

General Construction Approval

Deutsches Institut für Bautechnik
ANSTALT DES ÖFFENTLICHEN RECHTS

Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt

Mitglied der Europäischen Organisation für
Technische Zulassungen EOTA und der Europäischen Union
für das Agrément im Bauwesen UEAtc

Tel.: +49 30 78730-0
Fax: +49 30 78730-320
E-Mail: dibt@dibt.de

Datum: 15. Februar 2010 Geschäftszeichen: I 39-1.70.4-34/08

Zulassungsnummer:

Z-70.4-146

Geltungsdauer bis:

15. Februar 2015

Antragsteller:

Finiglas Veredelungs GmbH
Wierlings Hook 5, 48249 Dülmen

Subject of approval:

Thermally curved glazing, made of float glass, and laminated safety glass

The above mentioned subject of approval is hereby granted the general construction approval.
This document consists of eight pages and two appendices.

I. General provisions

1. The general construction approval verifies the applicability and practicality of the subject of the application in the sense of the state building regulations.
2. Insofar as the general construction approval specifies requirements for special expertise and experience of persons entrusted with the production of building products and building types in compliance with the state-level regulations according to Section 17, sub-section 5 Model Building Code, it must be ensured that this expertise and experience can be verified through equivalent verification in other member states of the European Union. This may also apply to equivalent verification provided within the framework of the Agreement on the European Economic Area (EEA Agreement) or other bilateral agreements.
3. The general construction approval does not replace those authorisations, approvals and certifications legally prescribed for the implementation of construction projects.
4. The general construction approval is issued without prejudice to the rights of third parties, particularly private protection rights.
5. Manufacturers and vendors of the subject of approval must provide the user or operator of the subject of approval with copies of the general construction approval, without prejudice to any further regulations in the "Special provisions", and specify that the general construction approval must be kept at the place of use. Upon request, copies of the general construction approval must be made available to the relevant authorities.
6. The general construction approval may only be copied in its entirety. Copying of excerpts requires the consent of the German Institute for Construction Engineering (DIBt). Texts and drawings for advertising material must not contradict the general construction approval. Translations of the general construction approval must include the note: "Translation of the original German version has not been reviewed by the German Institute for Construction Engineering (DIBt)".
7. The general construction approval is revocably granted. The provisions of the general construction approval can be updated unchanged at any time, particularly when necessary due to new technical knowledge.

II. SPECIAL PROVISIONS

1 Subject of approval and application area

1.1 Subject of approval

The subject of approval is thermally curved glazing, made of "Fini Curve Float" float glass, and "Fini Curve VSG" laminated safety glass, made of "Fini Curve Float". The permissible bending radii, dependent on the glass thicknesses, can be found in Appendix 1. "Fini Curve VSG" is manufactured using an intermediate layer made of PVB film, according to Building Rules List A, Part 1, Seq. No. 11.14, with the properties named therein.

The curved glass has the form of a circular cylinder segment. Tangential flat sections can be added in the circumference direction. Curved forms that are multi-axis, wave-shaped or counter-rotating are not covered by this general construction approval.

1.2 Application area

"Fini Curve Float" and "Fini Curve VSG" can be used for all vertical glazing according to the "Technical rules for the use of glazing with linear supports (TRLV)"¹, where flat float glass or laminated safety glass made of float glass is permitted. The glazing may be inclined by maximum 10° from the vertical. Use in overhead areas or as fall protection is not regulated by this general construction approval.

2 Provisions for the construction product

2.1 Characteristics and composition

2.1.1 Glass panes

The base glass used for the production of "Fini Curve Float" and "Fini Curve VSG" is float glass (soda lime silicate glass) with CE mark as per EN 572-92 and Ü mark (German mark of conformity) as per Building Rules List A, Part 1, Seq. No. 11.10.

Coated float glass with CE mark as per EN 096-43 and Ü mark (German mark of conformity) as per Building Rules List A, Part 1, Seq. No. 11.11 can also be used.

