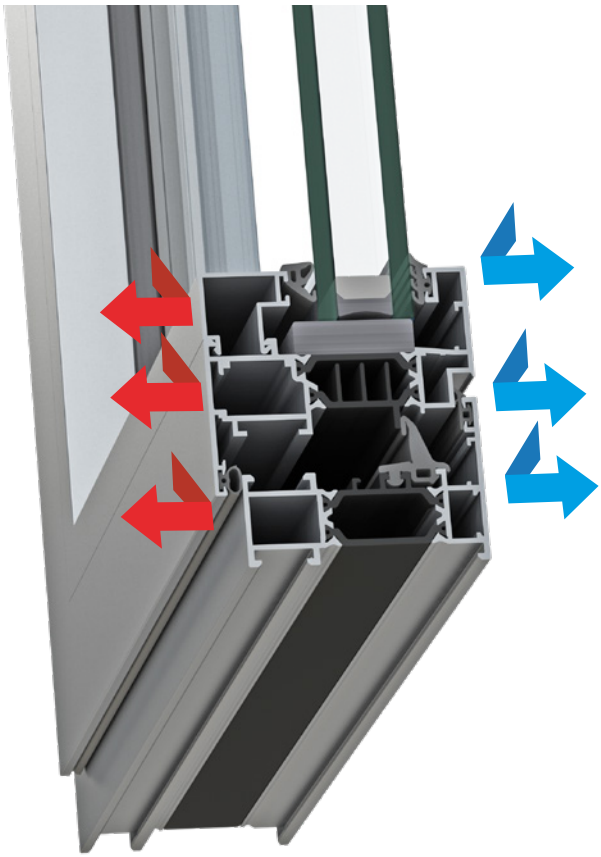
STAC

INDEX

1. ENERGY EFFICIENCY AND THERMAL BREAKING

In these times we are presently living, construction energy efficiency is all important in caring more for the environment and to comply with building regulations and reduce the use of fuel and electricity. All this together provides greater comfort and added value.

In order to achieve excellence with regard to energy efficiency in buildings, the technology for building enclosures and aluminium window and curtain walling systems plays an essential part. In order to achieve optimum insulation from these systems, a thermal insulation material must be used that is inserted between the external and internal profiles that in turn provides a barrier in order to minimise the energy transfer between both.



2. THERMAL BREAK RAW MATERIAL

Thermoplastics are materials with low thermal conductivity coefficients and therefore possess good thermal properties and for that reason they are ideal materials to be used for thermal breaking in aluminium window systems.

Nevertheless, the thermoplastic to be used has to comply with more requisites in order to be able to be used in this application.

A melting temperature of 250ºC and above in order to withstand the powder coating process.

Mechanical features that are moderated to the usage temperatures and those that can be subjected to during the various manufacturing process phases for thermally broken profiles.

A thermal expansion coefficient that is similar to aluminium.

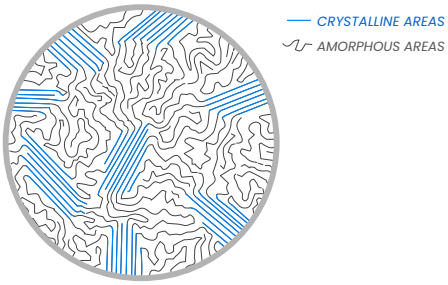
The thermoplastic that complies with the previously mentioned conditions is polyamide 66, and for that reason it is the principal material selected for extruding the STAC insulating profiles.

2.1 POLYAMIDE 66 STRUCTURE

At STAC we believe that when a product is manufactured or used for an application, it is vitally important to understand the structure and behaviour of the prime material used for its manufacture.

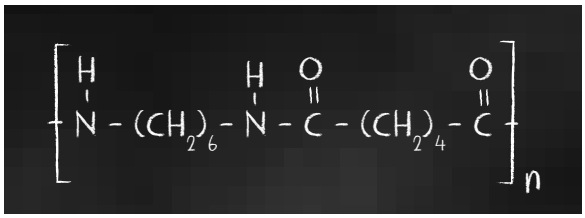
The thermal break profiles or rods manufactured at STAC comprise of PA66 reinforced with 25% fibre glass.

Polyamide polymeric matrix detail.



The polyamide 66 is a semi-crystalline polymer and its polymeric matrix comprises of crystallines and amorphous undefined shapes.

The semi-crystalline polymers, such as polyamide, have good mechanical properties and chemical resistance due to the uniform packaging of the molecules in the crystalline area.



Polyamide 66 chemical structure

2.2 HUMIDITY ABSORPTION AND ITS EFFECTS

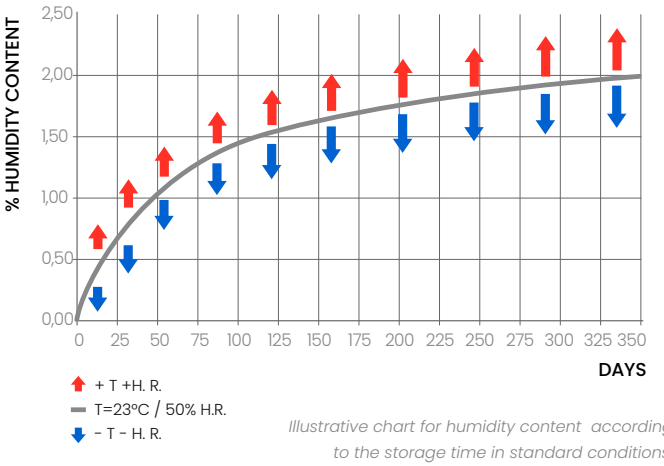
The polyamide 66 is a hygroscopic polymer that absorbs the water contained in the humidity from the atmosphere. The explanation of this phenomenon is within the connections that are produced within the amide group (-CO-NH-) and the hydrogen and oxygen found in the water molecules (H20). As the water content found in the polymeric matrix increases, a dimensional increase is produced and changes to the polymer mechanical properties.

The percentage of absorbed water weight fundamentally depends on the relative humidity, the temperature and the time it has been subjected to these conditions.

The chart that can be observed in continuation gives an idea as to how the polyamide 66 humidity content evolves with respect to time, for some temperature conditions and standard humidity (T=23ºC/ 50%H.R.).

Summing up, during the first 3 months the humidity absorption is quicker and from thereon it is produced more slowly until reaching the saturation of the specified temperature and humidity conditions where the chart then converts to a horizontal line (In this case around 2%).

At higher temperatures or relative humidities, the curve moves upwards which causes higher percentages of humidity content.

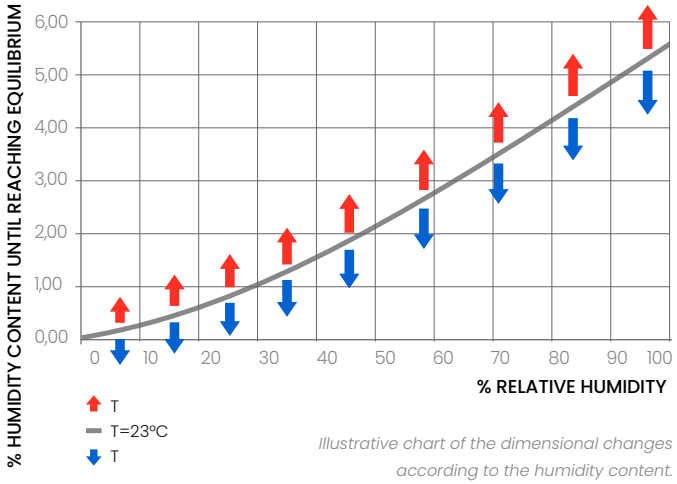


Illustrative chart for humidity content according to the storage time in standard conditions.

In continuation there is another chart in which can be observed the humidity contents reached until equilibrium for distinct relative humidities and a constant temperature of 23ºC.

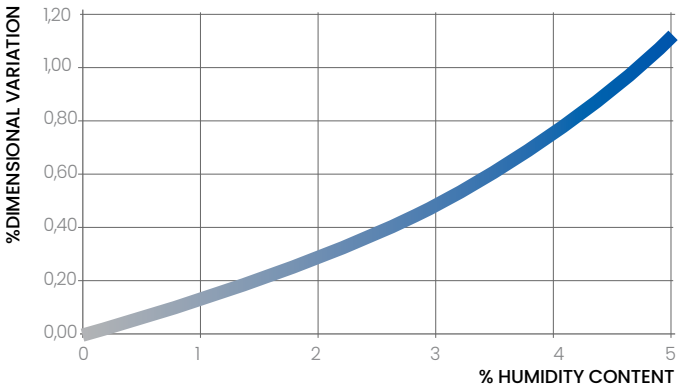
At higher temperatures, the curve moves upwards which causes higher percentages of humidity content.

The next chart relates to the dimensional variation of the polyamide 66 according to the percentage of humidity that it contains.



Illustrative chart of the dimensional changes according to the humidity content.

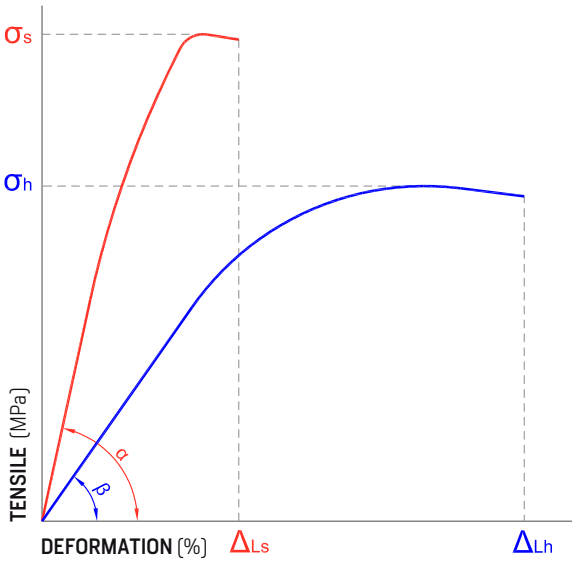
For some standard conditions (T=23ºC & 50% of relative humidity), the polyamide 66 reaches its equilibrium in humidity content at around 2% which causes an approximate dimensional increment of 0.3% as can be seen in the previous charts.



Illustrative chart of the dimensional changes according to the humidity content.

From a mechanical point of view: As the water content of the polyamide 66 increases, it loses rigidity and becomes more ductile and maleable which reduces its elastic module, resistance to traction and hardness. On the other hand it increases break deformation and impact resistance.

In the following chart it can be clearly seen how it affects the humidity content of the polyamide 66 from a mechanical point of view.



Generic tensile-strength graphs for Polyamide 66 dry and Polyamide 66 with % of humidity

TRACTION PROPERTIES COMPARISON
(PA 66 dry as opposed to PA 66 with % of humidity)

Tensile strength	$\sigma s > \sigma h$
Tensile modulus	$Es > Eh$
Elongation at break	$\Delta Ls < \Delta Lh$

Finally, we would like to emphasise that it is vital to understand all of the previous information in order to store and use the polyamide 66 in an adequate way with the objective of obtaining plainly satisfatory usage results.

	PA66 dry curve
	PA66 % humidity curve
σs	*Tensile strength (PA66 dry)*
σh	*Tensile strength (PA66 % humidity)*
ΔLs	*Elongation at break (PA66 dry)*
ΔLh	*Elongation at break (PA66 % humidity)*
$Es = tg\alpha$	*Tensile modulus (PA66 dry)*
$Eh = tg\beta$	*Tensile modulus (PA66 % humidity)*

2.3 THE PRINCIPAL QUALITIES OF POLYAMIDE 66

A. A low thermal conductivity coefficient.

B. A thermal expansion coefficient similar to aluminium.

C. A melting point that is higher than the temperature of the powder coating ovens.

D. Good resistance properties including temperatures up to 200° C.

E. Resistant to impact and ageing.

F. Resistant to UV radiation due to its black carbon content and the polymer intrinsic properties and the process method.

G. Resistant to corrosion and the majority of chemical products.

H. The residues produced from burning lack toxicity and neither are they harmful to the atmosphere.

I. Physically tested during its use in aluminium window systems over the last 3 decades.

2.4 TECHNICAL DATA SHEET

2.4.1 PHYSICAL, MECHANICAL & THERMAL PROPERTIES

POLYAMIDE CHARACTERISTICS				EXTRUDED PROFILE [1]	
COMPOSITION	Polyamide 6.6 with 25 % glass fibre				
COLOR	Black	**UNITS**	**STANDARD**	**DRY** [2]	**CONDITIONED** [3]
GENERAL	Density	g/cm³	ISO 1183-1	1,30 ± 0,05	
	Glass fibre content	%	ISO 3451-1	25 ± 2,5	
MECHANICAL	Tensile strength	MPa	ISO 527 2-4	≥ 80	≥ 50
	Tensile modulus	MPa	ISO 527 2-4	≥ 3500	≥ 2000
	Elongation at break	%	ISO 527 2-4	≥ 2	≥ 5
	Impact resistance	KJ/m²	ISO 179-1/2n	≥ 30	≥ 35 or without thermal break
	Shore D hardness	-	ISO 868	82 ± 5	78 ± 5
THERMAL	Melting temperature	°C	ISO 3146 ISO 11357-3	≥ 250	

[1] Test pieces extracted from extruded flat profiles. The results can vary depending on the transversal geometry of the profile.
[2] Samples recently extruded with a humidity content of 0% in weight.
[3] Humidity content corresponding to the state of equilibrium in standard conditions (ISO 1110).

HITEP: Maximum thermal efficiency polyamide

Through an innovative manufacturing process, we are able to produce Polyamide 6.6 GF25 profiles with a lambda value of 0.19 W/mK.

HITEP maintains profile manufacturing precision and excellent mechanical properties. Our customers can develop systems with lower thermal transmittance and optimised profile size.

	STANDARD	**PA 6,6 HITEP**	**PA 6,6 25 GF**	**UDS.**
DENSITY	ISO 1183	1,03 ± 0,05	1,30 ± 0,05	g/cm³
TENSILE STRENGTH	ISO 527-2/4	≥50	≥80	MPa
SHOCK RESISTANCE	ISO 179 1eU	≥20	≥30	KJ/m²
LACQUERING	-	SI	SI	-
THERMAL CONDUCTIVITY COEF.	ISO 10456	0,19	0,30	W/(m.K)
DIMENSIONAL ACCURACY	-	0,1	0,1	mm

2.4.2 ELECTRICAL PROPERTIES

The polyamide is considered as a bad electrical conductor polymer and can be used as an electrical insulator for determined applications.

In continuation there is a list of generic electrical characteristics for the dry polyamide 66 or with humidity content:

CHARACTERISTIC	UNITS	D.A.M. (4)	CONDITIONED (5)
Relative permitivitty / 100 Hz	-	4,3	10,3
Relative permitivitty / 1 MHz	-	3,6	4,2
Volumetric resistivity	Ω x cm	1x10 ^{11}	1x10^{9}
Dissipation factor / 100 Hz	-	150	2000
Dissipation factor / 1 MHz	-	240	750
Dielectric strength / 1.0 mm	KV/mm	30,5	-

Electrical properties illustrations for the polyamide 66

(4) Polyamide with a humidity content approaching 0% in weight (Dry)

(5) Polyamide with a humidity content corresponding to a state of equilibrium in standardal conditions (T=23ºC / 50% H.R.)

As can be seen, the relative permitivitty increases along with the increase in the humidity content and consequently the conductivity of the material is higher.

If fibre glass is added to the polyamide, it will also increase its conductivity.

2.5 SAFETY DATA SHEETS

1. PRODUCT AND COMPANY IDENTIFICATION

1.1. Product

PRODUCT DESCRIPTION: Polyamide insulating profiles

TYPES: Diverse transversal shapes according to reference STM XXXX.

PRODUCT USE: Thermal breaking in metallic profiles.

1.2. Company

STAC, Sistemas Técnicos del Accesorio y Componentes S.L.

Polígono industrial Picusa s/n

15.900 A Matanza, Padrón, A Coruña

Tlf: 0034 981 817 036

Fax: 0034 981 817 037

E-Mail: info@stac.es

2. HAZARD IDENTIFICATION

None.

3. COMPOSITION

Polyamide 66 with additives and reinforced with fibre glass.

4. FIRST AID

4.1. General recommendations

Remove the injured person from the exposed area and keep them in a lying position. Do not administer anything orally if the person is unconscious. If the injured party is vomiting and the mouth is pointing upwards, turn the head to one side.

4.2. Inhalation

Where accidental inhalation of smoke occurs caused by overheating or combustion, go outside and breathe fresh air and report to a doctor if exposed for a prolonged period of time.

4.3. Skin contact

Where the material has fused with the skin, apply fresh water immediately in the affected area. Never pull the polymer off that is stuck to the skin and see a doctor immediately.

4.4. Eye contact

Where particles (splinters, swarf etc.) have been projected in to the eyes, do not rub them. Wash with abundant water as a precautionary measure and see a doctor immediately.

5. FIRE PROTECTION MEASURES

5.1. Extinction methods

Carbon dioxide (CO2), dry powder, foam and water.

5.2. Specific dangers

Large melted masses can burn spontaneously when exposed to air. Good practice is to extinguish with water. A fire can produce dangerous gasses (see point 10).

5.3. Fire fighting protection equipment

Autonomous respiratory equipment and adequate protection equipment.

5.4. Others

The remains of a fire along with the contaminated water used extinguish the fire have to be disposed of according to the corresponding local legislation.

6. ACCIDENTAL SPILLAGE MEASURES

Where swarf is apparent, avoid that it is washed in to drains or pipes.

7. HANDLING AND STORAGE

7.1. Handling

Avoid overheating or production of volatile particles due to inadequate handling.

Where volatile powders are produced, ensure that adequate ventilation and extraction is installed which respects the current legislation with respect to particle size limit values.

7.2. Protection against fire and explosión

Take the adequate measures to avoid static electrical discharges, especially in areas where dust particles are present.

7.3. Storage

Keep in a dry area with the relative adequate temperature and humidity in order to guarantee correct handling and use.

8. PERSONAL PROTECTION

8.1. Skin protection

Use protective gloves and tight clothing when carrying out fabrication work.

8.2. Respiratory tract protection

If dust particles are produced whilst using or handling, ensure a protection mask is used.

8.3. Eye protection

Use protective glasses during cutting or fabricating.

8.4. General Hygiene

Respect the current legislation regarding industrial material hygiene. Hands must be washed before any breaks and at the end of the working day. Do not eat, drink or smoke in a work area.

9. PHYSICAL CHARACTERISTICS

Physical state: Various geometric transversal lengths

Colour: Black
Smell: Odourless
Density: 1,25-1,35 g/cm³
Fibre glass content: 22,5-27,5%
Melting point: ≥ 250ºC
Thermal decomposition: ≥ 300ºC
Ignition temperature: ≥ 400ºC

10. STABILITY AND REACTIVITY

The product is stable in normal conditions of use.
Avoid contact with strong acids and oxidant agents.
During the thermal decomposition, dangerous substances are released such as carbon monoxide and dioxide, hydrogen cyanide, ammonia, aldehydes, acroleine and cyclopentanone.

Small quantities of dangerous gasses can be released during drying or cleaning or particle material that could produce irritation in the eyes or respiratory tracts.

11. TOXICOLOGY INFORMATION

To our knowledge, if the product is handled correctly, it does not pose any health risk.

12. ECOLOGICAL INFORMATION

It is a product that does not dissolve in water and for that reason does not pose any environmental risks as long as it is handled correctly.

13. DISPOSAL CONSIDERATIONS

For disposal or recycling, please respect the current local legislation.

14. TRANSPORTATION INFORMATION

It is a material that is not considered dangerous according to transportation regulations.

15. ADDITIONAL INFORMATION

It is not obligatory to be marked and/or labelled.
If mechanical operations are carried out (cutting, fabrication, grinding etc.) the current norms and regulations must be complied with concerning the limit values of the particles generated.

The information contained in this data sheet is based on our knowledge of the product at the date of publication and is to be considered as a guideline for safe handling, use, storage, transport and disposal. The recipient of the product is responsible for its proper use in accordance with applicable regulations and legislation.

This document is not to be considered as a specification or guarantee of quality.

3. TECHNICAL OFFICE AND DEVELOPMENT

As has been explained previously, the energy efficiency requirements for buildings are and will be each time stricter as time goes by. For that reason we have a technical office available with the necessary infrastructure in order to advise the client regarding the developments in thermal breaking for new window systems with the objective of achieving the energy saving which is demanded by current legislation.

