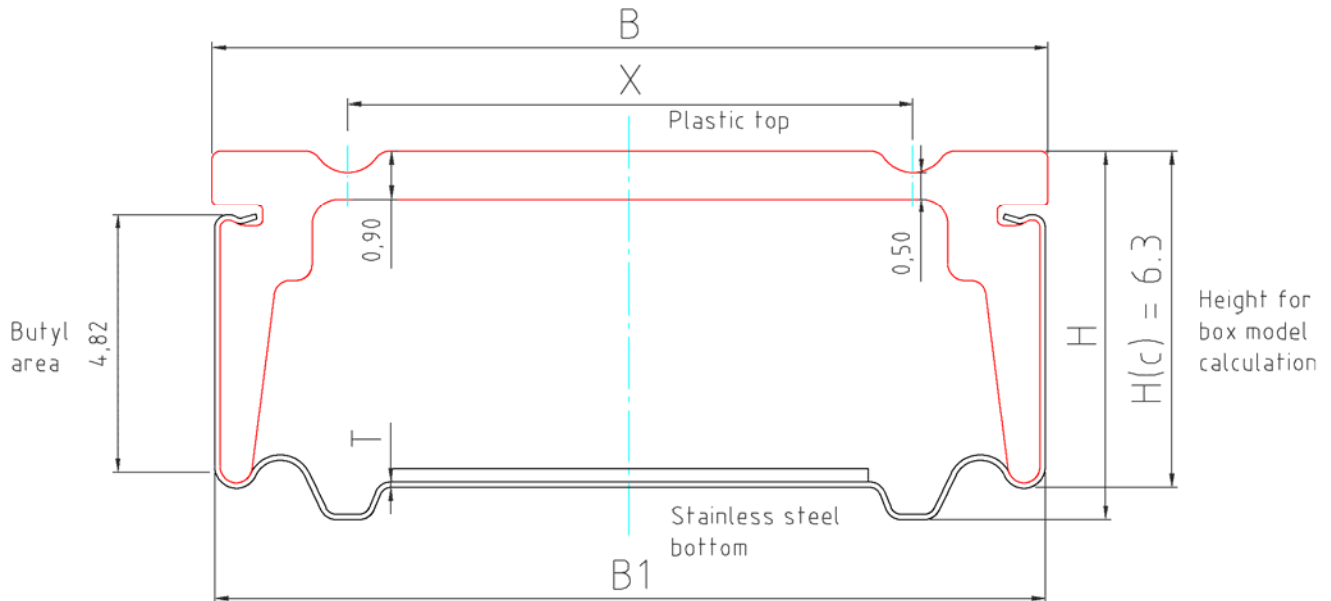


1. Spacer properties



1.1 Cross section and tolerances

| Spacer bar / cavity | H +/- 0.15 [mm] | H(c) [mm] | Butyl area +/- 0.1 [mm] | B +/- 0.15 [mm] | B1 -0.05/+0.25 [mm] | X +/- 0.1 [mm] | Volume Desiccant Grace 551 g/m | *T Standard steel [mm] |
|---------------------|-----------------------|--------------|----------------------------------|-----------------------|---------------------------|----------------------|---|---------------------------------|
| CHROMATECH ultra 8 | 6.9 | 6.3 | 4.82 | 7.6 | 7.5 | 2.45 | 20,2 | 0,10 |
| CHROMATECH ultra 10 | 6.9 | 6.3 | 4.82 | 9.6 | 9.5 | 4.45 | 32,5 | 0.10 |
| CHROMATECH ultra 12 | 6.9 | 6.3 | 4.82 | 11.6 | 11.5 | 6.45 | 36,3 | 0.10 |
| CHROMATECH ultra 13 | 6.9 | 6.3 | 4.82 | 12.6 | 12.5 | 7.45 | 40,5 | 0.10 |
| CHROMATECH ultra 14 | 6.9 | 6.3 | 4.82 | 13.6 | 13.5 | 8.45 | 44,7 | 0.10 |
| CHROMATECH ultra 15 | 6.9 | 6.3 | 4.82 | 14.6 | 14.5 | 9.45 | 48,6 | 0.10 |
| CHROMATECH ultra 16 | 6.9 | 6.3 | 4.82 | 15.6 | 15.5 | 10.45 | 52,4 | 0.10 |
| CHROMATECH ultra 18 | 6.9 | 6.3 | 4.82 | 17.6 | 17.5 | 12.45 | 60,2 | 0.10 |
| CHROMATECH ultra 20 | 6.9 | 6.3 | 4.82 | 19.6 | 19.5 | 14.45 | 67,9 | 0.10 |
| CHROMATECH ultra 22 | 6.9 | 6.3 | 4.82 | 21.6 | 21.5 | 16.45 | 76,1 | 0.10 |
| CHROMATECH ultra 24 | 6.9 | 6.3 | 4.82 | 23.6 | 23.5 | 18.45 | 84,0 | 0,10 |

*T: Standard is 0.10 mm for the F version.