The pane thicknesses are 3, 4, 5, 6, 8, 10, 12 and 15 mm. Dimensional tolerances as per EN 572-2 apply.

The edges of the float glass must be at least arised for the bending process.

2.1.2 Thermally curved float glass "Fini Curve Float"

"Fini Curve Float" can be produced in the production factories of the company Finiglas Veredelungs GmbH using the oven groups specified in Appendix 1. The maximum dimensions are listed in Appendix 1 and are dependent on the glass thicknesses, the permissible minimum bending radius, the oven group and the production factory. The bending process and the process parameters are archived at the German Institute for Construction Engineering (DIBt).

1 Technical rules for the use of glazing with linear supports - TRLV, version 08/2006, published in the notifications of the German Institute for Construction Engineering (DIBt), 3/2007, dated 11. June 2007

2 EN 572-9:2004-10
Implemented in Germany through DIN EN 572-9:2005-01: Glass in building - Basic soda lime silicate glass products - Part 9: Evaluation of conformity / Product standard

3 EN 1096-4:2004-10
Implemented in Germany through DIN EN 1096-4:2005-01: Glass in building - Coated glass - Part 4: Evaluation of conformity/ Product standard

2.1.3 Film made of polyvinyl butyral (PVB)

In accordance with this general construction approval, a film according to Building Rules List A, Part 1, Seq. No. 11.14 must be used for the production of the laminated safety glazing "Fini Curve VSG". The nominal thickness of the PVB film must be minimum 0.76 mm and maximum 3.04 mm.

2.1.4 Laminated safety glass "Fini Curve VSG"

The curved laminated safety glass "Fini Curve VSG" must be produced using at least two panes of "Fini Curve Float" or coated "Fini Curve Float" as per Section 2.1.1 and PVB film as per Section 2.1.3 according to the process archived at the German Institute for Construction Engineering (DIBt). The individual panes for the laminated safety glass must be bent together in one process, i.e. lying over each other.

The laminated safety glass "Fini Curve VSG" must meet the minimum requirements for laminated safety glass as per Building Rules List A, Part 1, Seq. No. 11.14. The dimensional tolerances, the maximum edge offset and the edge processing of the panels must be complied with as per DIN EN ISO 12543-54.

When using coated glass panes, the coating must be on one of the sides facing away from the PVB film.

2.2 Production, packaging, transport, storage and labelling

2.2.1 Production

"Fini Curve Float" and "Fini Curve VSG" are produced in the production factories and oven groups of the company Finiglas Veredelungs GmbH listed in Appendix 1.

"Fini Curve Float" and "Fini Curve VSG" must be produced in compliance with the process parameters determined during the initial testing and archived at the German Institute for Construction Engineering (DIBt).

2.2.2 Packaging, transport and storage

The glass elements may only be transported using suitable transport aids that protect the glass edges from damage. Suitable padding must be provided to protect the glass edges during temporary storage on the building site.

2.2.3 Labelling

The building products as per Section 2.1.2 and 2.1.4, or their packaging or delivery note, must be labelled by the producer using the German Mark of Conformity ('Ü') according to the regulations governing national marks of conformity. Such labelling may only be implemented when the requirements according to Section 2.3 have been met.

The thermally curved float glass "Fini Curve Float" must also be permanently marked in a corner or on an edge with the product designation "Fini Curve Float Z-70.4-146". Laminated safety glass made from thermally curved float glass "Fini Curve VSG" must be permanently marked in a corner or on an edge with the product designation "Fini Curve VSG Z-70.4-146".

2.3 Verification of conformity

2.3.1 General information

Confirmation that the thermally curve float glass "Fini Curve Float" as per Section 2.1.2 complies with the provisions of this general construction approval must be implemented for each production factory and each oven group with a declaration of conformity by the manufacturer on the basis of a factory production control and initial testing by a testing authority to be agreed upon with the German Institute for Construction Engineering (DIBt).