Because we believe, and the passage of time has demonstrated this, that by working as a team with our clients, solutions can be achieved that are highly efficient and functional and benefit both parts from the technological, economical and competitive point of view.

3.1 KNOW-HOW: OUR OWN CREATIONS OF EXTRUSION TOOLING AND CALIBRATORS

We firmly believe that in the industrial world in general and particularly in extrusion, that the responsible for the product design has to have ample knowledge regarding the materials to be processed, the manufacturing process and the extrusion tooling to be used as all of them are intimately related.

Therefore, we have decided to centralize in our technical office, the product design jointly with the die and calibrator design that are necessary for manufacturing the product.

The dimensions, calculus and layout of the extrusion tooling and calibrators are made based on the accumulated experience in extrusion from the beginning of our evolution in this sector.

3.2 OUR OWN DIE SHOP

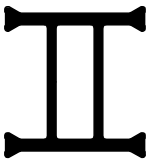
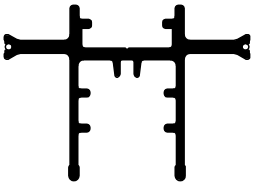
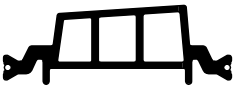
In order to provide flexible service to our clients regarding the delivery of the first samples, we have available our own die shop which is equipped with electro-erosion units and fabrication where we make our own extrusion tooling and calibrators. This allows us to provide to the client savings in tooling which we could not achieve by working with external suppliers.

4. TYPES OF POLYAMIDE PROFILES

We have an extensive catalogue of profiles in various widths and geometric configurations based on what function is required. In continuation please find the most common examples:

Where a profile is needed for a new project and does not appear in our catalogue of standard profiles, please do not hesitate in requesting it. It would give us great satisfaction to collaborate, design and manufacture new products to integrate in to your new systems. Our technical office will be completely at your disposal to offer proposals and carry out the corresponding studies.

In the shortest possible time you will receive the quotation from our commercial department.

	FLATS		DOUBLE TUBULARS
	C SHAPED		CONCEALED SASH
	WITH SUPPORT FOR CENTRAL GASKET		WITH SUPPORT FOR HARDWARE
	WITH RUBBER PORTS		SASH CRUCIFORMS
	WITH CHAMBER DIVIDER		CURTAIN WALL
	WITH SCREW PORTS		OPERATING RODS
	TUBULARS		SPECIALS

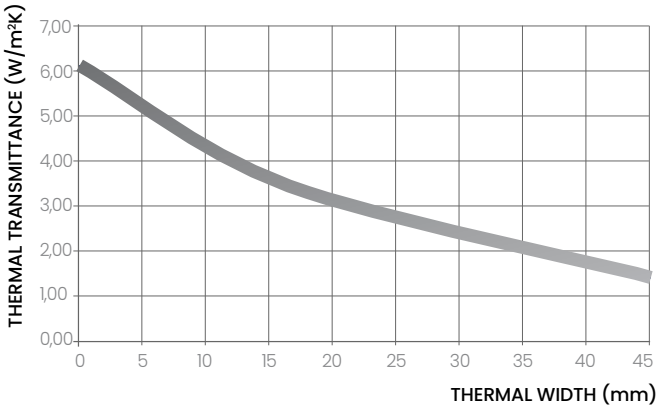
4.1 RELATION BETWEEN THE POLYAMIDE PROFILE GEOMETRY AND THE THERMAL INSULATION

Depending on the transversal section of the polyamide profile, its width and the additional insulation elements used, (Tubulars, dividers, foam rubber, etc.) will alter the thermal insulation of the window

The greater the width of the thermal break used then there will be a lesser coefficient of thermal transmittance of frame and sash therefore achieving a greater insulation and thermal efficiency of the system.

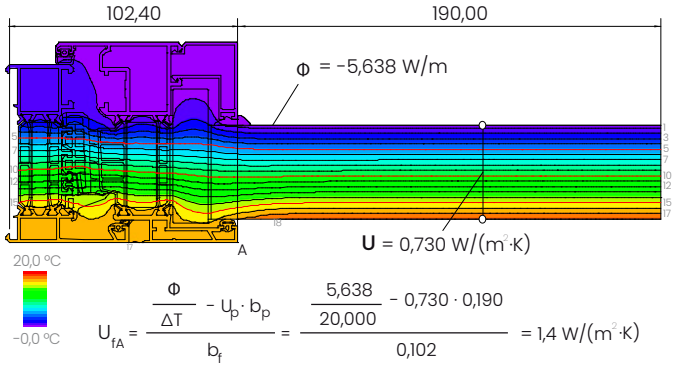
We have a technical office available that is ready to provide proposals and solutions together with the client in order to achieve the optimum thermal transmittance coefficients.

By using the Flixo software, we can simulate the thermal transmittance coefficients for the proposed frame-sash systems, in order to be able to achieve a better solution.

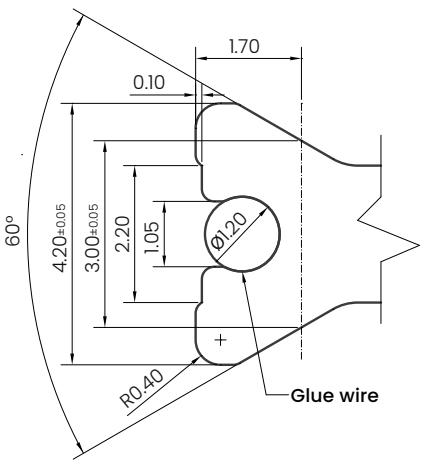


Illustrative chart for the variation of thermal transmittance (1) based on the width of the thermal break used (Data extracted from Flixo software)

(1) The thermal transmittance coefficient is defined as the amount of energy transmitted of a constructive system by a unit of time and surface, for a temperature gradient of 1 Kelvin degree or centigrade degree, between both sides of said system.



Example of the thermal transmittance and isothermal lines results obtained by using the Flixo programme.



Standard dovetail detail with a glue wire.

4.2 FIXING ZONES

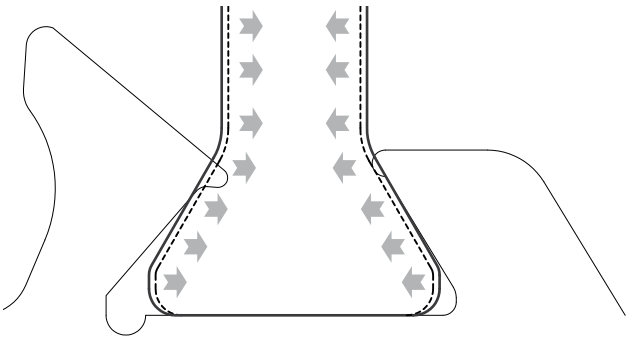
In order to achieve a secure and solid join between the polyamide profiles and the aluminium profiles, the “dovetail” fixing system is used.

4.2.1 THE FUNCTION OF THE THERMAL-ADHESIVE STRIP

As explained in paragraph 2.2 in this manual, following manufacture of the polyamide profiles they will absorb a determined percentage of humidity that will cause a small volumetric inrease.

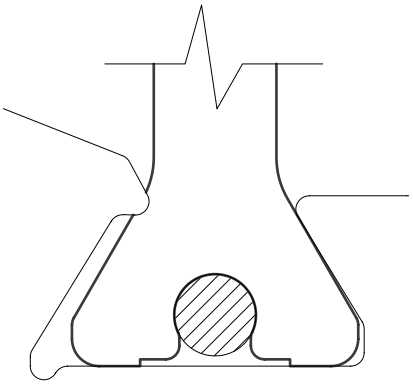
The total or part of said increment will be lost after exposing the profiles to temperatures and process times of the powder coating with the tendancy that the section will recover its original extrusion shape.

The volumetric reduction would implicate lesser tightness with relation to the hammers against the dovetail that will lead to a loss of resistance to the joint shear with respect to what it had before going through the powder coating process ovens.



——— POLYAMIDE SECTION **BEFORE** POWDER COATING

--------- POLYAMIDE SECTION **AFTER** POWDER COATING



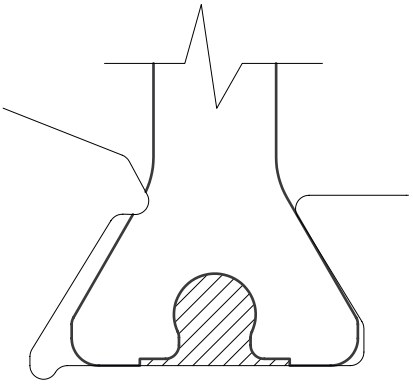
BEFORE POWDER COATING

In order to recover the shear strength that has been lost by the contraction of the polyamide, a thermal-adhesive strip is inserted into the inside of the dovetail resulting in that on passing through the powder coating ovens it melts and firmly adheres to the polyamide 66 and the aluminium.

EAA MATERIAL

PROPERTIES	UNITS	VALUE
Melting point	°C	≥95
Diameter	mm	1,20 ± 0,05
Break resisance	MPa	≥33
Break elongation	%	≥280

Thermo-adhesive technical data sheet



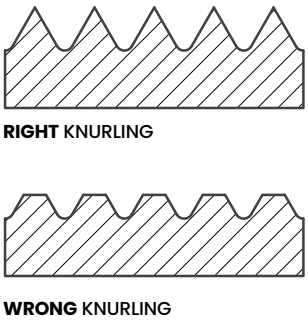
AFTER POWDER COATING

In the case where the polyamide assembly process is carried out after the powder coating process of the aluminium profile, it will not be necessary to have dovetails with thermo-adhesive profiles (although if it does have this it will absolutely not be detrimental) as the humidity contained in the polyamide will never vary in representative quantities and will maintain its resistance to shear appropriate to the tightness of the hammers.

4.2.2 THE IMPORTANCE OF THE KNURLING OF THE ALUMINIUM PROFILE CAVITY

In order to achieve a quality assembly with great mechanical features, special attention must be paid to the knurling of the aluminium profile cavity.

A good knurling provides good penetration of the dovetail hammers and consequently a more solid join between the aluminium and polyamide profiles. This will positively affect in the shear strength value and the transversal tension of the thermally broken profile and complies with EN14024 & NF252 standards (See section 7.4).



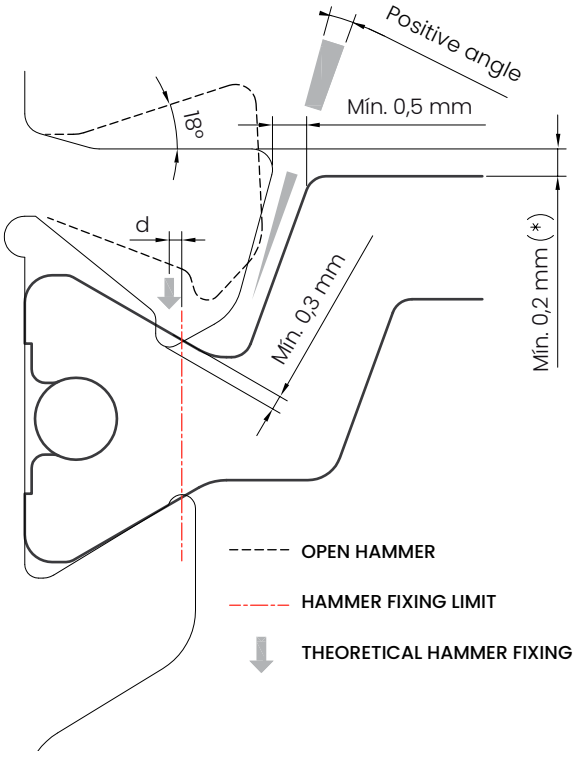
Example of right and wrong knurling.

4.2.3 GENERAL RECOMMENDATIONS FOR THE CAVITY DESIGN

The basic and general rules for the cavity design can be seen in the diagram in continuation..

A rotation of around 18° must be anticipated during assembly that will produce a penetration of the hammer in the dovetail of 0.3 mm as a minimum. The fixing point of the dovetail has to be situated over, or at a distance "d", with respect to the limiting line of the fixing and never outside of this so that the polyamide is subjected to compression and never at a shear loading in the fixing zone.

Once the hammer is closed, a conical space must remain between this and the sloped position of the polyamide in order to avoid accumulations of cold water which could damage the assembly. Additionally, the minumum distances between the hammer and the polyamide must be respected as per the following detail.



General detail for the design of the hammers

4.2.4 RECOMMENDED TYPES OF CAVITY

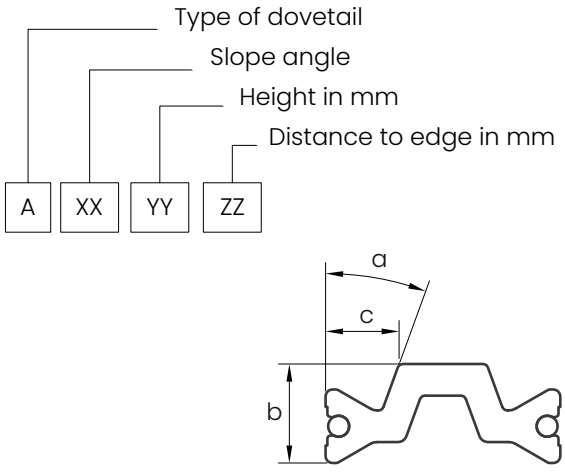
Depending on the transversal geometry of each profile (Dovetail type, flat, C shaped etc.) a determined type of cavity is recommended for its fitting to the aluminium profile.

This does not mean to say that another type of existing cavity is not equally valid for a specific polyamide profile.

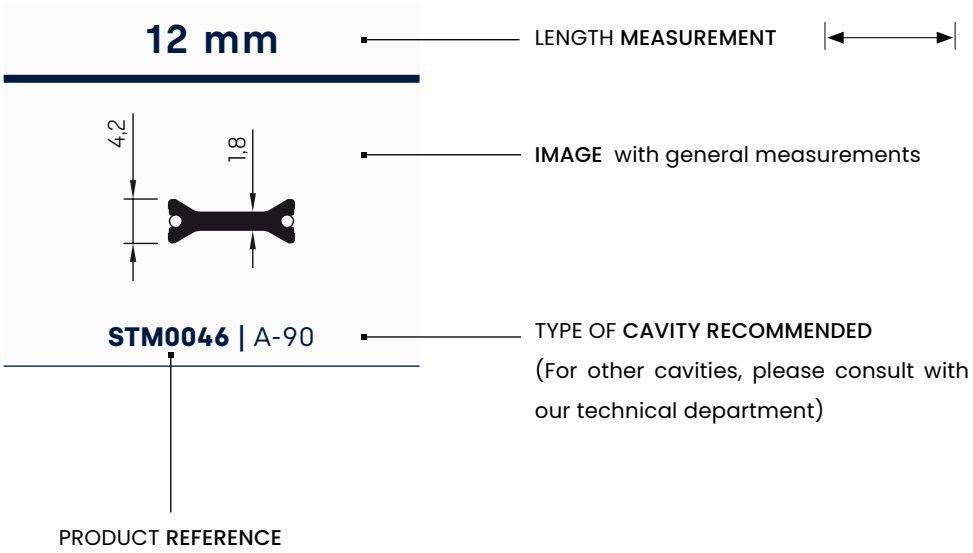
Our technical office will be pleased to give you advice regarding which reference from our catalogue would be better adapt to your cavity

In the case of "C" shaped polyamide profiles, there could be various configurations for the fixing zone depending on the angle and position of the sloped area of the profile.

In continuation there are drawings of the various recommended cavities that can be found in our polyamide profile catalogue. In the lower part of each drawing reference in the catalogue, the recommended cavity Is indicated according to the following heading:

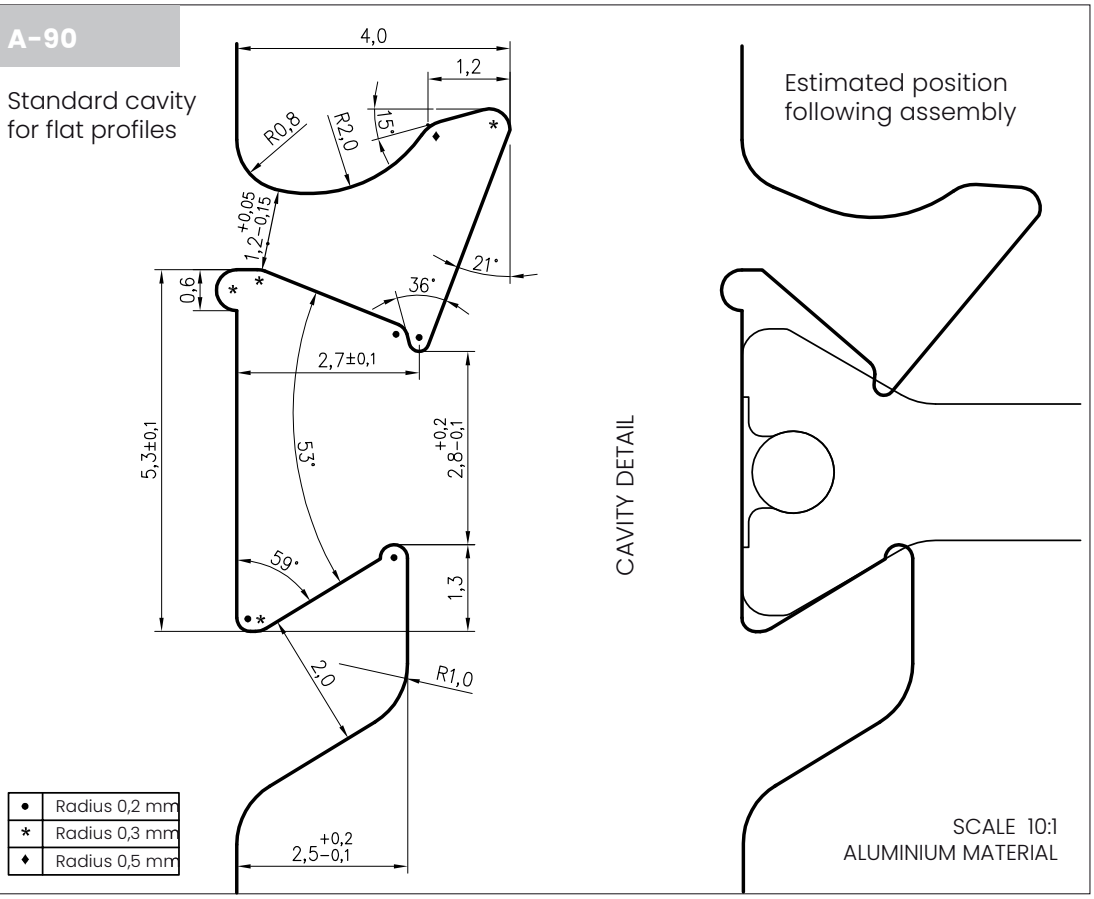


Classification of the aluminium profile cavity according to the most relevant geometric characteristics in the polyamide fixing zone.