EN 1279-6 reference to table A.2 & A.5

| Ref. No. | EN Ref. | Description/specification | Internal test method |
|---------------------------|------------|---|----------------------------------|
| Further Spacer properties | | | |
| 1.2 | 2.3 2.4 | Geometry/shape The spacer geometry is shown in the cross section picture above. On enquiry a specific drawing can be delivered. Tolerances above. | Slide gauge and inspection drift |
| 1.3 | 2.2 | Length and straightness Standard length is 6,000 mm +/- 10 mm. Straightness deviation 15 mm/m at room temperature. | Steel ruler. Visual. |
| 1.4 | 2.7 | Undesired openings The spacer is tight as the backside is one uninterrupted piece of material. | Process validation. |

| | | | |
|----------------------------|-----|---|-------------------------------------|
| | | Plastic and steel are glued together with a PU hotmelt. | |
| 1.5 | 2.6 | Perforation. Se comments below ** Calibrated perforation holes measured for optimal performance. | Air flow meter. |
| 2.0 Spacer material | | | |
| 2.1 | | Material for calculations Steel material used is according to DIN EN 10 088 type 1.4372 (AISI 201) or similar grades. Thermal conductance $\lambda_s = 15 \text{ W/mK}$ at $20 \text{ }^\circ\text{C}$. Engineered plastic based on PVC $\lambda_p = 0.17 \text{ W/mK}$ acc. EN ISO 10077-2. These values are to be used for calculations. DXF file can be supplied. Total box model height: $H(c) + \text{sealant} = 6,3 \text{ mm} + 3 \text{ mm} = 9,3 \text{ mm}$. | <i>Documented by supplier.</i> |
| 2.2 | 2.5 | Surface The surface is clean and do not undergo any treatment with chemicals. RAL colours 9004, 7035, 7040, 8003, 8016 and 9016. RAL 9004 and 9016 are named CHROMATECH ultra F1. | Visual test & Adhesion test. |
| 2.3 | | Tolerances of the steel material The wall thickness of the spacer "F" is standard 0.10 mm. | Micro meter. |
| 2.4 | | Lubrication During the forming of the spacer lubrication is used. The lubrication will evaporate fully leaving no volatile elements. | Adhesion test. |
| 2.5 | 2.8 | Volatile elements Volatile elements are tested according to EN 1279-6 annex G. | Weight loss test. M_v measured |

** 1.5.1 Level of perforation

The Rolltech standard perforation will reduce the absorption of aqueous vapour to be app. 1.0 weight % over a period of 24 hours (16 mm cavity tested by Grace Davidson Europe) - relative to the spacer size. The perforation is targeted EN 1279 - 6 annex A – specified maximum preload $H_2O \leq 3 \%$.

** 1.5.2 Function of the perforation

The perforation holes are until a certain particle size able to detain dust from the desiccant. This point is particular related to the performance of the bending machine and to the desiccant quality. An incorrect adjustment of the bending tool can cause damage to the perforation.

3.0 Quality aspects

3.1 Quality management

ROLLTECH A/S is certified according to DS EN ISO 9001.

3.2 Tests of the product

Processes and routines are established to secure the quality of the delivered material. During production the spacers are continuously monitored through systematic and random checks. Data will be available for a period of 5 years.

3.3 Quality agreement

ROLLTECH A/S fulfil the requirements of EN 1279 - 6 annex A. Specific quality agreement can be made to reduce inspection and test of the incoming material according to EN1279-6 part 5.2.6.

4.0 Customer focus and warranty

On all spacers ROLLTECH offers a 5 year product warranty. The warranty covers free exchange of spacers in case of a defect. The spacers must have been stored, installed and used according to present norms and technical standards. Special solutions and **usage that are not standardized** will need prior approval in writing from ROLLTECH in order to be covered. Related to temperature standardized condition for IG is -30° to 70°C.

4.1 Storage and use

To secure the performance of the spacers, the stock conditions must be acceptable. Broken packaging, humidity and variation in temperature will have an effect on the spacer in general. Make sure the spacer is conditioned at room temperature before use.

Preferred conditions will be a room temperature over 15°C and humidity RH of minimum 45%
Avoid having an environment with a high concentration of dust.

General handling and attention according to safety data sheet for the spacer. Use gloves when handling the spacer/frames and make sure there is exhausting when cutting the spacer.

It is recommended to check out and control all the specific points above.

4.2 Adhesion check

When preparing checks for adhesion test according to EN1279-6 F3.2.2 make sure the spacer backside is covered and in full contact with the sealant (no air bubbles). When pulling the samples make sure to support the spacer fully inside to avoid deformation. If the spacer deforms the adhesion test will be affected. Written procedure can be delivered up on request. Curing time according to instruction from sealant manufacturer.

4.3 Pressure

Deformation by pressure such as wind load and weight load by horizontal installation.

Compression data for a 16 mm CU cavity:
50 N/cm → 0 mm; 80 N/cm → 0.3 mm; 110 N/cm → 0.5 mm.

4.4 System performance

The user (here the IG producer) must secure the whole system consisting of spacer, connector/corner key, bending machine, desiccant, butyl and sealant works well together in the chosen setup. Focus on compatibility, adhesion, dust and corner quality.

After handling and transport of the frames, it's important to check if the connector/corner keys are still in the correct position, if not there is a significant risk for desiccant dust inside the IG unit. Foam behind the connector/corner can be used to avoid such problems.

4.5. Cleaning the plastic surface

If for some reason the plastic surface is defiled by dust from other materials it can be cleaned again by the use of water or air. Dust can easily be removed with antistatic loaded compressed air or a moist cloth.

The surface is particularly sensitive to esters, ketones and PAH. Check reaction before use!

4.6 UV stability

The plastic used is an organic material with UV stabilizer in order to minimize the ageing effect caused by sun light.

The material is tested for 3.000 hours according to EN ISO 4892-1 & En 4892-2 method A, cycle 1. Evaluation is done according to grey scale index.