Confirmation that laminated safety glass made from thermally curve float glass "Fini Curve VSG" as per Section 2.1.4 complies with the provisions of this general construction approval must be implemented for each production factory with a declaration of conformity by the manufacturer on the basis of a factory production control and initial testing by a testing authority to be agreed upon with the German Institute for Construction Engineering (DIBt).

The manufacturer must provide the declaration of conformity by labelling the construction product with the mark of conformity (Ü mark).

The manufacturer must provide the German Institute for Construction Engineering (DIBt) with a copy of the initial test report on request.

2.3.2 Factory production control

A factory production control must be set up and implemented in each production factory and for each oven group for the construction product as per Section 2.1.2 and in each production factory for the construction product as per Section 2.1.4. Factory production controls are understood to be the continuous monitoring of production by the manufacturer to ensure that the construction products produced by the manufacturer comply with the provisions of this general construction approval.

The factory production control must include at least the measures listed below:

- Description and checking of the starting materials as per Sections 2.1.1 and 2.1.3.
- Checking the angle accuracy, edge processing, dimensional accuracy and surface properties of the panes.
- For all bending processes: Compliance with the planned cooling phase as per the production parameters for the production of "Fini Curve Float" archived at the German Institute for Construction Engineering (DIBt).
- "Fini Curve Float" without coating: Applicable for each oven group: Each calendar week, cutting tests as described in Appendix 2 must be implemented on two test panes measuring 1100 mm x 360 mm each, taken from the ongoing production process. The thickness of the test panes must be selected so that at least two test panes per quarter are checked in each produced thickness and radii group ($R < 1000$ mm and $R > 1000$ mm). Ensure that test panes are taken from various bending ovens in an oven group so that all ovens are included in the check.
- "Fini Curve Float" with coating: Applicable for each oven group and each coating group: Each calendar week, cutting tests as described in Appendix 2 must be implemented on two test panes measuring 1100 mm x 360 mm each, taken from the ongoing production process. The thickness of the test panes must be selected so that at least two test panes per quarter are checked in each produced thickness and radii group ($R < 1000$ mm and $R > 1000$ mm). Ensure that test panes are taken from various bending ovens in an oven group so that all ovens are included in the check. The coated panes can be divided into coating groups based on the emissivity according to DIN EN 12150-25 Table 2b, so that the testing outlay is limited.
- Fini Curve VSG: Implementation of tests as per Section 2.3.3.2.

The results of the factory production control must be recorded and evaluated. The records must include the following data as a minimum:

- Name of the construction product or the starting material and the component
- Type of control or test
- Date of production and testing of construction product or starting material or component
- Results of controls and tests, and where applicable, comparison with requirements
- Signature of person responsible for the factory production control

The records must be archived for at least five years and made available on request to the German Institute for Construction Engineering (DIBt) and the highest responsible building authority. In the case of unsatisfactory test results, the manufacturer must immediately implement measures to rectify the defect. Construction products that do not meet the requirements must be handled in such a manner as to exclude any confusion with compliant products. Once the defect has been rectified, the relevant test must be repeated immediately - insofar as is technically feasible and necessary as verification of defect rectification.

2.3.3 Initial testing of "Fini Curve Float" and "Fini Curve VSG"

2.3.3.1 Fini Curve Float

The testing authority for the initial test must be agreed with the German Institute for Construction Engineering (DIBt).