A-90

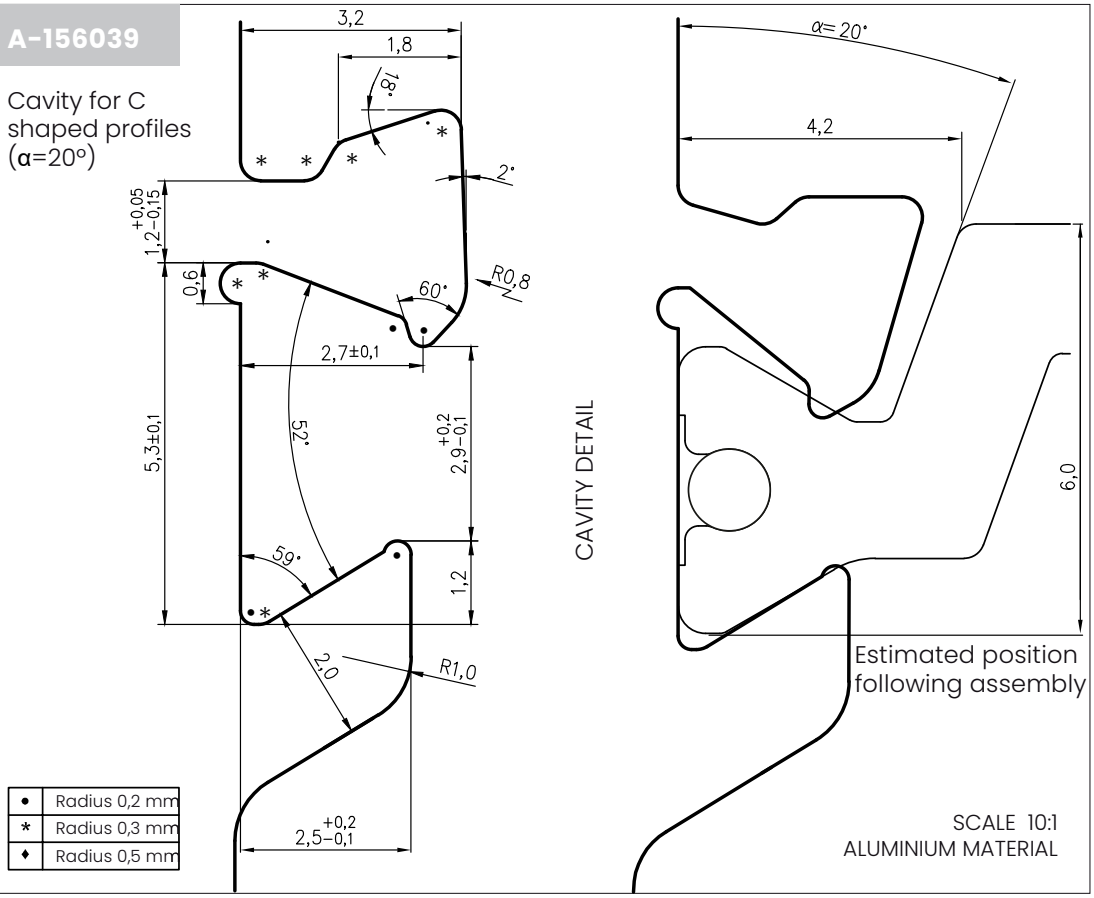
Standard cavity for flat profiles



•	Radius 0,2 mm
*	Radius 0,3 mm
♦	Radius 0,5 mm

A-156039

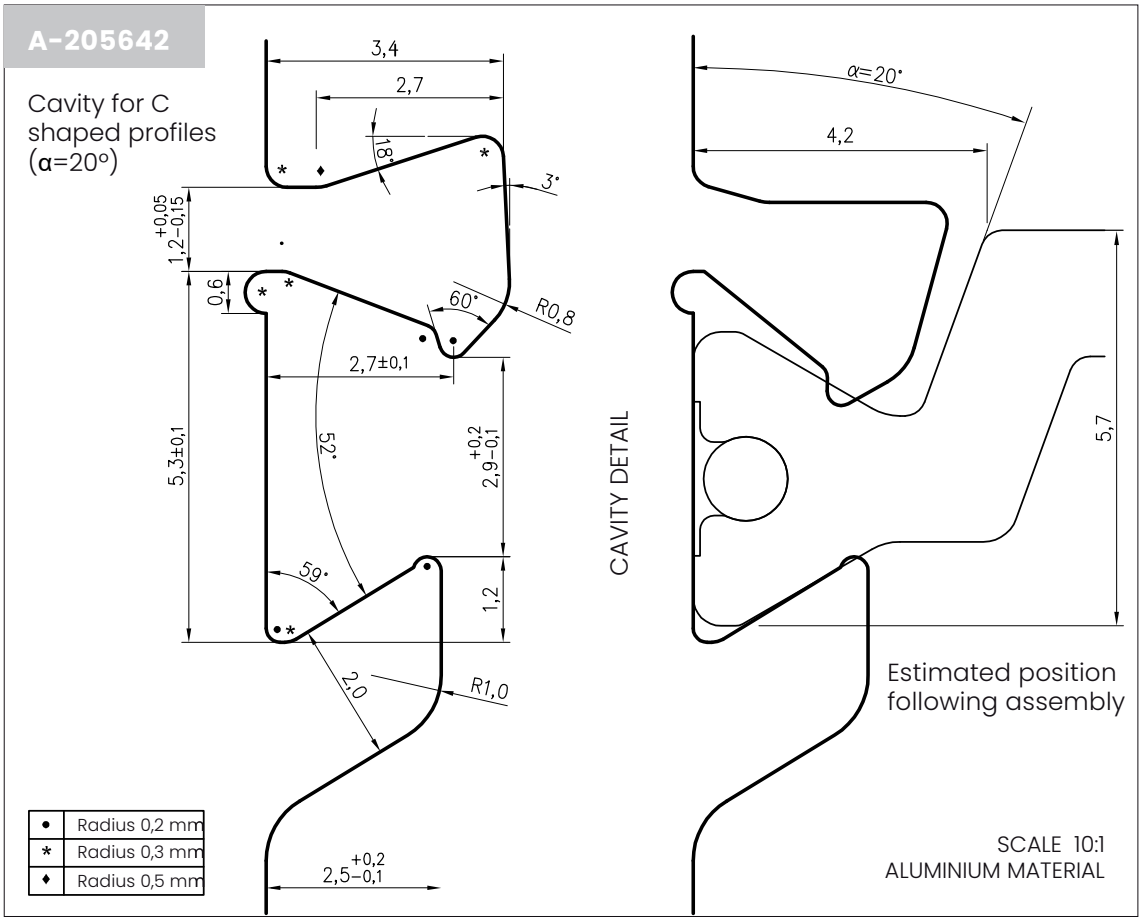
Cavity for C shaped profiles (α=20°)



•	Radius 0,2 mm
*	Radius 0,3 mm
♦	Radius 0,5 mm

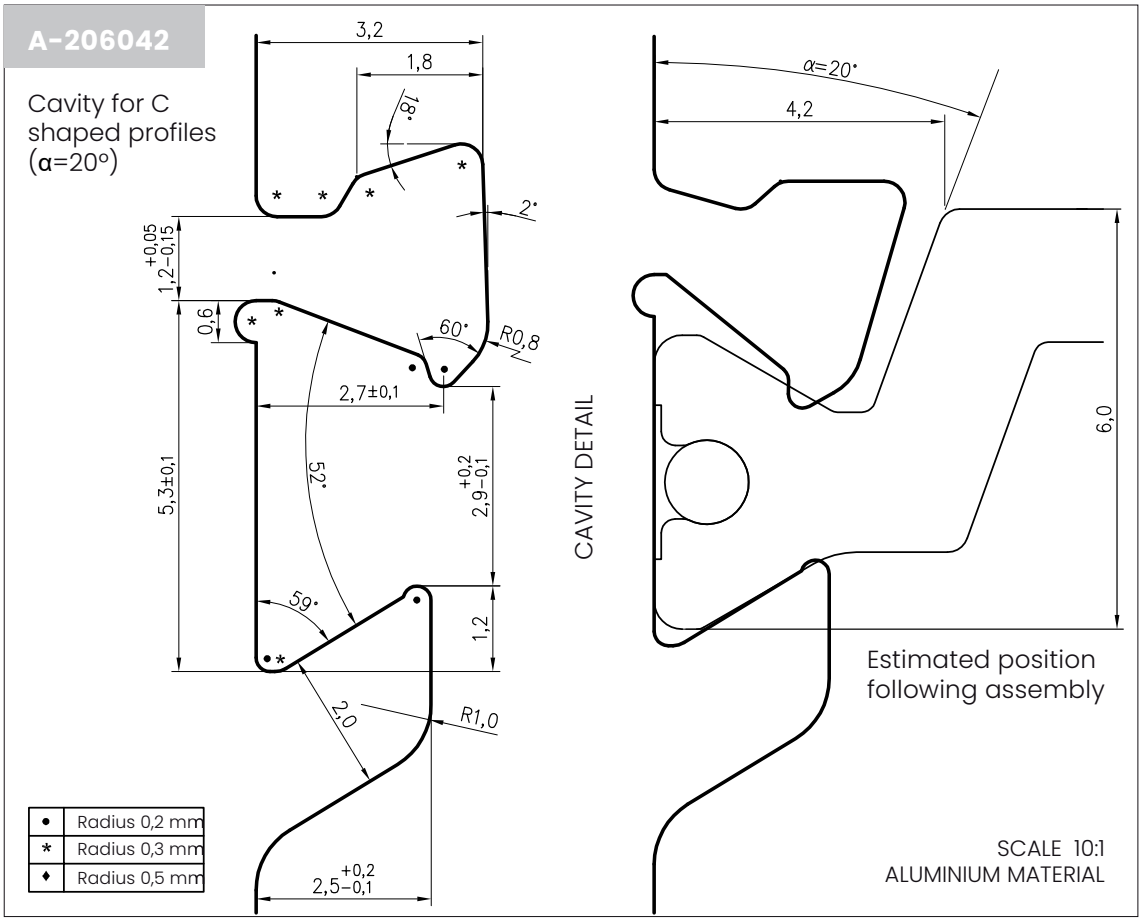
A-205642

Cavity for C shaped profiles (α=20°)



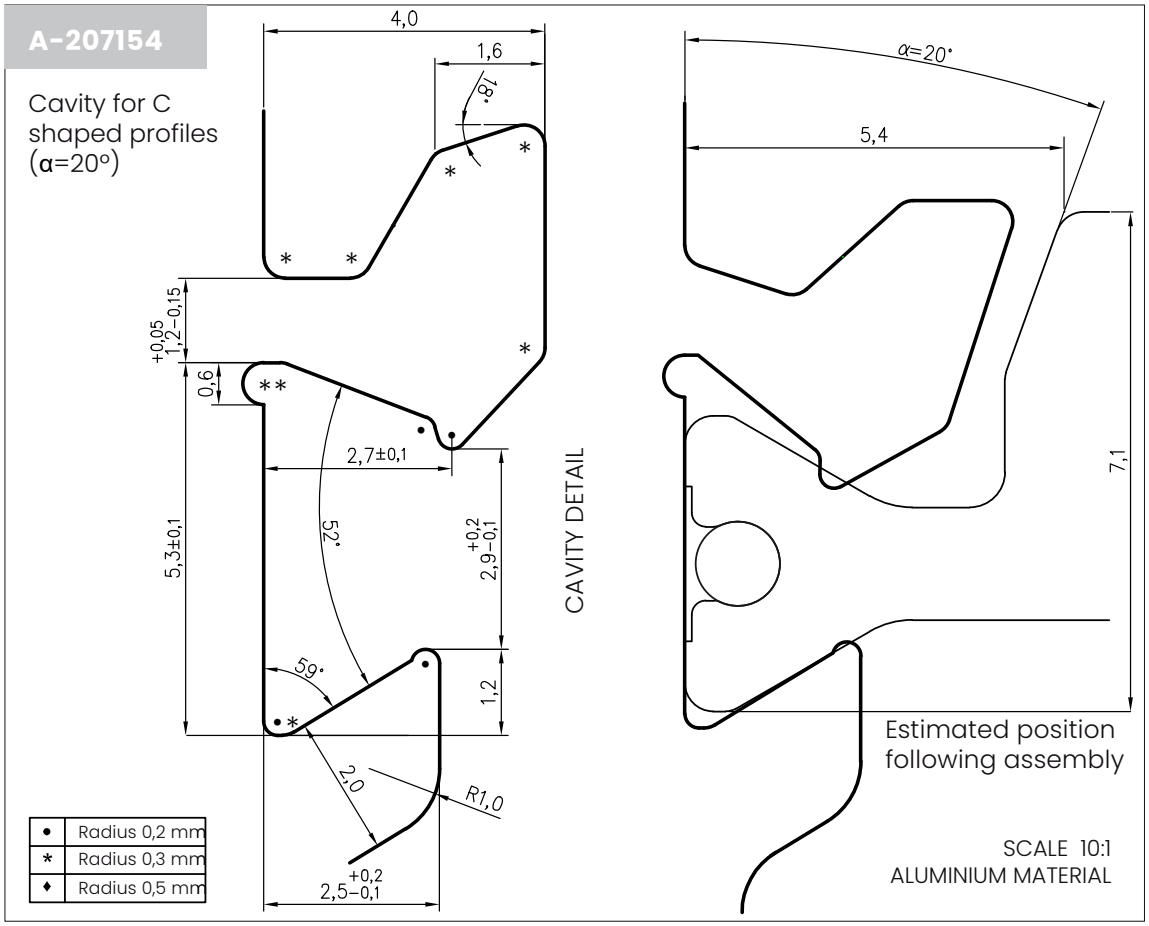
A-206042

Cavity for C shaped profiles (α=20°)



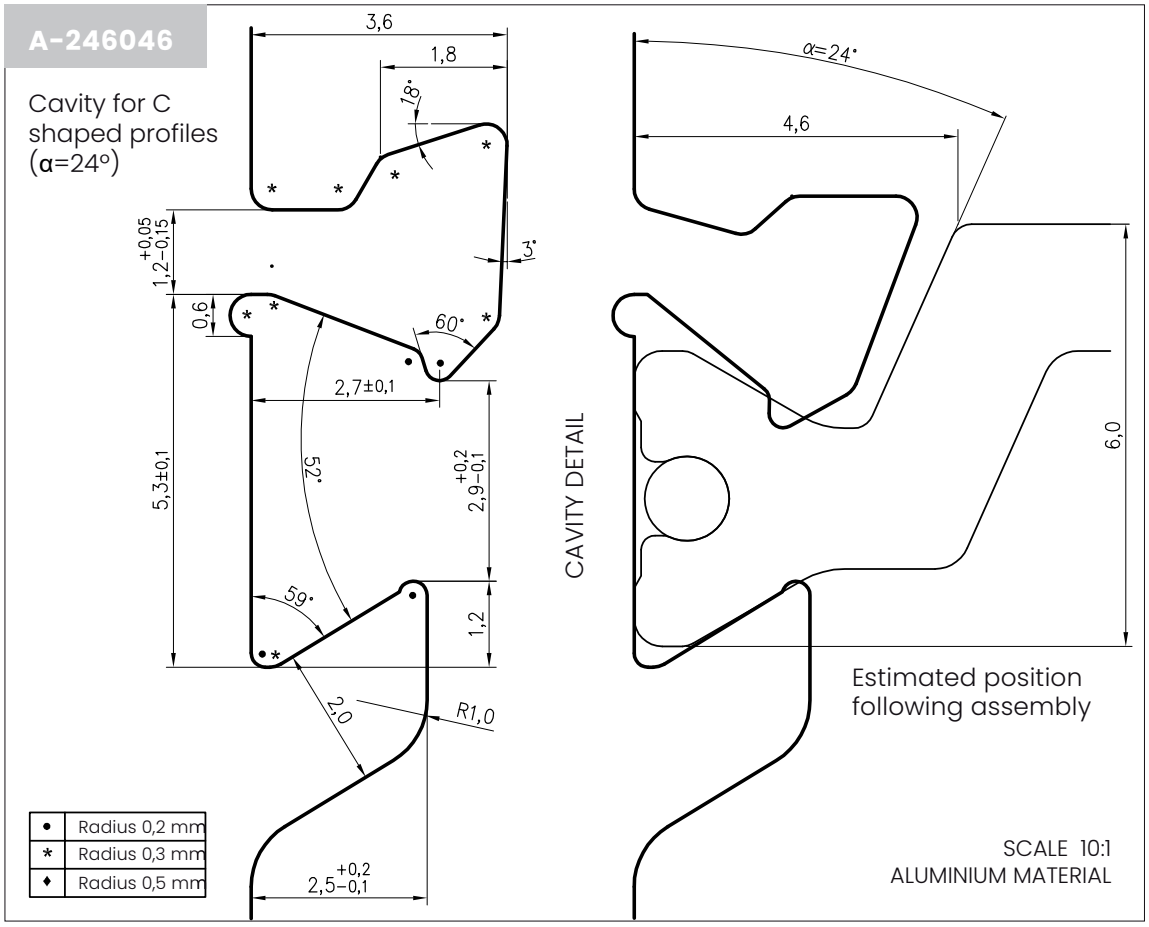
A-207154

Cavity for C shaped profiles (α=20°)



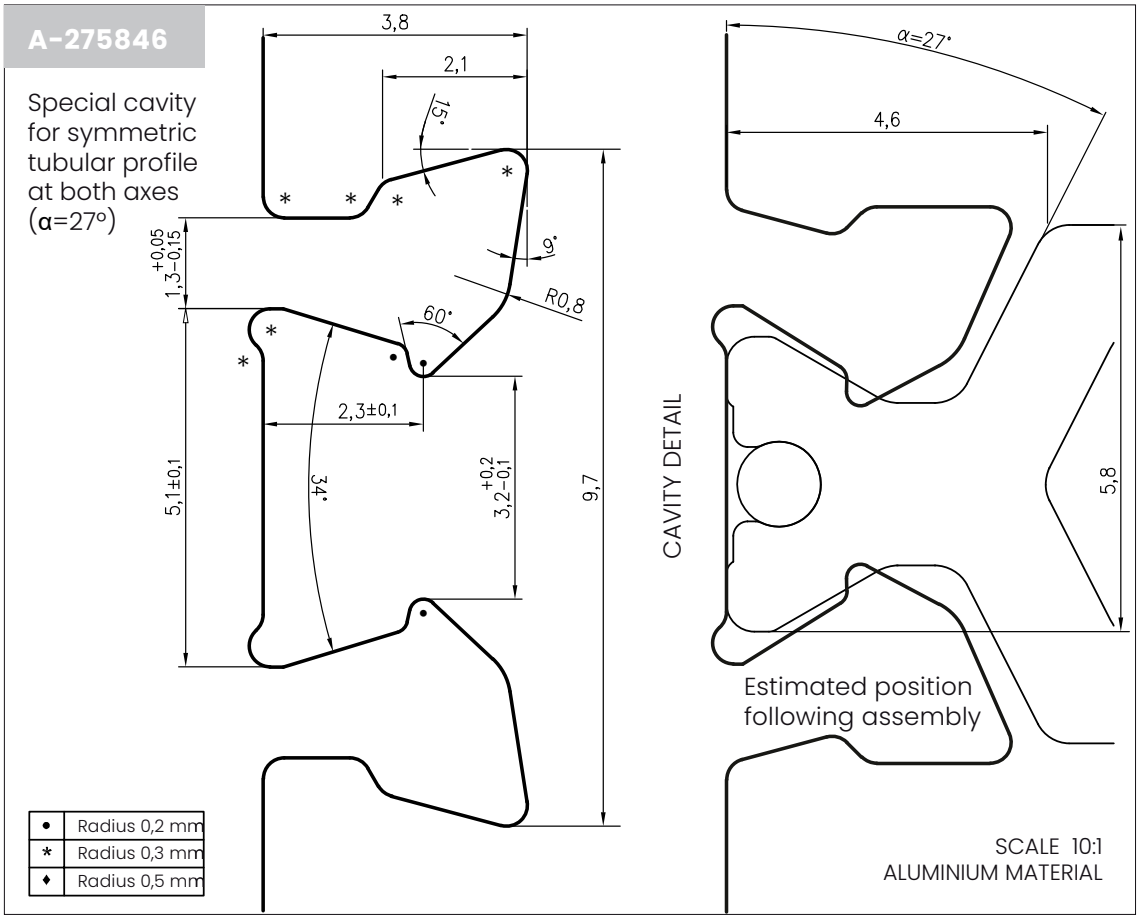
A-246046

Cavity for C shaped profiles (α=24°)