The following tests must be implemented for the initial testing in each production factory for each oven group:

- Regarding pane thicknesses 6 mm and 10 mm, 15 test panes with dimensions 1100 mm (chord length) x 360 mm and a bending radius of R1083 mm (rise: 150 mm), implement tensile strength tests based on DIN EN 1288-36 (Appendix 1). The 5 % fractile value for a confidence level of 95 % must be greater than 30 N/mm² (edge strength).
- Regarding pane thicknesses 6 mm and 10 mm, at least three test panes with dimensions 1100 mm (chord length) x 360 mm and a bending radius of R1083 mm (rise: 150 mm) must be subjected to stress optical measurements on the concave side in at least 3 measurement points (Appendix 2). This test is only possible on the uncoated side if the panes are coated. No tensile stresses must occur. The correlation between the stress optical measurements and the cutting tests must be recorded.
- Regarding pane thicknesses 6 mm and 10 mm, at least three test panes with dimensions 1100 mm (chord length) x 360 mm and a bending radius of R1083 mm (rise: 150 mm), implement cutting tests with at least 2 cuts to check the surface compression stresses using a suitable cutting tool in compliance with the method described in Appendix 2. These results must be confirmed for the smallest produced bending radii.
- Regarding pane thicknesses 6 mm and 10 mm, cutting tests must be implemented on two test panes with minimum dimensions of 1500 mm (chord length) x 1000 mm and the lowest bending radius for these dimensions.

- The coated, curved float glass must also be tested in the same way as the uncoated, curved float glass. Tensile strength tests, stress optical measurements and cutting tests must be implemented. The tensile strength tests must be implemented on 15 test panes with dimensions 1100 mm (chord length) x 360 mm and a bending radius of R1083 mm (rise: 150 mm), for the glass thickness 6 mm with the coated side in the tensile zone. The coated panes can be divided into coating groups based on the emissivity according to DIN EN 12150-27 Table 2b, so that the testing outlay is limited. The cutting tests and the stress optical measurements are limited to tests with 2 test panes and a pane thickness of 6 mm.

The results of the initial testing must be archived for at least five years and made available on request to the German Institute for Construction Engineering (DIBt) and the highest responsible building authority.

2.3.3.2 Fini Curve VSG

Initial testing based on the Building Rules List A, Part 1, Appendix. 11.8, Section 2, must be implemented for the curved laminated safety glass "Fini Curve VSG" on suitable test specimens. In addition to the visual inspection and testing at high temperatures, a humidity test as per DIN EN ISO 12543-48 is required. The drop weight test is not required.

3 Provisions for design and assessment

3.1 General information

Thermally curved float glass "Fini Curve Float" and laminated safety glass made of thermally curved float panes "Fini Curve VSG" can be used for all vertical glazing according to the "Technical rules for the use of glazing with linear supports (TRLV)", where flat float glass or laminated safety glass made of float glass is permitted. The TRLV provisions must be complied with.

3.2 Verification with permissible stresses as per TRLV

Supplementary to Table 1, TRLV, the permissible tensile strength stresses in Table 1 below apply to the curved glass subject to this general construction approval.

Table 1: Permissible tensile strength stresses in N/mm²

Glass	Vertical glazing
„Fini Curve Float“ and coated „Fini Curve Float“	16
„Fini Curve VSG“ and coated „Fini Curve VSG“	20

The permissible tensile strength stresses in Table 1 must be reduced by 20% for the edge strength.

The strain on curved insulating glass units due to climatic influences must be taken into consideration during assessment according to the TRLV specifications. The simplified verification as per Appendix A, TRLV, does not apply here.

Stability-relevant tests may be necessary for the assessment.

4 Provisions for execution

All panes must be checked for the correct execution of the pane edges before installation. Panes with edge damage that visibly penetrates the glass body may not be installed. The provisions of the "Technical rules for the use of glazing with linear supports (TRLV)" must be complied with during execution.

It must be ensured that the glass or film edges only come into contact with neighbouring materials that are long-term compatible with the PVB film used. Comply with the data of the company Finiglas Veredelungs GmbH or film manufacturer in this respect.

Ensure stress-free suspension during installation.

5 Fire protection

The fire behaviour of the laminated safety glass "Fini Curve VSG" is not dealt with in this general construction approval and must be verified according to DIN EN 14449. 9

6 Provisions for use, upkeep and maintenance

Damaged panes must be replaced immediately. Hazardous areas must be closed off immediately. When panes are replaced, ensure that new panes complying with this general construction approval are used.

Dr.-Ing. Kathage

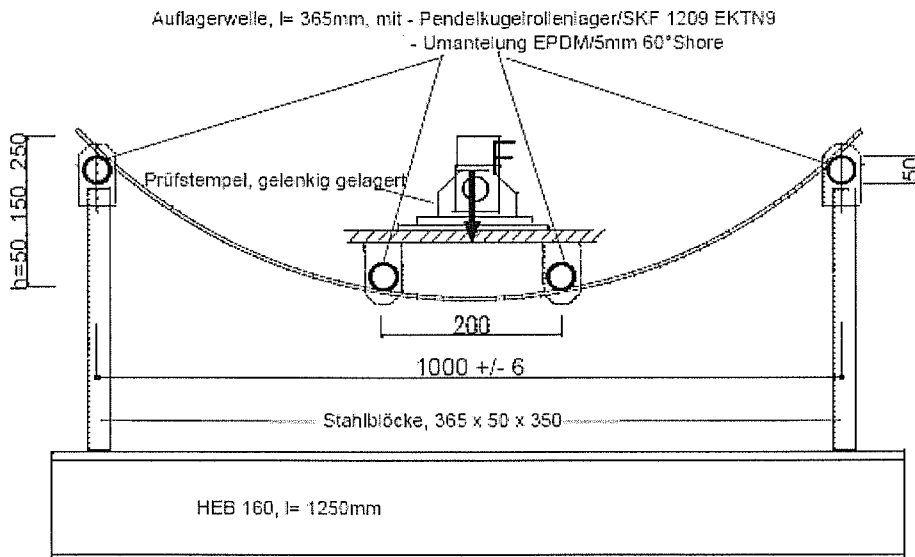
Note: The present translation of the original German version has not been reviewed by the German Institute for Construction Engineering (DIBt)

Pane thickness, bending radii, pane measurements

Oven group 1 Floatglas	Finiglas Veredelungs GmbH Wierlings Hook 5 48249 Dülmen
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
3	100	1900 x 3300
4	100	1900 x 3300
5	150	1900 x 3300
6	200	1900 x 3300
8	250	1900 x 3300
10	300	1900 x 3300
12	400	1900 x 3300
15	600	1900 x 3300

Experimental setup for measuring of flexural strength



¹ Forschungsantrag (AiF): Trag- und Resttragfähigkeitsverhalten von unterschiedlichen gebogenen Glasscheiben im Bauwesen, Entwicklung von Berechnungsmethoden, Prüf- und qualitätssichernde Kriterien. FH München, 2006

Finiglas Veredelungs GmbH
Wierlings Hook 5
48249 Dülmen

Herstellwerke / Ofengruppen
Versuchsaufbau zur Prüfung der
Biegezugfestigkeit

Anlage 1

zur allgemeinen
bauaufsichtlichen Zulassung
Z-70.4-146
vom 15. Februar 2010

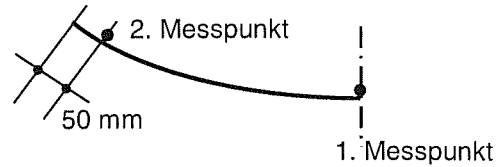
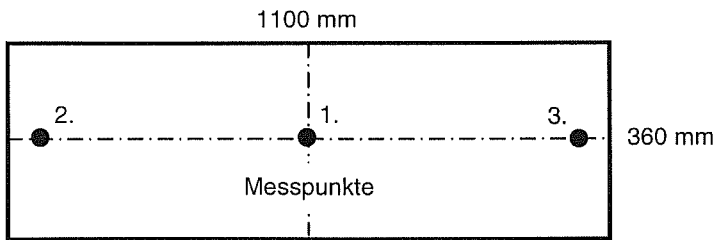


Photoelastic measurements

Three areas have to be measured photoelastically (e.g. with Scalp, or Strainoptics) on the concave part of the pane.