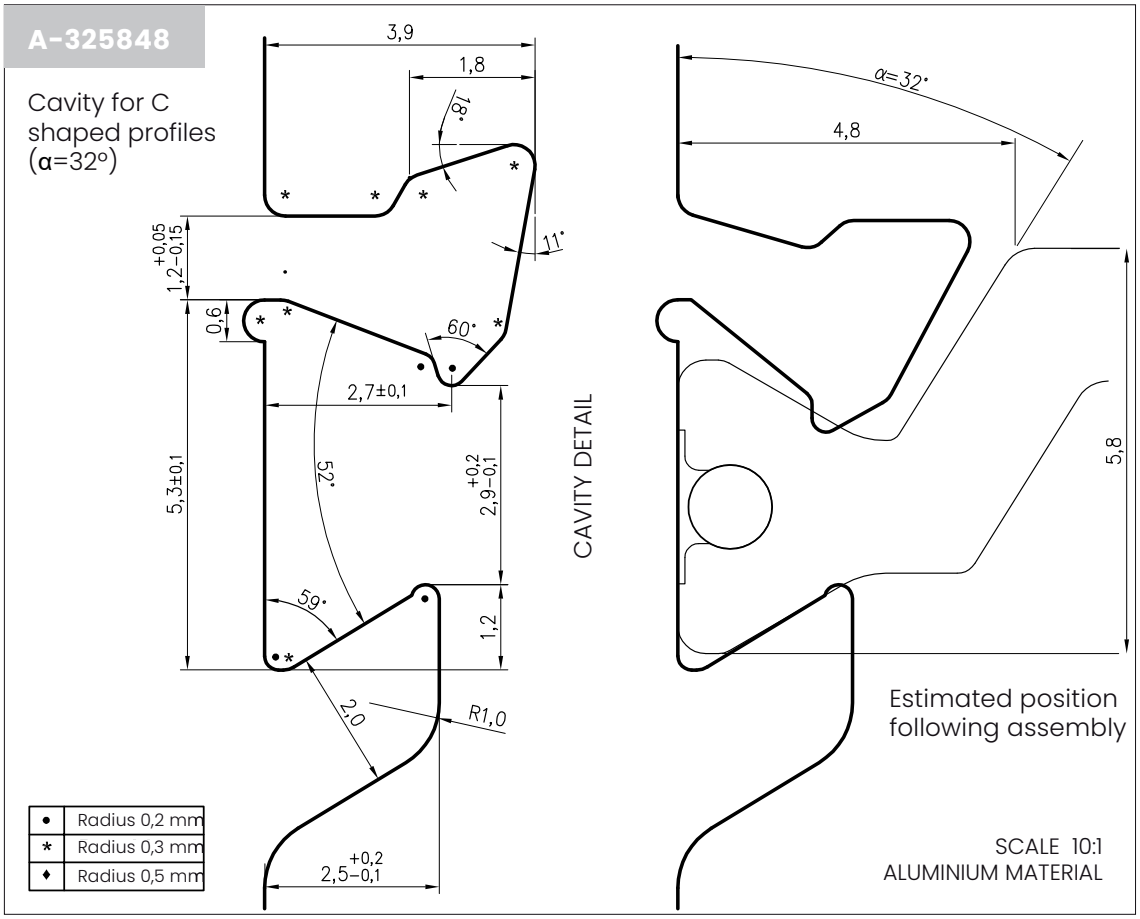
A-275846

Special cavity for symmetric tubular profile at both axes (α=27°)



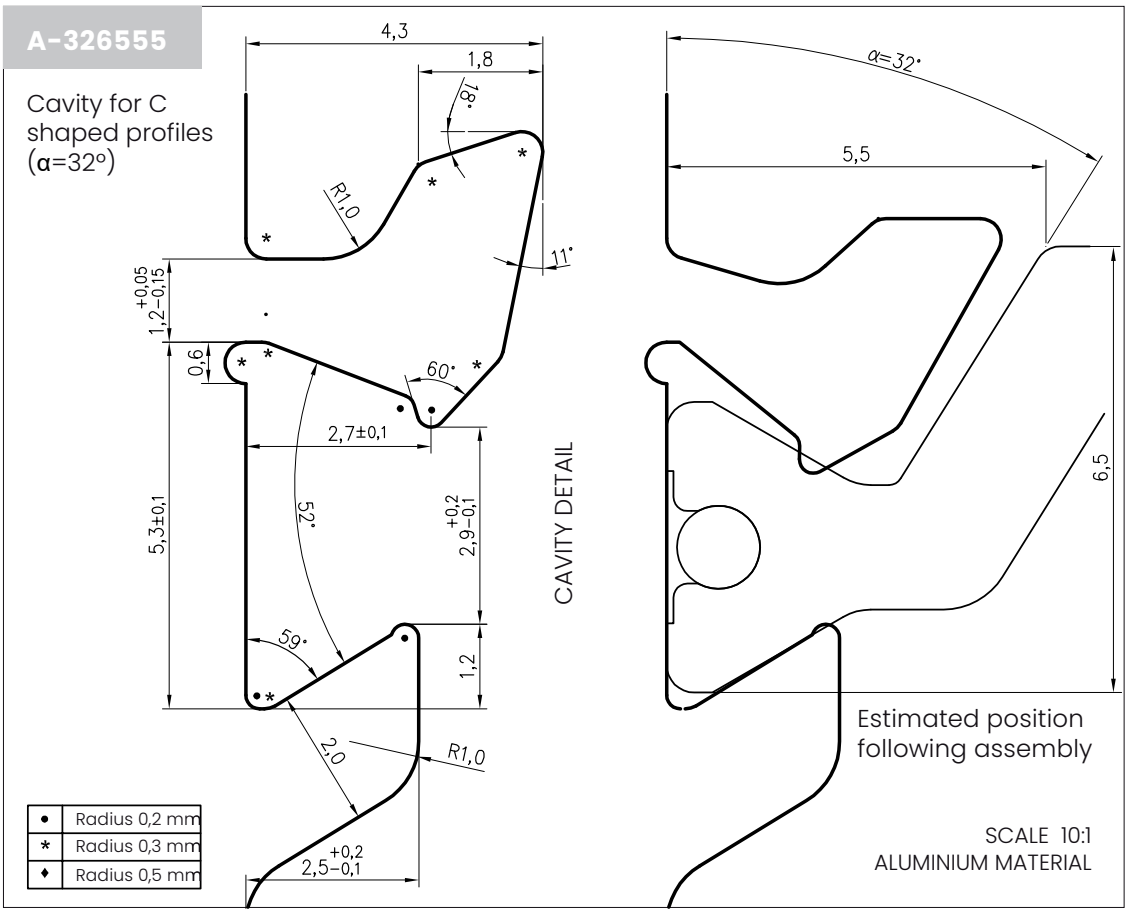
A-325848

Cavity for C shaped profiles (α=32°)



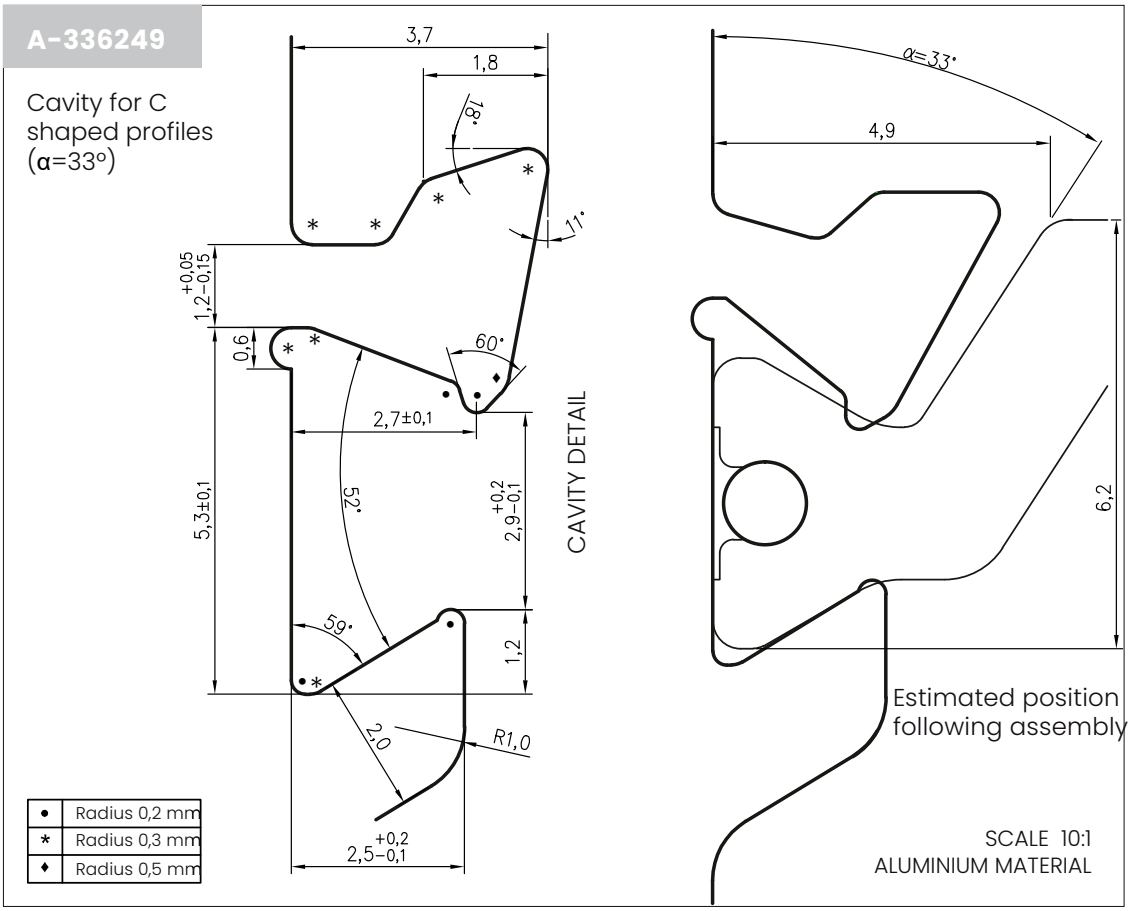
A-326555

Cavity for C shaped profiles (α=32°)



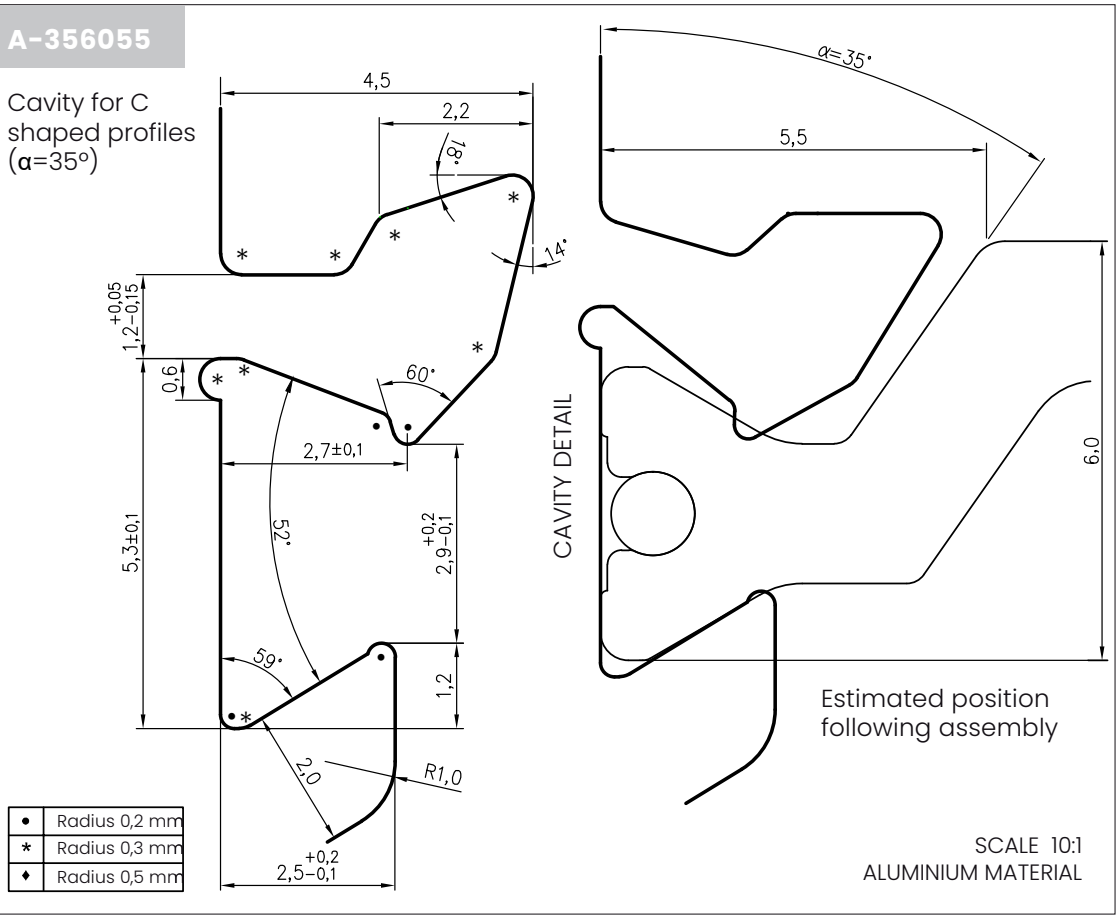
A-336249

Cavity for C shaped profiles (α=33°)



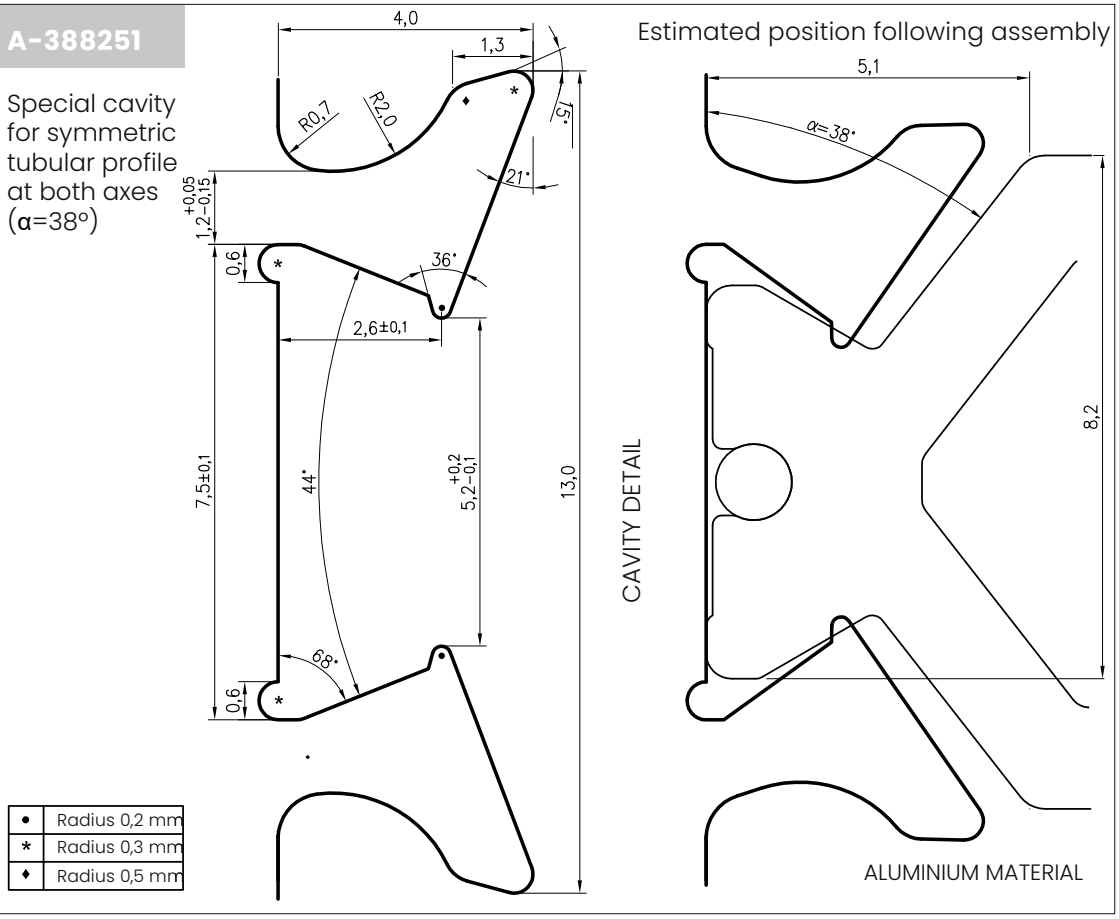
A-356055

Cavity for C shaped profiles (α=35°)



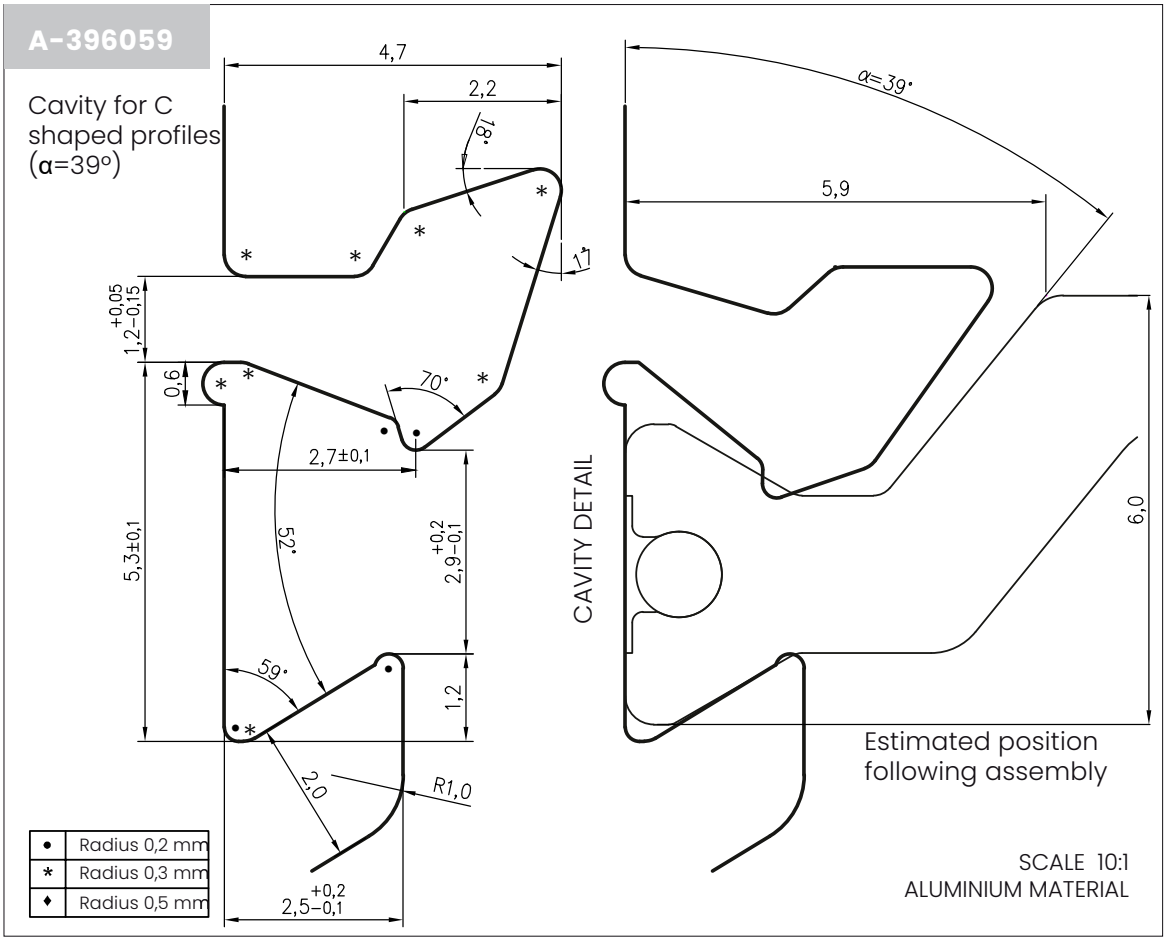
A-388251

Special cavity for symmetric tubular profile at both axes (α=38°)



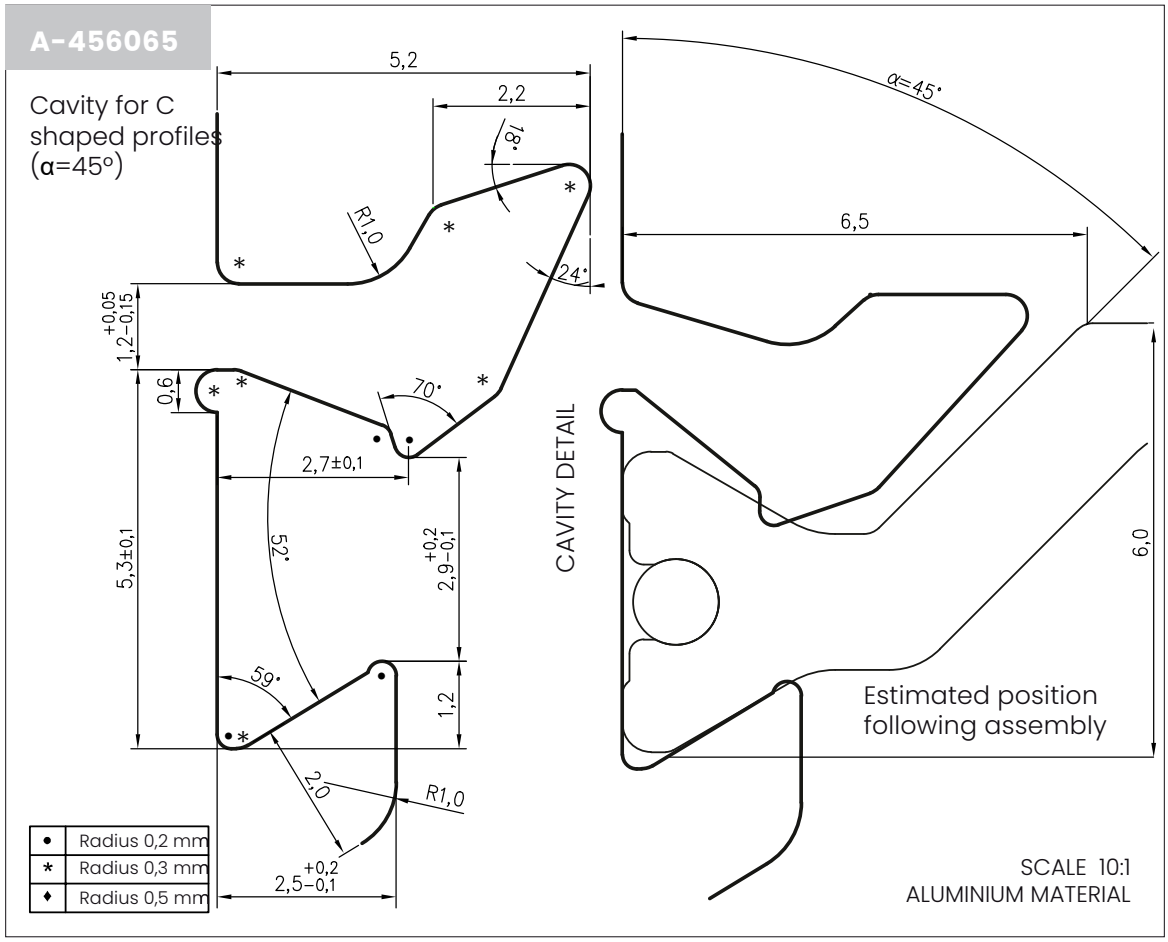
A-396059

Cavity for C shaped profiles (α=39°)



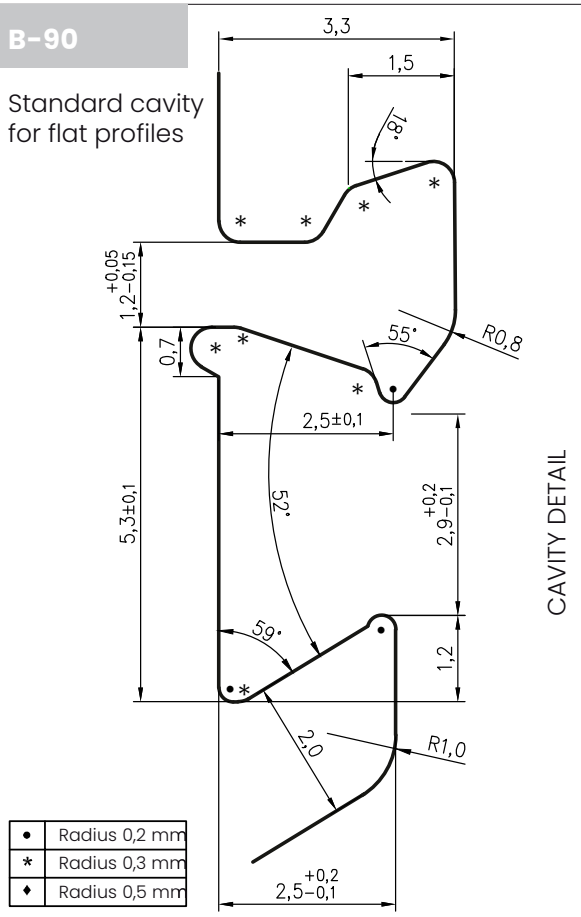
A-456065

Cavity for C shaped profiles (α=45°)

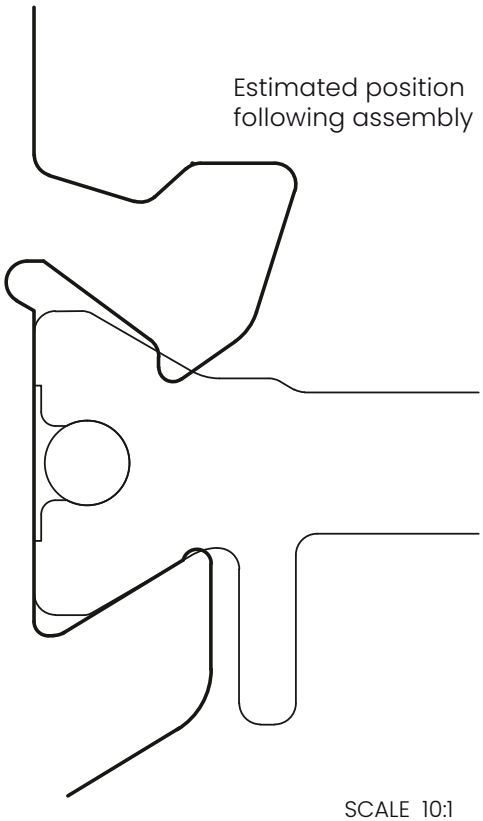


B-90

Standard cavity for flat profiles



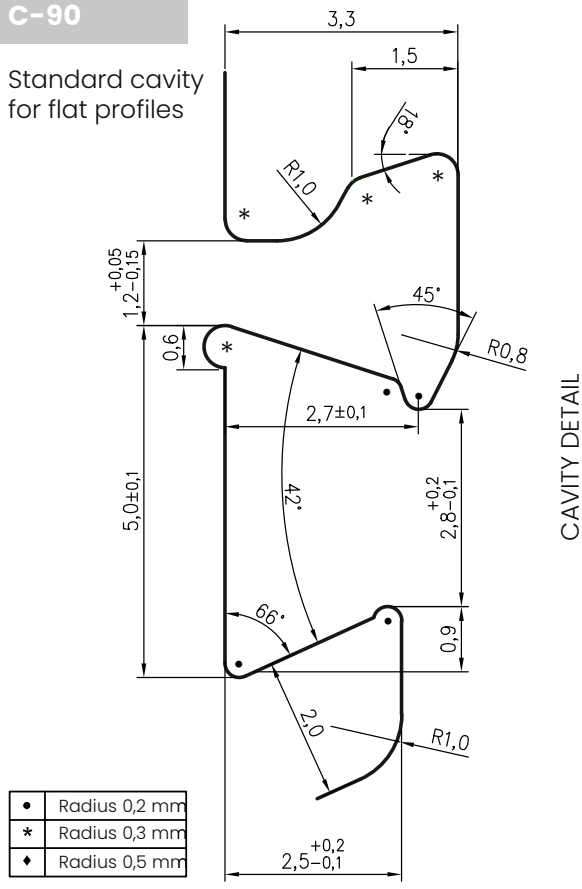
CAVITY DETAIL



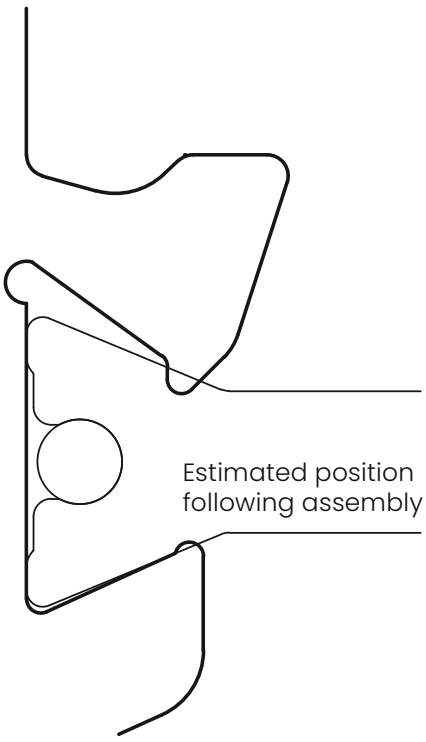
SCALE 10:1
ALUMINIUM MATERIAL

C-90

Standard cavity for flat profiles



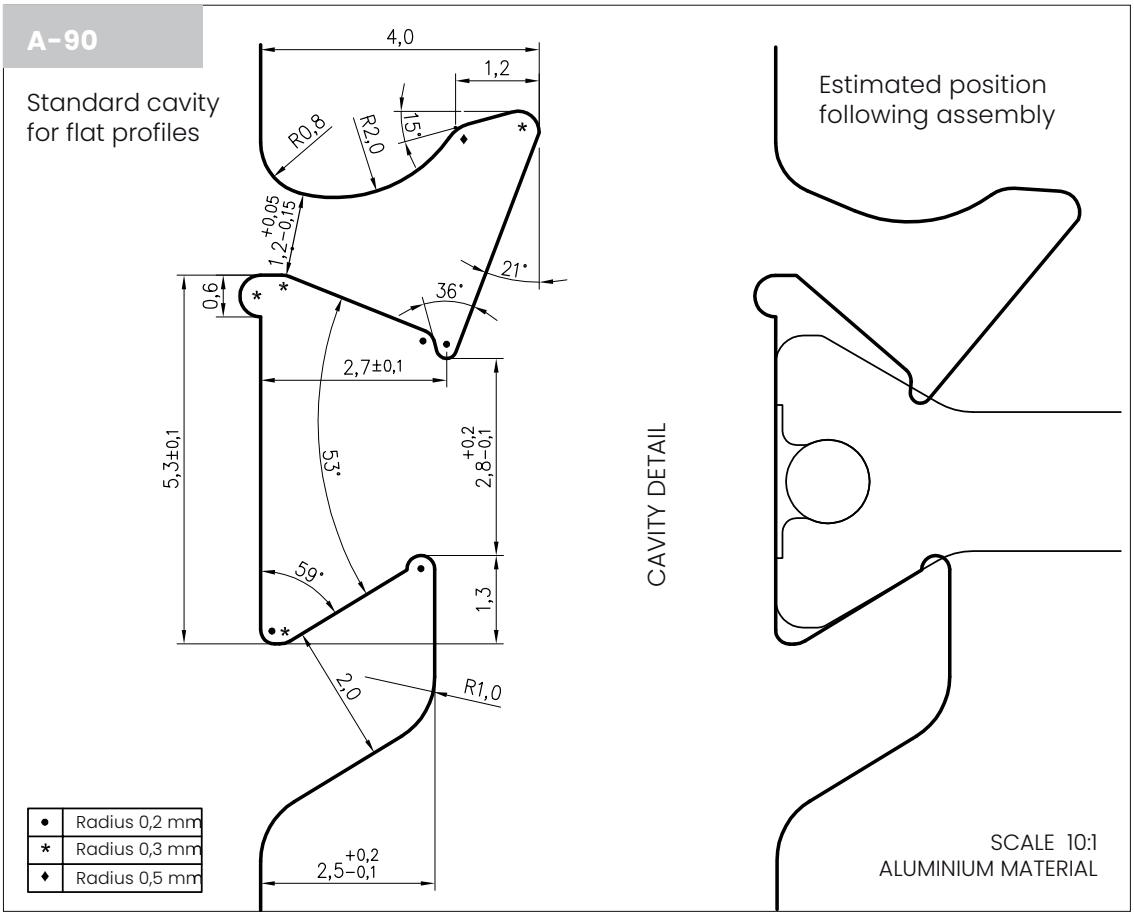
CAVITY DETAIL



SCALE 10:1
ALUMINIUM MATERIAL

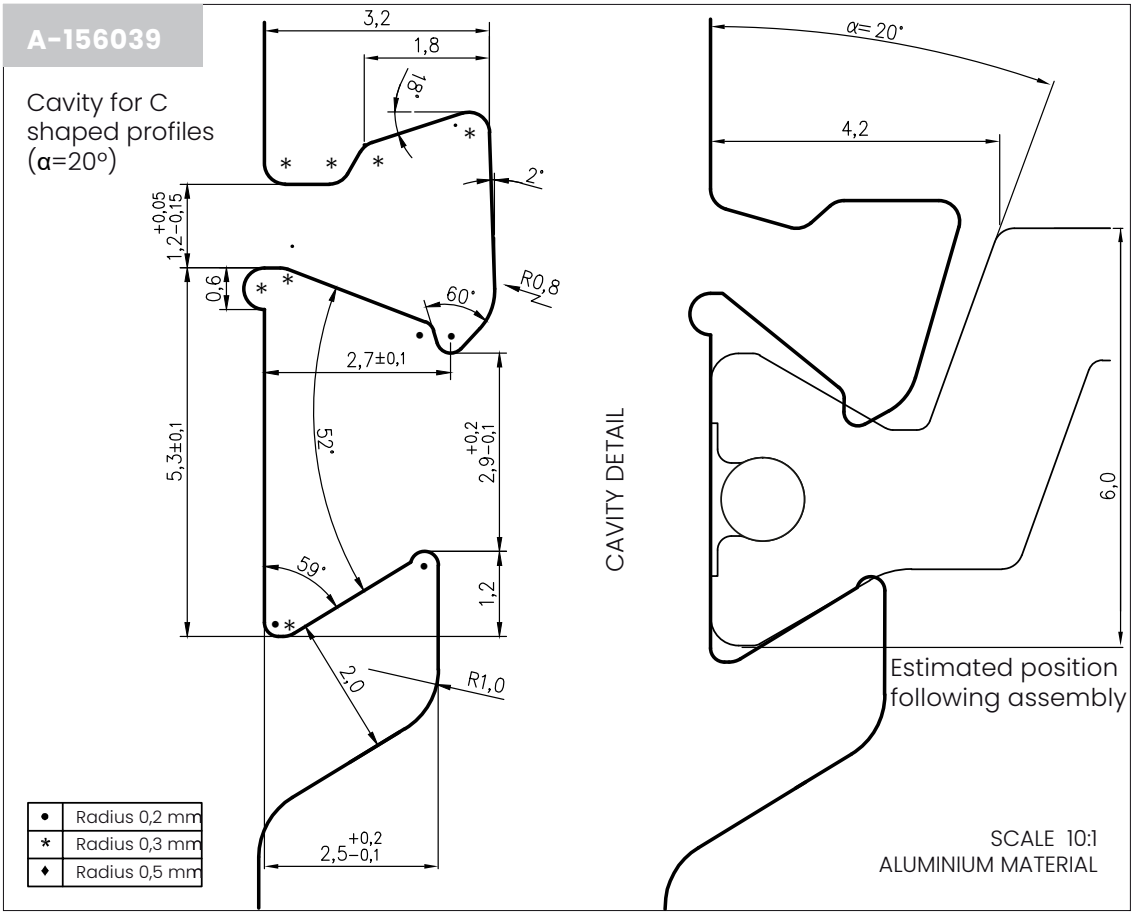
A-90

Standard cavity for flat profiles

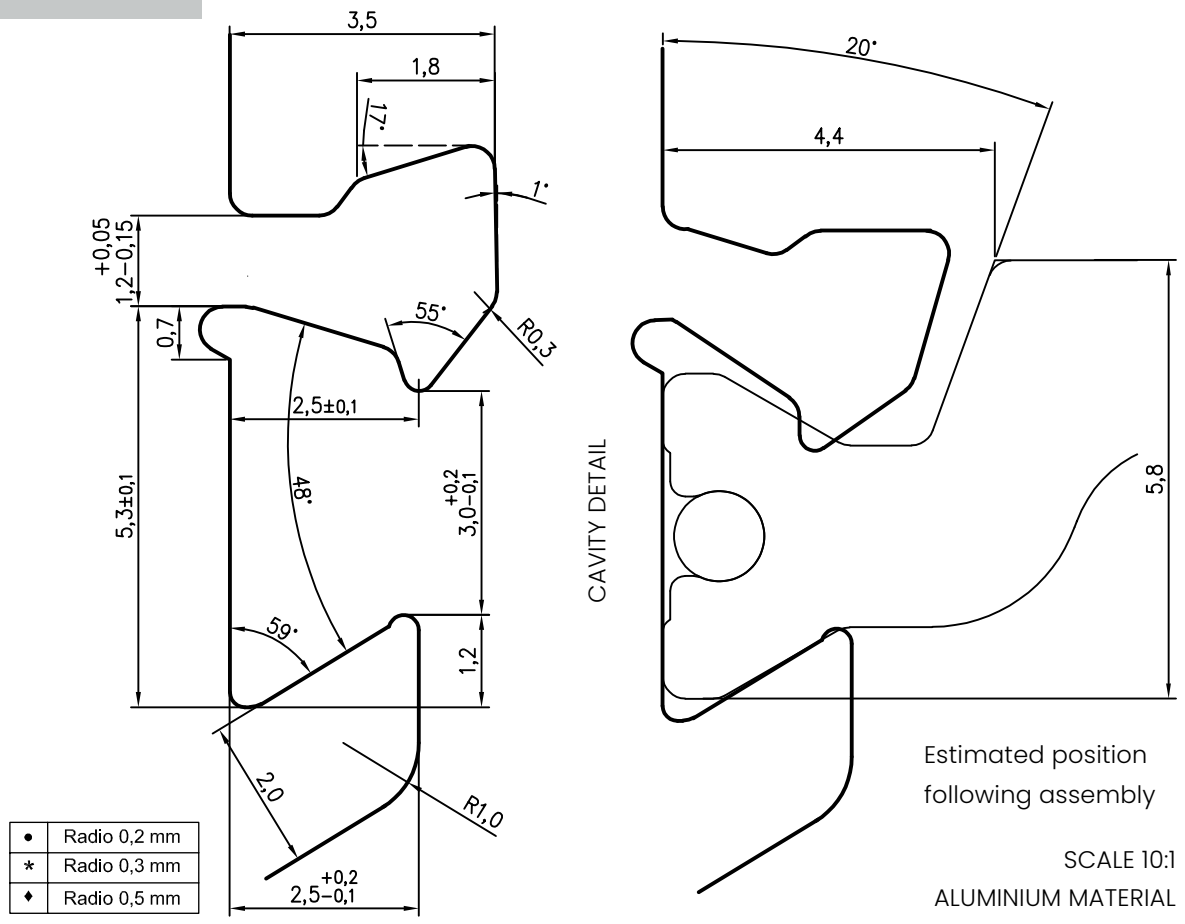


A-156039

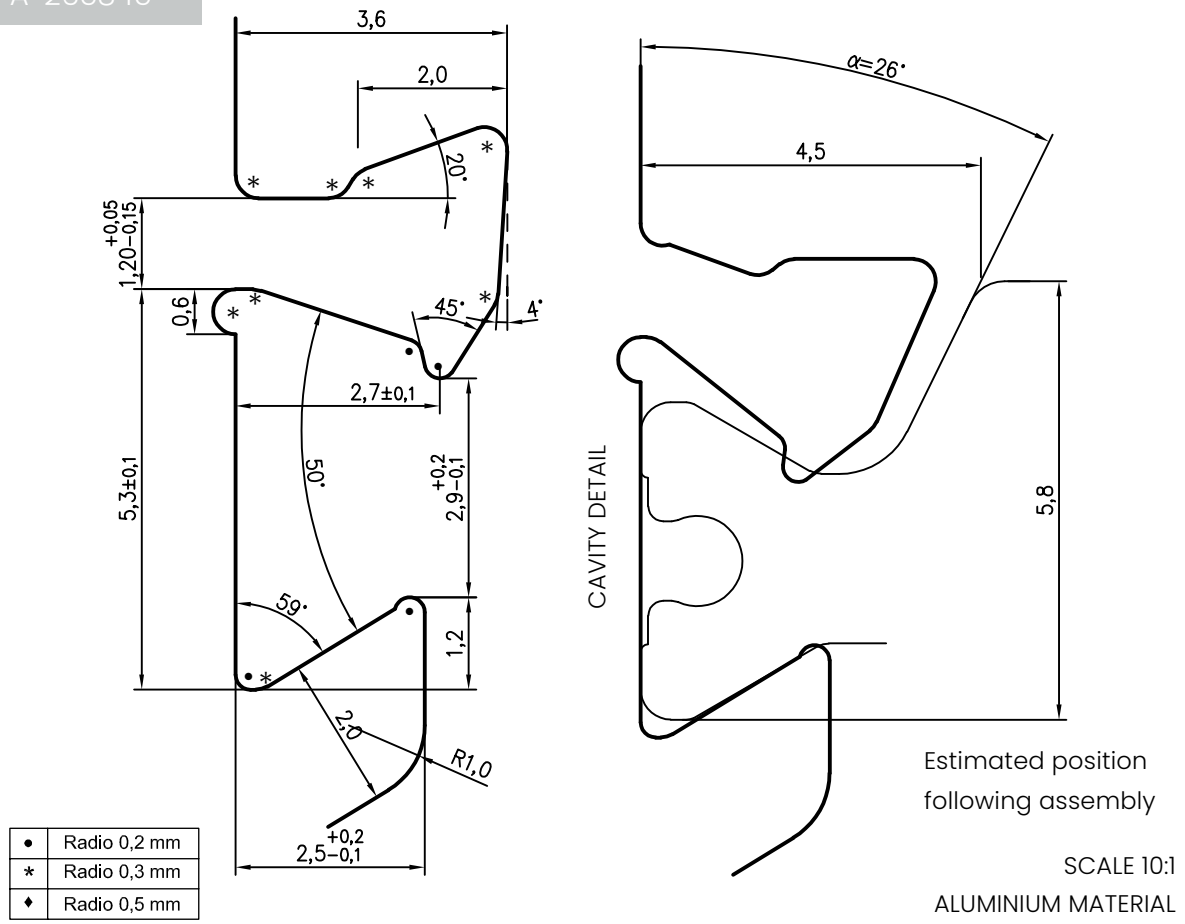
Cavity for C shaped profiles (α=20°)