Spannungsoptische Messungen: Format 1100 (Sehne) x 360 mm (Draufsicht u-Lage)

(Ansicht)



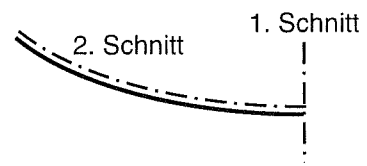
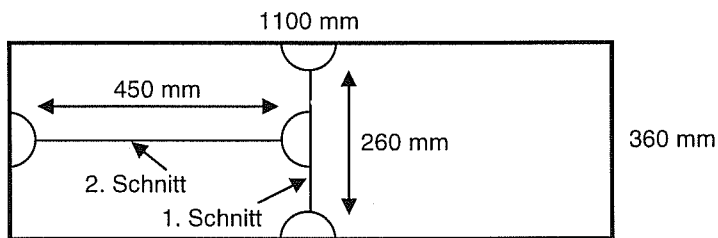
Cutting tests

Cutting tests have to be done for formats 1100mm x 360mm and 1500mm x 1000mm with two cuts each.

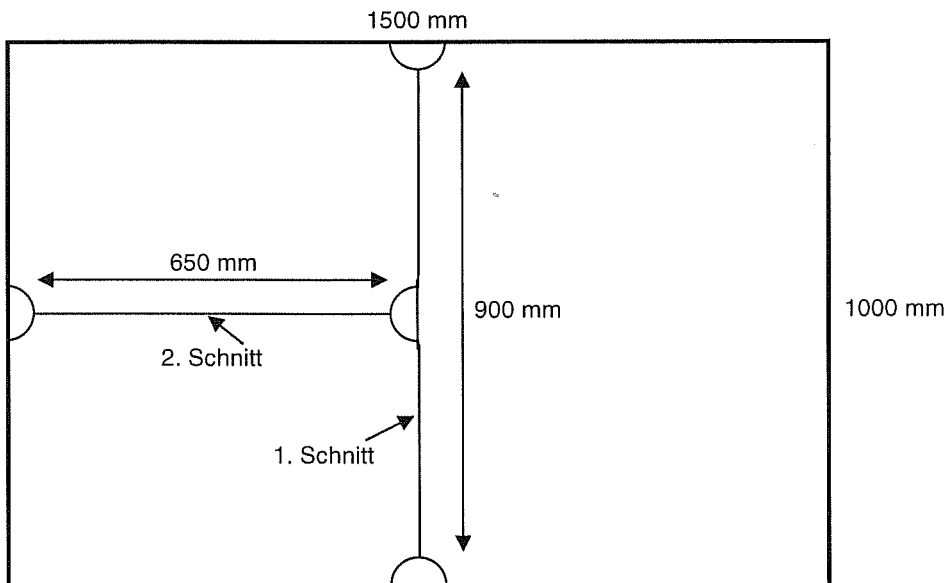
1. The pane has to be carved with a cutting wheel
2. After each carving the pane has to be broken
3. The fracture behavior has to be evaluated. The fracture line may only diverge from the carving line by an amount equal to the pane thickness. Edge areas of 50mm are not evaluated.

Schneidversuch: Format 1100 (Sehne) x 360 mm (Draufsicht u-Lage)

(Ansicht)



Schneidversuch: Format 1500 (Sehne) x 1000 mm (Draufsicht u-Lage)



Finiglas Veredelungs GmbH
Wierlings Hook 5
48249 Dülmen

Spannungsoptische Messungen
Schneidversuche

Anlage 2
zur allgemeinen
bauaufsichtlichen Zulassung
Z-70.4-146
für Bautechnik
vom 15. Februar 2010



Addendum to the General Construction Approval

15. Februar 2010

Deutsches Institut für Bautechnik
ANSTALT DES ÖFFENTLICHEN RECHTS

Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt

Mitglied der Europäischen Organisation für
Technische Zulassungen EOTA und der Europäischen Union
für das Agrément im Bauwesen UEAtc