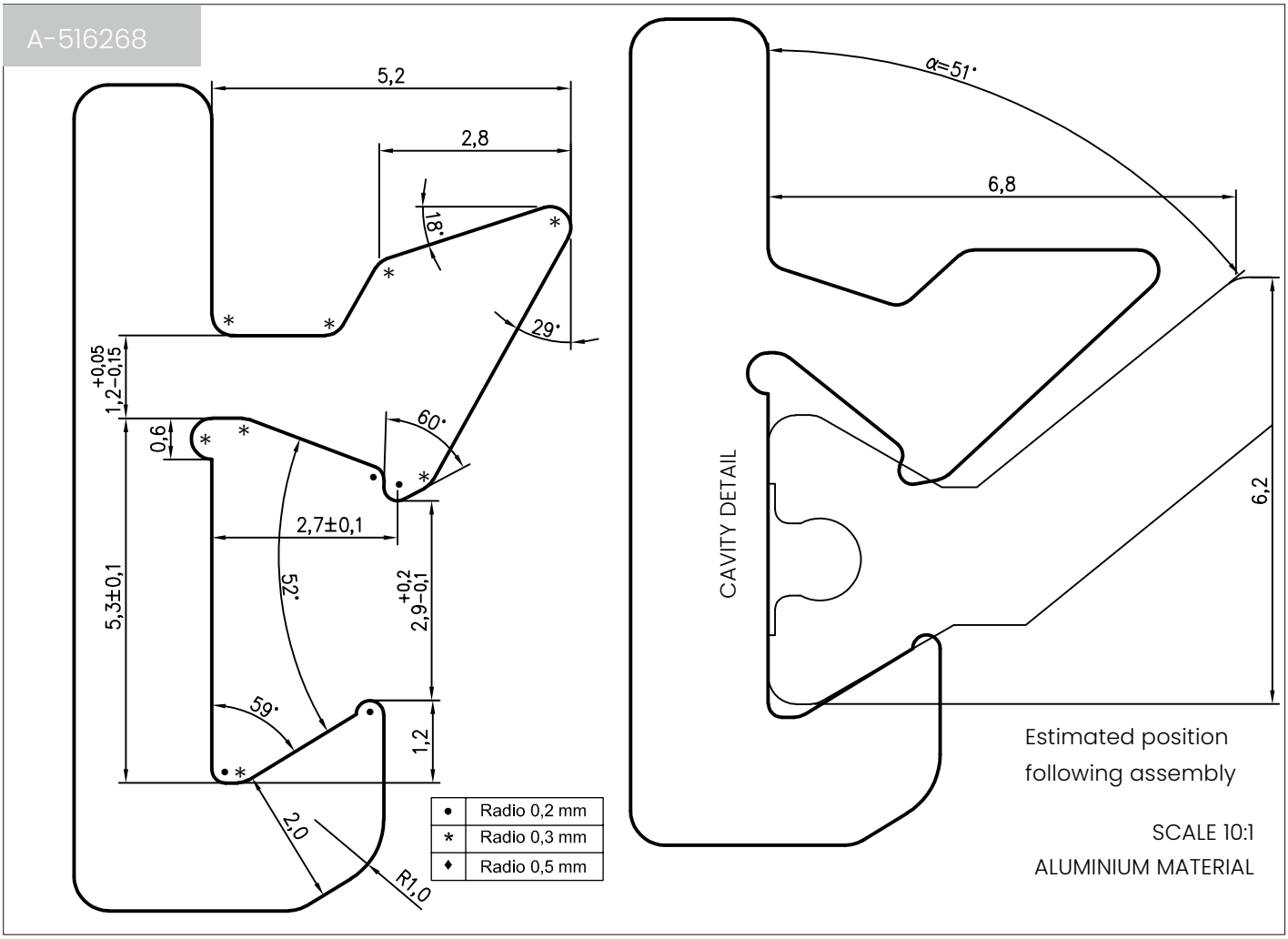
B-205844



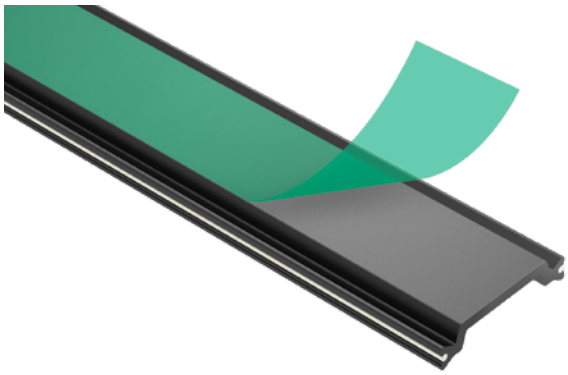
A-265845



A-516268


5,2
2,8
18°
29°
60°
52°
59°
0,6
1,2 +0,05 −0,15
2,7±0,1
5,3±0,1
2,9 +0,2 −0,1
1,2
2,0
R1,0
• Radio 0,2 mm
* Radio 0,3 mm
♦ Radio 0,5 mm
α=51°
6,8
6,2
CAVITY DETAIL
Estimated position following assembly
SCALE 10:1
ALUMINIUM MATERIAL

5. SPECIAL APPLICATIONS



5.1 MASKING TAPE

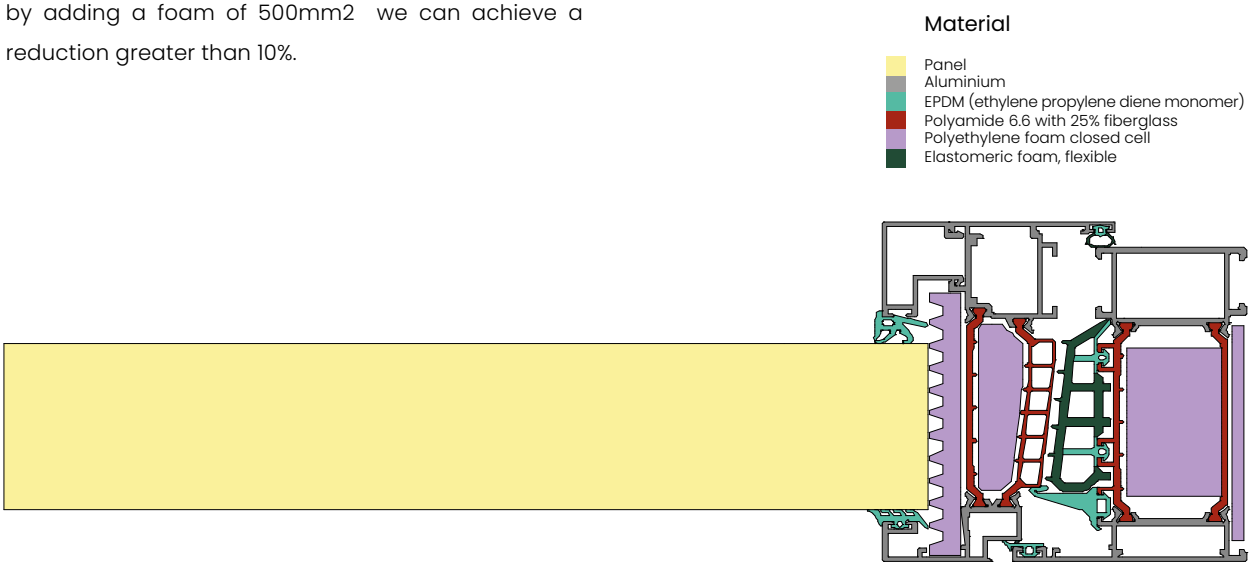
For clients wishing to lacquer the assembled profiles but retain the distinctive black colour of the thermal bridge breaks, STAC supplies its polyamides with a protective tape. This heat-resistant tape is stuck to the visible face of the polyamide profile to protect it during painting. After the lacquering process it is easily peeled off, leaving no residues on the profile.

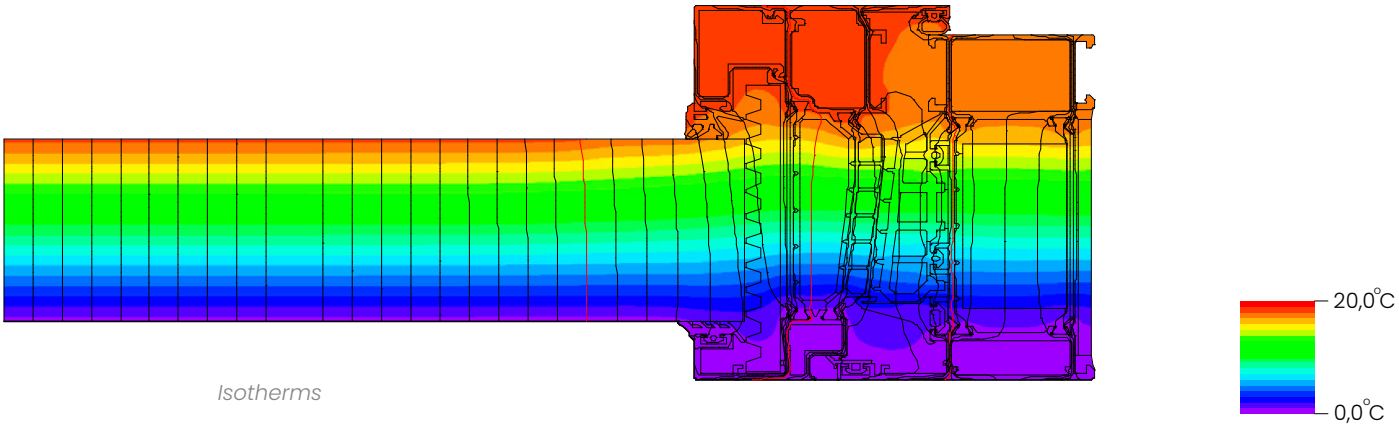
5.2 FOAMS TO REDUCE THERMAL TRANSMISSION

With the aim of reducing thermal transmission of the aluminium structure and increase energy efficiency, STAC offers polyamide profiles assembled with foam filling. By providing the profiles pre-assembled, we make it easier for our clients and reduce the impact on the end cost of the system as the difficult process of on-site assembly is avoided.

Depending on the quantity of foam added we can obtain greater reductions in heat transmission of the system. For example, in a theoretical system, by adding a foam of 500mm2 we can achieve a reduction greater than 10%.

> "STAC will advise clients in choosing the correct grade of foam to meet their requirements.





Isotherms

5.2.1 POLYETHYLENE FOAM (PE)

The most widely used foam on the market. As well as its low thermal conductivity, there are grades which are highly flame-proof to comply with the most stringent building sector regulations.

Polyethylene foam (PE)

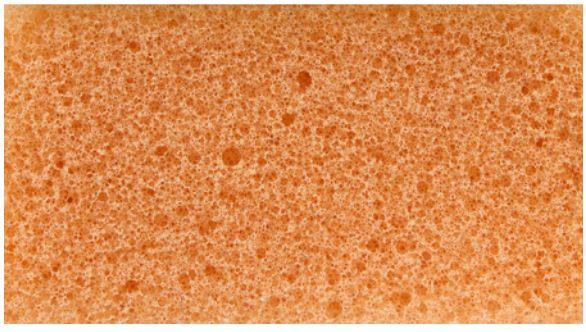
5.2.2 MELAMINE FOAM

This foam has the advantage of resisting the powder coating process. This allows the polyamide profile to be added to the assembly and the whole lot powder coated afterwards.

Melamine foam

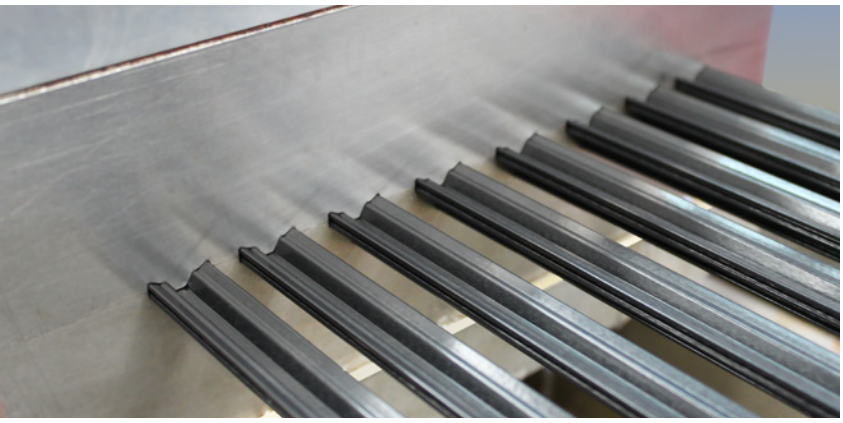
5.2.3 POLYURETHANE FOAM (PUR)

As well as being a great thermal insulator, this product also improves acoustic insulation of the system.



Polyurethane foam (PUR)

6. MANUFACTURE AND QUALITY CONTROL



A vital point in our policy is to pay special attention and care to the manufacturing process, control of the finished product and complying with manufacturing lead times, and having in mind at all times a principal objective:

"Maintain client satisfaction and the quest for zero defects."

6.1 EXTRUSION

The production method of the polyamide profiles consists, and broadly speaking, of the following steps:

A. Provision and mixing of prime materials.

B. Dehumidification of the mix.

C. Entry and advance of the mix through the extrusion machine (Transport, melting and compression process).

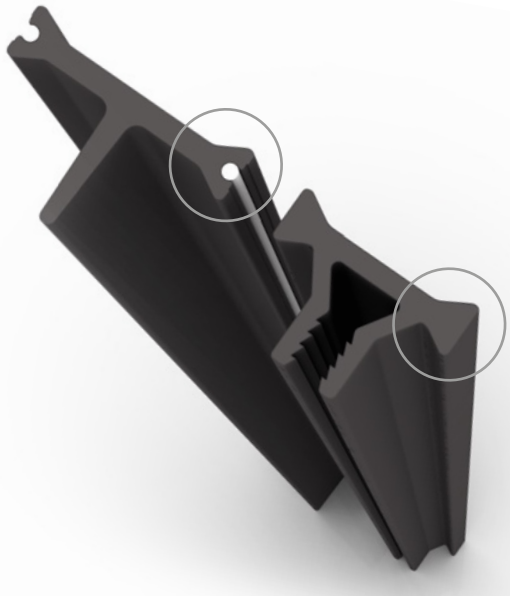
D. Passage of the molten polymer through the extrusion die in order to convert the polymeric mass in to a transversal section.

E. Solidification of the profile using a special calibration process that provides an interweaving of the glass fibre and an ideal degree of cristalization of the polymer in order to obtain adequate mechanical features.

F. Insertion of the thermo-adhesive strip.

   The STAC profiles have a thermo-adhesive strip inserted in the dove tail in order to provide resistance to the trasnversal tension and the shear that is lost during the powder coating process.

The profiles with a thermo-adhesive strip are always versatile as they can be used both for the powder coating of an assembled set as well as for assembly after powder coating the aluminium profile. For this reason, our policy is to insert the strip in the majority of our polyamide profiles, as without this it would result in an additional cost to the client.



Example of different types of dovetail (With or without thermo-adhesive strip)

G. Marking (Traceability codes, logos, date of manufacture etc).

There is also the option of printing personalised logos on to the surface of the profile, following previous tests and viability studies, which will be accompanied with a traceability code which allows for a tracking of all of the manufacturing process (from the raw material batches to dispatch of the material). As well as all of this, other information can be added that could be of interest to the client, such as date of manufacture, client reference, etc.

H. Saw cutting.

I. Packaging, labelling and palletizing.

Example of marking on the profiles

6.2 DIMENSIONAL CONTROL

In order to ensure the quality of the manufactured profiles, controls of visual, dimensional and functionality at intervals are carried out during production.

To carry this out, various control equipment is used such as verniers, go-no go guages (Poka Yoke system) or a profile projector (shadowgraph).

All of this is done with the objective that the client always receives first class material that can provide benefits from the point of view of the process optimisation for the client.

6.3 LABORATORY TESTS

Another point that we regard as relevant is the control of the physical characteristics of the extruded profiles. For this reason, periodic tests of the product are carried out to ensure the quality of the manufactured batches.

6.3.1 DENSITY

The density test is carried out according to ISO 1183 standards, by using an analytical scale accompanied by a density kit.

The procedure consists of weighing a sample in air and afterwards weighing it inside a container with distilled water and its temperature is measured by a thermometer.

By knowing the water density and its temperature, and the 2 previous weights, the sample density can be calculated.

$$\rho = \frac{Mass\ in\ air\ x\ \rho\ Immersion\ Liquid}{Mass\ in\ air\ -\ Submerged\ Mass}$$

The value of the density obtained will be a good indicator of the degree of compactness of the extrusion..

6.3.2 SHORE D HARDNESS

This test is carried out according to ISO 868 standards by using a Shore D hardness guage for rigid plastics.

This hardness guage constitutes basically of a dial commanded by a metallic point that penetrates the sample. Depending on the degree of penetration of said point, the dial will indicate the corresponding hardness. In order to obtain repeated results, the hardness guage must be held under pressure on the sample surfaces during 15 seconds during each measuring and the surfaces must be flat and parallel with respect to the supporting surface for the hardness guage.

The hardness value obtained will be, to some degree, proportional to the traction resistance of the tested sample.

6.3.3 ASH PERCENTAGE

ISO 3451 standard is used as a reference for carrying out this test. The equipment necessary will be a muffle furnace, an analytical scale and porcelain linings for the calcination of the samples and a dessicator.

The test method consists of weighing the sample and then introducing it to the muffle furnace within a melting pot at a temperature of 800 ºC, during the necessary time for it to volatise the polymer and only the residue remains. The melting pot is extracted from the oven and left to chill in the dessicator until reaching an atmospheric temperature. Afterwards the residue is weighed and the sample percentage is calculated.

6.3.4 WATER ABSORPTION

For this test ISO 62 standard directives are followed.

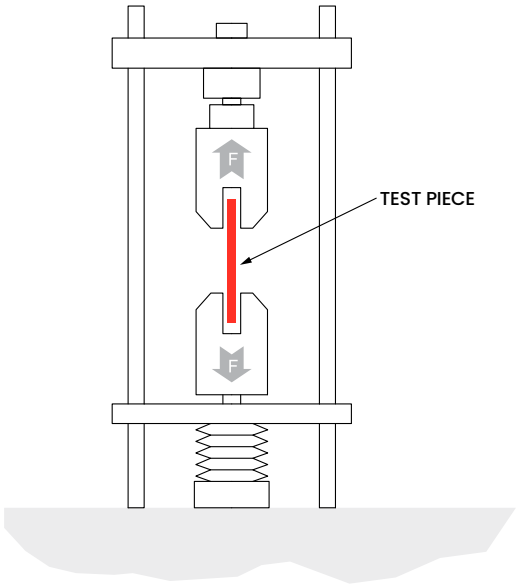
The equipment necessary will be a thermostatic bath, an analytical scale and an oven.

In this case a 24 hour water absorption test is carried out that consists of drying the samples to a constant mass and then introducing them to a thermostatic bath at 23ºC for a period of 24 hours at which point it is extracted, dried and weighed, obtaining the percentage of water weight that has been absorbed.

Depending on the type of polyamide tested (PA 6, PA66, PA 11, etc.), the percentage of fibre or other factors and the percentage of absorbed water will vary.

6.3.5 TRACTION

The test equipment basically consists of 2 clamps. The clamps grip the sample and it is displaced by mechanical means seperated from each other and excercising a variable force “F” axially on the sample. Also a dynanometer is used and a displacement sensor which allows a tension-deformation curve of the tested sample to be obtained. From the analysis of this curve the traction resistance, elasticity module and break stretching can be obtained.



Schematic representation of the traction equipment.

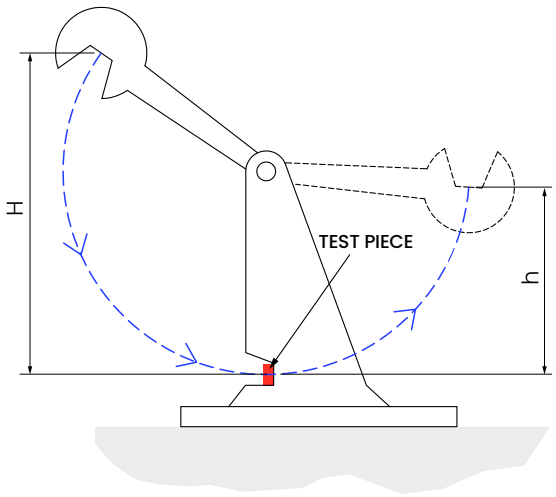
6.3.6 IMPACT RESISTANCE OR RESILLIENCE

This test is carried out using a Charpy pendulum that spins over an axis and impacts over a rectangular sample that can be or is not slotted.

Once the sample is fitted in the indicated position, the pendulum is raised until “H” height with respect to the level it is found on and then the pendulum is left to fall by gravity in such a way that it will follow a circular trajectory that will bump in to the sample at its lowest point, destroying it and then rising to a new “h” height.

The two previous heights will be registered and from them, applying the principle of mechanical energy conservation, the energy that the sample has absorbed when broken, can be obtained. In other words, the impact or resillience value is obtained.

This value serves to give an idea of how fragile the tested material is.



Schematic representation of the Charpy pendulum

6.3.7 TEMPERATURA DE FUSIÓN

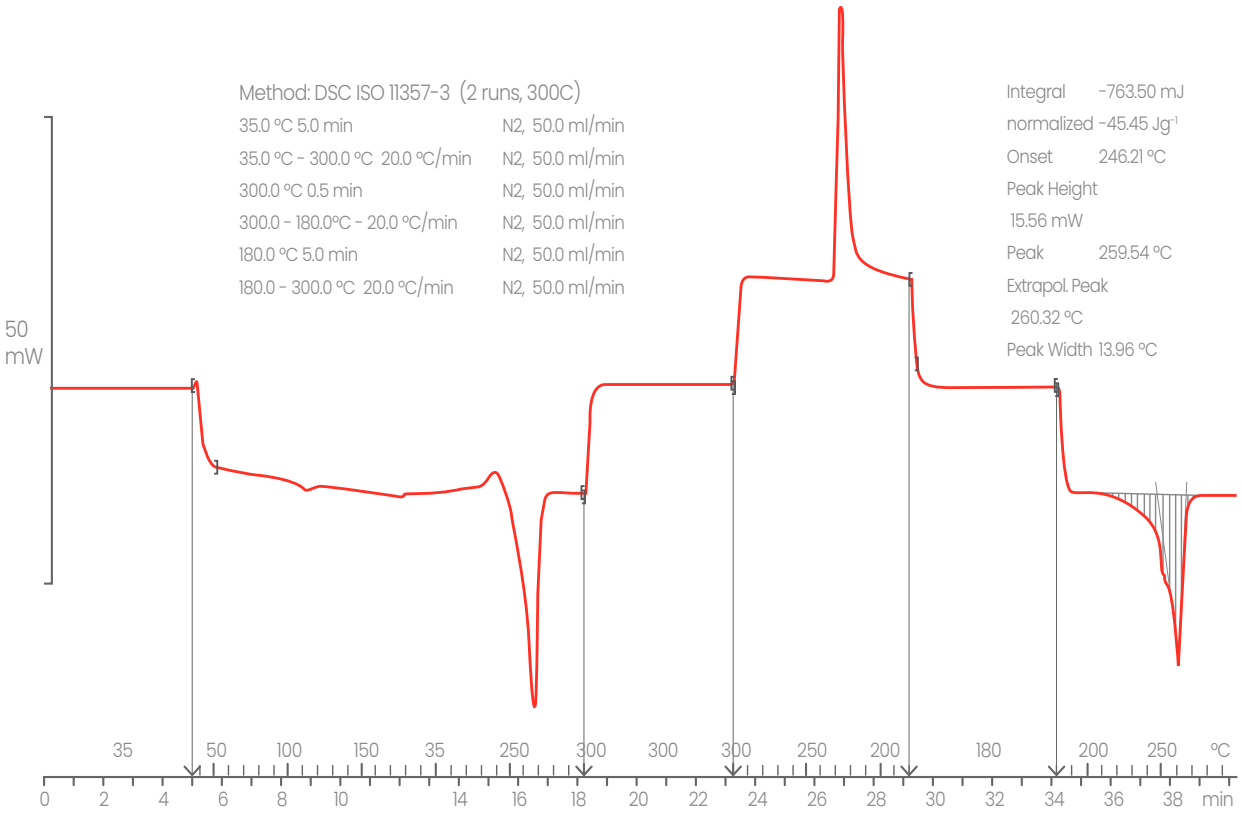
This test is carried out using DSC equipment (Differential scanning calorimetry).

This equipment subjects the polymeric sample to a temperature, variable as a function of time, generating a graph where the absorption peaks (endothermic reaction) or energy detachment (exothermic reaction), corresponding to the fusion temperatures or crystalisation of the polyamide respectively.

The endothermic reaction (lined area on the graph) is produced at the fusion temperature which is about 260 ºC in this particular case.

By studying the completed graph it will show if it is an amorphous polymer, semi-crystalline or completely crystalline.

The crystalline or semi-crystalline polymers, like the polyamide, have a defined fusion point from which it will completely lose its mechanical stability converting rapidly from solids to fluids.

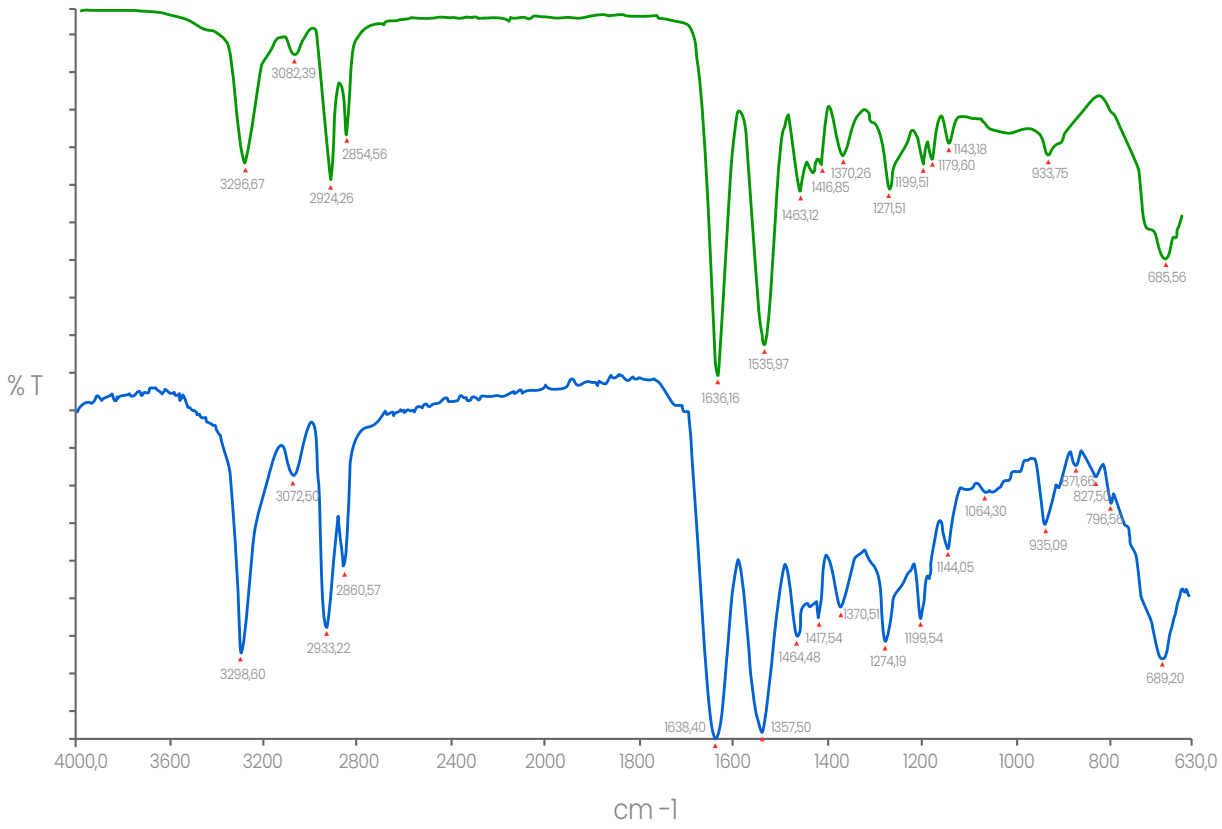


Example of a graph generated with DSC equipment

6.3.8 CARACTERIZACIÓN FTIR

The FTIR characterization or Fourier Transformed Infrared Spectroscopy consists, roughly speaking, in identifying a sample of polymeric material by means of the comparing the infrared absorption spectrum curve with the library of spectrum curves for diverse materials.

This test is very useful for identifying polymeric materials.



Examples of polyamide spectrums.

6.4 COLLABORATING LABORATORIES

In order to carry out the tests, we rely on highly respected suppliers with national or international recognition for example:

CSTC: A Belgian institute of investigation with wide experience in the study of products for the construction sector where they carry out, among others, the test contents for the European standard EN 14024 "Metallic profiles with thermal barriers. mechanical performance, requisites, tests & trials for evaluation."

BECETEL: A Belgian laboratory whose mision is the study, improvement and development of plastic products for pipework, profiles and accessories. In this laboratory they carry out mechanical tests for traction, hardness and impact resistance as well as density tests, melting points and FT-IR characterization.

TECNALIA: A supplier of thenological servises, tests and certification. A member of EOTA (European Organisation for Technical Assessment) and are authorised for official issues of documents for technical suitability. At this centre they carry out tests for traction, impact resistance, melting points and FT-IR characterization.

LEICAL: An industrial test laboratory that is part of the University of Valladolid where they carry out conductivity and thermal expansion coefficiency tests.

AIMEN: A technology centre dedicated to carrying out R & D activities and the provision of technological services. This laboratory is another of our suppliers for mechanical traction tests.

6.5 QUALITY & CERTIFICATIONS

At STAC we have implemented and maintain a quality control system according to the ISO 9001:2008 Standard in order to ensure total quality and continuous improvement.

ATG H894

ISO 9001
BUREAU VERITAS
Certification

The STAC polyamide profiles, are certified by the ATG with the technical suitability document which has been issued by the Belgian UBAtc institute (Union Belge pour l'Agrément technique de la construction), a memeber of the UEAtc (Union Européenne pour l'Agrément Technique dans la Construction) and the EOTA (European Organisation for Technical Approvals).

Contained in the ATG technical suitability document, are the materials used that are specified along with the physical, mechanical and thermal characteristics, its principal dimensions, the manufacturer and place of manufacturing, the external and internal controls and the suitability of the material for thermal break according to the European standard EN 14024.

At STAC we have implemented and maintain a product control and a manufacturing process management system starting with the selection of raw materials up to the dispatch of the finished product. With this system the following production phases are controlled:

- Selection of suppliers and raw material.
- Control, inspection, reception, storage and handling of the raw material.
- Extrusion process.
- Dimensional, functional, visual and laboratory analysis control.
- Laboratory Analysis.
- Product handling and labelling.
- Dispatch.
- Equipment calibration.
- Complaint management.
- Corrective action.

This control and management system is audited 3 times per year by external certification entities that take samples directly from the production lines for analysis at their own laboratories.

The raw materials used for the manufacturing of STAC

ISO 9001 Certification

ATG Certification

polyamide profiles have passed the following tests contained within the European Standard EN 14024 (*) and carried out at the prestigous CSTC laboratory in Belgium:

- Suitability of thermal break material / Point 5.2 - EN 14024
- Transversal tension resistance (Q) / Point 5.3 - EN 14024
- Shear resistance and constant elasticity (T, c) / Point 5.4 - EN 14024
- Ageing / Point 5.5 - EN 14024

All of the above mentioned guarantees that the STAC polyamide profiles constitute a high quality product to be used for thermally breaking within aluminium profiles.

(*) When always referring to the EN14024 standard, it must be taken in to account that the tests are carried out using the combination of "Polyamide assembled with aluminium profiles)" (Aluminium profile with thermal break). It can be the case thata systems does not comply with these minimum requirements due to an inadequate design or assembly or a déficit in resistance of the aluminium profile.

7. DISPATCH

7.1 PACKAGING

The final phase in the extrusion process consists of the packaging of the profiles which is done using intermittent strapping that has a retractable film of various types depending on the transversal geometry of the profile to be packed. Once the package is completed it is then identified using the following label:

The label appears with data such as the Factory address, the name of the client, product reference, number of lengths per package, order number, bar codes if required by the client, etc.

<table>
<tr><td>Cliente:</td><td colspan="2">Su Ref.:</td><td></td><td rowspan="2">STAC
Polígono Picusa, s/n
La Matanza 15900
Padrón (A Coruña) ESPAÑA
T +34 981 817 036
F +34 981 817 037
www.stac.es</td></tr>
<tr><td rowspan="2">Nº Pedido:
Su Pedido:
Nº Orden:</td><td>N/Ref.:</td><td>Longitud: mm
Nº Barras Barras/Paq.</td><td rowspan="2">ATG H894</td></tr>
<tr><td colspan="2"></td><td>Control:</td></tr>
</table>

Sample dispatch identifying label

Example of the identification label on the front of the packages

Example of the identification label on the side of the packages

We currently have 2 variants for the placement of the identification label. It can be placed on the front of the package or on the side, according to customer requirements.

The number of bars per package will vary depending on its cross section for the purpose that packages are manageable. If the client wants to know the number of bars per package of one or more references, he has to contact the sales department, which will provide the information.

The bars can be cut in different lengths depending on the requirements of the client. The standard lengths ranges between 5 and 7 m, though the cut does not discard to different lengths if the client demands it, with a previous study of viability.

7.2 PALLETIZING

The packages described in the previous section are placed in returnable metallic stillages identified with the following plaque which is found on its frame that reflects the data such as the year of manufacture and its loading capacity:

The usable transversal section of the stillage is 645x600 mm and 6000 mm in length.

The packages can jut out by a maximum of 50 cm at each end of the stillage symmetrically as long as they do not exceed the maximum load.

Our logistics department will take responsibility of the removal of the empty stillages from the client's installations in the most efficient way possible.

CE officially approved plaque

7.3 STILLAGE HANDLING INSTRUCTIONS

Please read carefully the following instructions before handling the stillages.

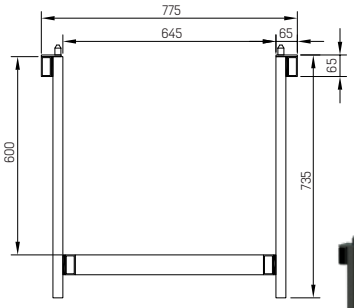
7.3.1 STILLAGE TECHNICAL DATA SHEET

MAXIMUM LOAD CAPACITY: 1.800 Kg

OWN WEIGHT: 166 Kg

¡NEVER UNDER ANY CIRCUMSTANCE EXCEED THE STILLAGE LOADING CAPACITY!

GENERAL DIMENSIONS (in mm)

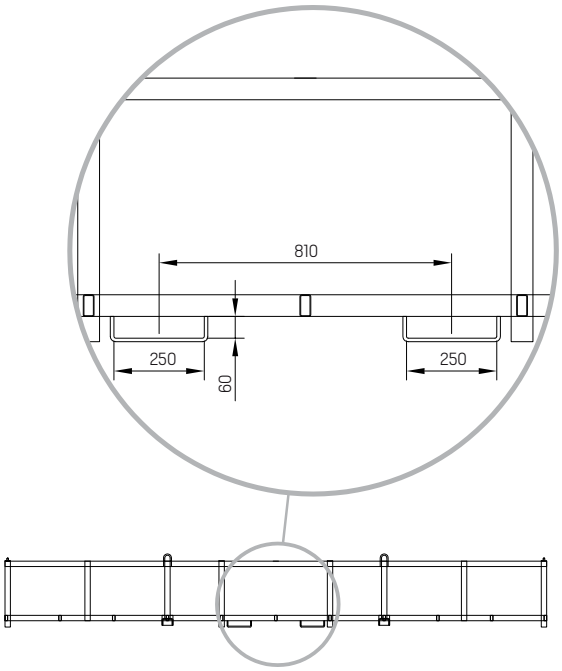


Transversal stillage section

7.3.2 FORKLIFT HANDLING

The stillages are designed to attach to an elevating forklift so that they can be transported and/or lifted. The forklift to be used must satisfy the following conditions:

- A maximum work load of more than 2,250 Kgs.
- Have a CE marking.
- The accessory will be fixed to the forklift mast using chains with hooks with security flanges and shackles. (all with their corresponding CE marking).
- The brackets will have dimensions according to those indicated in the following diagram in order to attach the stillage safely.



The operating process for moving the stillage will consist of the following steps:

A. Starting with the stillage situated on the floor

B. The stillage will be attached to the forklift by introducing a forks in to the rectangular holes that are there for this reason

C. The stillage position will be fixed by introducing the forks until the stillage meets the forklift mast.

SECURITY WARNINGS

Check the correct position of the forklift forks and their position in the stillage before lifting.

The load within the stillage must be centred and symmetrical.

7.3.3 HANDLING WITH AN OVERHEAD CRANE

The stillages have 4 lugs in the upper part that couple with the hook which can be seen in the following diagram:

Conjunto de araña y jaula.

This spider hook also has 4 lugs for fixing to the stillage as well as a top lug for fixing to the overhead crane. All of the hooks with security flanges must have the CE marking.

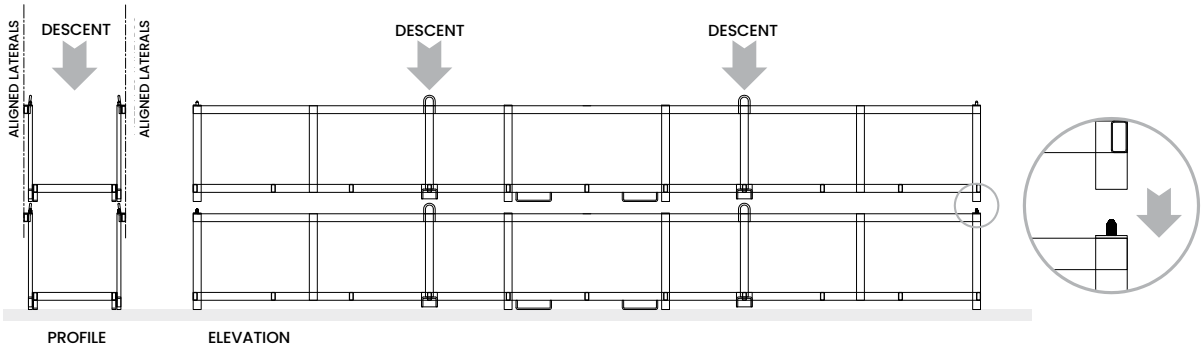
The operating process for moving the stillage consists of the following steps:

1. Starting from the stillage situated on the floor.
2. Move the spider hook which is attached to the overhead crane, and then attach the spider hooks to the stillage lugs.
3. Raise the stillage about 10 cm from the floor in order to check that the hooks and load are stable.
4. If all is stable, start the manouvere.
5. For uncoupling the load, lower the stillage with the overhead crane cable in the most vertical position possible and not moving, in a horizontal position.

6. Once the stillage is totally supported on the floor, uncouple the fixings that join the spider hook.
7. Move the spider hook to one side using the overhead crane in order to avoid that the load is not below it.