Tel.: +49 30 78730-0
Fax: +49 30 78730-320
E-Mail: dibt@dibt.de

Datum: 12. Mai 2010 Geschäftszeichen:
I 39-1.70.4-13/10

Zulassungsnummer:

Z-70.4-146

Geltungsdauer bis:

15. Februar 2015

Antragsteller:

Finiglas Veredelungs GmbH
Wierlings Hook 5, 48249 Dülmen

Subject of approval:

**Thermally curved, linearly supported glazing panes „Fini Curve Float“ and
„Fini Curve VSG“**

This addendum is for the General Construction Approval Nr. Z-70.4-146 of February 15 2010. The addendum consists of two pages and two appendices and is only valid together with the aforementioned General Construction Approval.

Special requirements regarding II.

The special requirements of the General Construction Approval are ammended as follows:

The appendices are ammended by Appendix 1a and Appendix 1b.

Based on these appendices the thermally curved „Fini Curve Float“ may be produced with coatings and in different oven groups.

Dr.-Ing. Kathage

Pane thickness, bending radii, pane measurements

Oven group 1 Werk Dülmen	Floatglass with coating Emissionsgrad $0,25 \geq \epsilon > 0,10$
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
4	150	1900 x 3300
6	250	1900 x 3300
8	250	1900 x 3300
10	300	1900 x 3300
12	400	1900 x 3300

Oven group 2 Werk Dülmen	Floatglas
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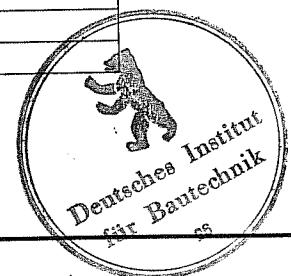
Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
3	100	2850 x 3850
4	100	2850 x 3850
5	150	2850 x 3850
6	200	2850 x 3850
8	250	2850 x 3850
10	300	2850 x 3850
12	400	2850 x 3850
15	600	2850 x 3850

Oven group 2 Werk Dülmen	Floatglass with coating Emissionsgrad $0,25 \geq \epsilon > 0,10$
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
4	150	2850 x 3850
6	250	2850 x 3850
8	250	2850 x 3850
10	300	2850 x 3850
12	400	2850 x 3850

Oven group 2 Werk Dülmen	Floatglass with coating Emissionsgrad $0,10 \geq \epsilon$
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
4	200	2850x 3850
6	300	2850x 3850
8	300	2850x 3850
10	400	2850x 3850
12	500	2850x 3850



Herstellwerke / Ofengruppen

Anlage 1a

Zur allgemeinen bauaufsichtlichen
Zulassung Nr. Z-70.4-146

vom 12. Mai 2010

Pane thickness, bending radii, pane measurements

Oven group 3 Werk Dülmen	Floatglas
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
3	100	3210 x 6000
4	100	3210 x 6000
5	150	3210 x 6000
6	200	3210 x 6000
8	250	3210 x 6000
10	300	3210 x 6000
12	400	3210 x 6000
15	600	3210 x 6000

Oven group 3 Werk Dülmen	Floatglass with coating Emissionsgrad $0,25 \geq \epsilon > 0,10$
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
4	150	3210 x 6000
6	250	3210 x 6000
8	250	3210 x 6000
10	300	3210 x 6000
12	400	3210 x 6000

Oven group 3 Werk Dülmen	Floatglass with coating Emissionsgrad $0,10 \geq \epsilon$
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Nominal thickness (mm)	Minimum radius (mm)	Maximum edge length (mm)
4	200	3210 x 6000
6	300	3210 x 6000
8	300	3210 x 6000
10	400	3210 x 6000
12	500	3210 x 6000

Herstellwerke / Ofengruppen

Anlage 1b

Zur allgemeinen bauaufsichtlichen
Zulassung Nr. Z-70.4-146

vom 12. Mai 2010