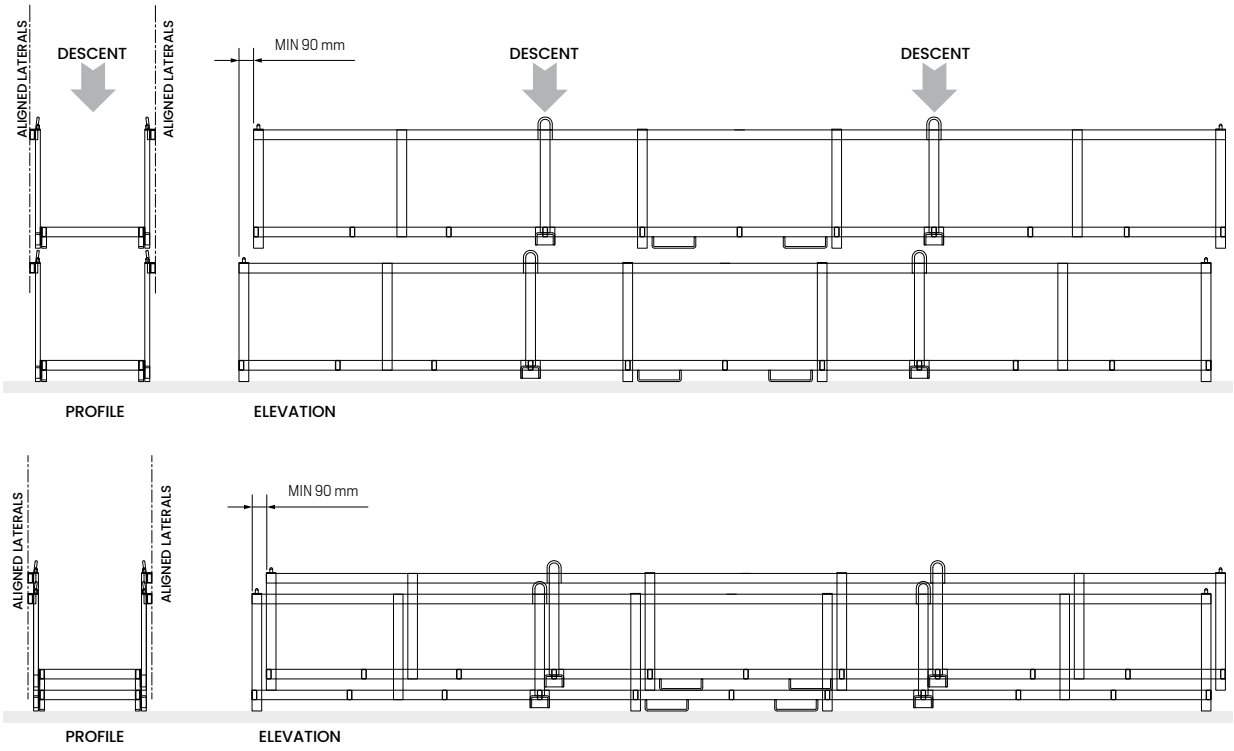
Ver **ADVERTENCIAS DE SEGURIDAD** en la página siguiente.

Filled stillages with profiles for storage will be positioned as per the detail below:



Detail of stacked stillages for profile storage

To store empty stillages (for example, returns), they will be placed as per the detail below:



Detail of returned stacked empty stillages

SECURITY WARNINGS

The spider hook to used to lift the overhead crane must have a CE marking and be dimensioned in order to support at least the maximum load capacity of the stillage (1800 kgs.)

Stillage loading must be symmetrical and centered.

Check the correct state of the lugs, hooks and the CE marking before lifting and that they are correctly anchored.

The overhead crane cable must be completely vertical before starting to lift the stillage.

If the stillage is not level (horizontally), return it to the floor and take the opportune steps to ensure that this does not occur again.

The load must be at an approximate distance of 50 cm. from the floor wherever possible.

It is totally prohibited to stand underneath or on top of the suspended load and neither in the manouvere radius.

Sudden movements and swinging during handling must be avoided.

A correct vertical position must be maintained during stillage stacking or interlocking operations as well as the secure support between the elements.

The operator that handles the loads must be speciffically trained in the use of fork lift trucks and overhead cranes.

Follow the corresponding health and safety regulations (Hard hat and safety shoes as well as adequate gloves and workwear).

All personnel related with stillage handling must be correctly informed as to the risks and handling instructions as it is their responsibility regarding good practice in order to avoid accidents.

7.4 NON-RETURNABLE PACKAGING

For intercontinental dispatches in containers, 2 variations of packaging are used depending on the transversal geometry of the profiles and the client requirements:

REEL: A cylindrical packaging for dispatching flat profiles where the profile is arranged spirally. This type of packaging cannot be used for tubular or profiles with additional incorporated pieces due to the increase in the moment of inertia in the sections. These reels are sent on wooden pallets.

Reels on a wooden pallet

WOODEN STILLAGE: A stillage made of wood and enclosed in all of its faces for sending all types of transversal sections (Flat, C shaped, tubular etc.).

Wooden stillage.

7.5 DOCUMENTATION

For each material dispatch a delivery note is printed and attached containing the following information:

- Name, address and manufacturers contact details.
- Name, address and contact details of the client
- Date, delivery note nº, fiscal identification, client nº, etc.
- STAC product code, description, Client product code, client order nº, quantity, weight etc.

The delivery notes are comprised of lines, each one of them correspond to each reference sent. In each line and in this order there appears, our product code, a description of the product together with the cut length of the profiles, the client product code, the client order number and the quantity of Hm (hectometres) together with the nº of lengths at the specified length size. Each stillage sent will also have a line for its reference and the quantity (see example).

In the case of a dispatch of references that are officially approved (EN 14024, NF 252, ATG etc.), the certifícate of production will be sent or other necessary technical documents according to the loading notes agreed with our client.

STAC

SISTEMAS TÉCNICOS DEL ACCESORIO Y COMPONENTES, S. L.

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CLIENT CONTACT DETAILS

DELIVERY NOTE

FECHA	ALBARÁN Nº	CLIENTE	DIVISA	PAG.	N.I.F.
22/09/15	432/0000504	XXXXX	EURO	1	B0000000

CÓDIGO	DESCRIPCIÓN	S/ CÓDIGO	S/ PEDIDO	CANT.	PRECIO	DTO.	IMPORTE
STM0002T	T SHAPED POLYAMIDE PROFILE WITH STRIP RAL: STM-6500 6,50 m profiles	3225	010915	31,200			
			010915	480,000			
STM-P-0321	STAC STILLAGE Nº 0231 Nett weight: 1.098 Kg			1,000			

BASE IMPONIBLE	% I.V.A.	CUOTA I.V.A.	% R. E.	CUOTA R. E.	TOTAL ALBARÁN EUROS

NOTAS:

Example of a delivery note

7.6 CONDITIONS OF USE FOR THE STILLAGES

In continuation please find a contract model which includes the conditions of use and return of the returnable metallic stillages.

DEPOSIT CONTRACT

In Padrón, the ..... of ..... 2014 ..... meeting together.

On one part, D. ....., of legal age , and resident in ....., and address ..... and National Identification or Passport nº .....

And on the other part, D. ....., of legal age, and resident in ....., and address ..... and National Identification or Passport nº. .....

PARTICIPANTS

D. ..... with the position of ..... for the entity SISTEMAS TECNICOS DEL ACCESORIO Y COMPONENTE S.L. (hereafter to be known as THE DEPOSITOR) and domiciled in Polígono Industrial Picusa s/n – La Matanza 15900 Padrón (A Coruña), Company Registration nº B-15799307 declares to the applicant that his or her position within the company is current and registered and is authorised to oblige the company to the terms of this contract

D. ....., with the position of....., of the entity ..... (hereafter to be known as THE DEPOSITARY), and domiciled in ....., with Company Registration Nº ..... declares that his or her position within the company is current and registered and is authorised to oblige the company to the terms of this contract.

BOTH DECLARE

That both entities will carry on maintaining or have the intention to maintain in the future, commercial relations where the THE DEPOSITOR serves or will serve the THE DEPOSITARY, polyamide profiles in bar length that are transported or will be transported in numbered stillages that belong to THE DEPOSITOR which THE DEPOSITARY receives or will receive "on deposit" with the delivery of each order or orders of merchandise that said stillages contain.

With the intention of formalising the terms that govern the deposit of said stillages, both parties agree to subscribe to this contract in line with the following:

CONDITIONS

FIRST.- In virtue of this contract, THE DEPOSITARY is obliged to receive from the DEPOSITOR, with having the obligation to care for, safe keep and return them according to what has been agreed, the numbered stillages that contain the orders for polyamide profiles in bar length that has been delivered to them and complying with the commercial agreements between both parties.

SECOND.- THE DEPOSITARY must comply with the obligations regarding reception, care and safe keeping of the stillages that are subject to this current document from the moment the order delivery note or merchandise orders have been signed for and the material contained therein understanding that they have been received "on deposit" and until they have been removed by THE DEPOSITOR.

The corresponding numbering of each stillage that THE DEPOSITARY receives, must be indicated in the order delivery note or merchandise orders that are contained therein.

THIRD.- After three months have elapsed from the delivery of each order, THE DEPOSITOR can request from THE DEPOSITARY the return of the stillage or stillages that were previously delivered. Said request can be made by fax, post, electronic mail or any other form of notification that is put on record regarding the shipment and following 15 days elapsing from the request, THE DEPOSITARY must have the stillage or stillages empty at the same place they were delivered to and ready for return according to the request.

FOURTH.- Should the return request to THE DEPOSITARY for the stillages according to the aforementioned conditions not be complied with according to the way and notice referred to, the amount of 500 Euros for each stillage not returned must be paid to THE DEPOSITOR, and that said payment does not exonerate the compliance of their obligations to the care and safe keeping of the stillage or stillages that are involved, nor the return to THE DEPOSITOR, remaining subject to, and consequently, the right to demand the compliance of said obligations.

FIFTH.- Given the complexity involved with the manipulation, loading and unloading of the stillages for deposit, whether being made avaialble to THE DEPOSITARY for the delivery of the order or orders of profiles contained within, or complying with the return of same to THE DEPOSITOR as well as during their transit, storage or general manipulation whilst they remain under the care and safe keeping of the DEPOSITARY, the instructions supplied by THE DEPOSITOR must be rigoursly observed and are detailed in the ANNEX and together with this contract, signed by both contracting parties, will form an integral part of this document.

To this effect, THE DEPOSITARY is obliged to take note of these instructions and require their personnel that load, unload, store and handle in general the stillages that have been deposited to comply with said instructions.

SIXTH.- In no case, whilst the stillages remain under the care and safe keeping of THE DEPOSITARY, can they be used for any other purpose without previously obtaining express and written permission from THE DEPOSITOR.

SEVENTH.- THE DEPOSITARY requires from the DEPOSITOR whilst carrying out its activities, that it takes in to account "Annex 1" that is found at the end of this Deposit Contract where there are detailed 12 basic points regarding security measures concerning the loading and handling of the stillages.

EIGHTH.- In order to resolve any incident or controversy that arises relating to the interpretation or compliance of this contract, both contracting parties will expressly submit to the Courts and Tribunals in the jurisdiction of THE DEPOSITOR.

And, as proof of conformance, both parties confirm and sign in duplicate in the place and the date indicated in the heading.

THE DEPOSITOR **THE DEPOSITARY**

This contract is accompanied by an annex with security instructions for the handling of the spider hook and the stillages. These instructions can be found in point 6.3.

8. WAREHOUSING AND STORAGE CONDITIONS

In order to understand the recommendations stated in this point, we advise that sections 2.1 "Polyamide 66 structure" and 2.2 "Humidity absorption and its effects" be read carefully. In these sections, estimated data can also be obtained of how the profiles will be affected whilst in storage in particular humidity, temperature and time conditions.

At the point of extrusion, the polyamide profiles contain a percentage of humidity close to 0%, that is to say that they are practically dry. At this precise moment the profile tolerances strictly comply with those that appear in the product drawings and will continue to comply always and when they are meticulously stored according to our instructions.

8.1 STORAGE

In order to maintain the polyamide rods in adequate conditions for use, the following recommendations must be respected:

- Gather together the profiles without excssive overlapping or distance between supports
- Store in dry areas and with mild temperatures (between 15ºC & 23ºC)
- Avoid exposure to sunshine
- "First in first out" stock management

The profiles do not have a use by date, nevertheless they must be adequately stored in order to avoid important dimensional and mechanical changes that can be caused by a high humidity content. This elevated humidity content can cause problems when assembling with aluminium profiles or when passing through the powder coating oven which can result in bubbles appearing below the paint.

Part or the total of the humidity content that the profiles could have will be lost once passed through the powder coating oven with a tendancy to recover its original manufactured dimensions.

We recommmend using stock management in such a way that the first material received will be the first to be incorporated in to the production process and in no case should they be mixed during assembly with profile lots manufactured on very different dates. This could cause deviations in the parallel or perpendicular thermal break profile tolerances.

What better than to have a practical example in order to understand the negative effects of inadequate stock management and storage:

Let us suppose that the warehouse is situated in a climatic zone where the average annual relative humidity is at around 80% and the average temperature is around 20ºC and that there is a stillage containing profiles of 35 mm in width and 6.5 mts. in length and stored for 2 years (sufficient time to reach equilibrium with respect to humidity content). How will this affect the profiles with respect to dimensions and humidity content?).

If we go to the "Illustrative chart of the dimensional changes according to the humidity content" found in section 2.2 in this manual, we can see that for a relative humidity of 80% the estimated saturation humidity content will be 4.1% in weight.

To this humidity content found in paragraph 2.2 of this manual and according to the "Illustrative chart of the dimensional

changes according to the humidity content", there will be a dimensional increment of approximately 0.8% meaning that the profiles will have a width of 35.30 mm instead of 35 mm and a length of 6.55 mts. instead of 6.50 mm.

Apart from the dimensional deviation, this high water content can also produce bubbles during the powder coating process and found on the polyamide after passing through the oven.

In order to avoid these undesired consequences, we advise that the storage of the profiles be in adequate and controlled atmospheres, or failing that, to manage the warehouse temperatures according to the prevailing humidity and temperature.

There is nothing better than the above example in order to raise awareness of the importance of respecting adequate warehousing and stock management guidelines in order to maintain the product in optimum conditions for use.

8.2 ASSEMBLY

Before starting to handle the polyamide profiles with the aluminium profiles, we advise that the material data safety sheet found in paragraph 2.4 in this manual be read carefully. It is the responsibility of the company using the product to inform all personnel involved in the handling of the product of the details contained in the document.

The assembly of the polyamide profiles with the aluminium profiles basically consist of the following steps:

1. Knurling of the cavities in the aluminium profiles (See section 4.2.2 of this manual).
2. The rods are bayonet inserted in to and through the aluminium profile cavities.
3. Crimping of the hammers in the aluminium profiles..

The degree of mechanical and rigidity consistence of the complete assembly will depend largely on the correct design of the cavities (see section 4.2.3 of this manual), a good knurling and crimping of the hammers, and the vital importance of the infrastructure and good practice carried out by the personnel who carry out the assembly process.

8.3 RECOMMENDATIONS FOR POWDER COATING

Broadly, the phases of the thermally broken profile powder coating process will be as follows:

1. A tank with cleaning agents and superficial pre-treatment.
2. Drying.
3. Application of powder coating.
4. Paint polymerization.

The drying phase after the tank must be carried out until no residue remains as these can cause bubbles or even fissures in the polyamide during the paint polymerization phase in the oven.

For the paint polymerization phase, the profiles pass through an oven at a temperature of 190ºC to 200ºC during a period of 20 minutes and for that reason the polyamide used must be stored according to the recommendations found in section 7.1 of this manual in order to avoid the appearance of bubbles under the paint as a consequence of the evaporation of excess water content on the polyamide profiles.

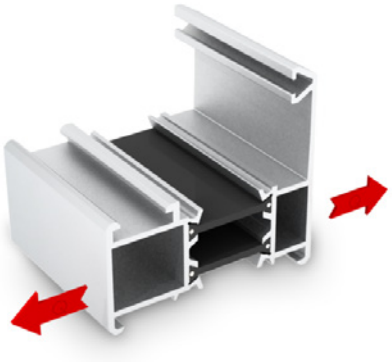
The oven temperature must never in any case exceed 200ºC. If this occurs, it could affect the mechanical stability of the polyamide.

8.4 MECHANICAL FEATURES OF A THERMALLY BROKEN PROFILE

Mechanical tests on the batches of the manufactured thermally broken profiles should be carried out with respect to shear resistance and transversal tension in order to ensure that they exceed the minimum requisites for the application standards (EN14024, NF252, etc.)

TRANSVERSAL TENSION RESISTANCE TEST (Q)

The test piece (*) is fixed to the traction equipment supports and this exerts an incremental force in the direction of the red arrows until the thermally broken profile fails. The maximum force necessary for the fail remains registered in the equipment.

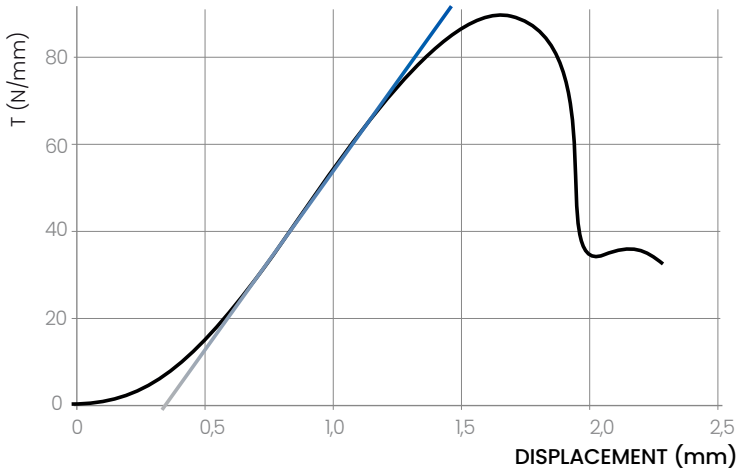


Transversal tension(Q)

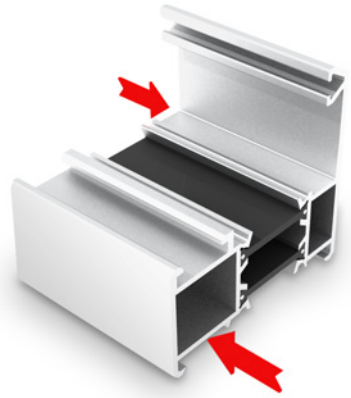
(*) A shear slippage must be induced on the test pieces before starting this test.

SHEAR RESISTANCE TEST (T)

One of the aluminium profiles rests on the fixed support and over the rest of the profile a plunger is operated that exerts an incremental force in the direction of the red arrows until the thermally broken profile fails or a there is a displacement of at least 2 mm. Once one of the 2 previously mentioned premises are achieved, the maximum force will be registered in the equipment.



Example of the graph obtained from the shear test.



Shear resistance (T)

For the European group the EN14024 standard is used, nevertheless, for the French territories it can be the application of the NF252 standard whose requisites are even more demanding:

STANDARD	TRANSVERSAL TENSION RESISTANCE (Q)		SHEAR RESISTANCE (T)
EN 14024	≥ 12 N/mm*	≥ 20 N/mm**	≥ 24 N/mm
NF 252	≥ 50 N/mm		≥ 40 N/mm

T & Q mechanical features demanded by the EN14024 & NF252 standards.

(*) Window and door profiles and secondary components of light façades
(**) Principal components of light façades.

The thermally broken profiles assembled with our polyamide have been tested at the CSTC Belgian laboratory and the T & Q results obtained exceed the minimums demanded by the standards that appear in the above table.

9. ATTENTION TO THE CLIENT AND AFTER SALES SERVICE

Within our policy we consider as a priority to attend and react with great speed to the requirements of studies, offers, delivery times or complaints, if any, with the only goal that our clients are completely satisfied with our work.

If any problem presents itself during the use of the product, you only have to advise us and we will do whatever is in our hands to solve it as quickly as possible. In this way you will see a resolution to the problem and for us it serves as valuable feedback which will help to us to grow in experience and learning and to avoid that the problem occurs in the future.

We have the ISO 9001 quality certification and consequently we have implanted in our procedures the management and control regarding complaints where we carry out a compilation of the information, dimensional analysis (verniers, shadowgraph projectors and other specialist tools) and physically (Laboratory equipment) of the affected samples. We also can track backwards starting from the printed codes on the lengths so that we can know their complete history from the start of the process. Finally we produce a report with a description of the non-conformity, the causes, the corrective and preventative actions taken that will be put in to place in order to avoid that the problem is repeated.

With this process the intention is to reach an exponential quality with respect to client attention and service as well as constantly improving our processes and products.

CONTACT DETAILS:

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comercial@stac.es

Internacional
T (+34) 629 390 720
j.lopez@stac.es

PRODUCTION CENTRE

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comercial@stac.es

9.1 DATA PROTECTION

Once an offer or order has been made, client data remains registered in our management system at our address and at central offices.

This data can be used for sending promotional material, technical or commercial information etc. using electronic mail, post or fax.

If required, the client can send by email, fax or letter to the above indicated address advising us if it is his wish not to have this data registered or to change any of the details in our database.

SISTEMAS TÉCNICOS DEL ACCESORIO Y COMPONENTES, S.L.

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