

***Information and guidance notes on
DIN EN 1279:2018-10***

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Contents

1.0 Introduction	2
2.0 Basis	3
2.1 What has changed in DIN EN 1279:2018?	3
2.2. Expectations for the service life of insulating glass.....	4
2.3. Key terms in DIN EN 1279	4
2.4. Definition of insulating glass types A, B and C in accordance with DIN EN 1279	6
2.5. System description, type test and durability	7
2.6. Marking of insulating glass units	9
2.7. Simplified verification.....	10
2.7.1 Enterprises with multiple lines / multiple sites.....	10
2.7.2 Rules for the use of other party type test results	10
3.0 What to do if the system needs some modification?	11
3.1 What does “rules of substitution” mean?	11
3.2. Points to note when the spacer system needs to be substituted?	13
3.2.1 Range of systems – spacer categories in accordance with DIN EN 1279-1	13
3.2.2 Which spacer categories can be substituted?.....	14
3.3. Flow charts for the substitution of components	15
3.4. Examples of how to use the substitution rules.....	21
3.4.1 Examples for the substitution of spacer bar profiles (gas-filled IGU).....	21
3.4.2 Examples for the substitution of inner sealants (gas-filled IGU)	22
3.4.3 Examples for the substitution of outer sealants (gas-filled IGU).....	23
3.4.4 Examples for the substitution of desiccants (gas-filled IGU)	23
4.0 Literature	24

1. Introduction

The DIN EN 1279 standard, with its six parts, lays down the standard requirements which are relevant to the CE marking of insulating glass units [1 – 6]. The new version of this standard series was published in October 2018. Part 1 summarises and considerably expands on all the previous rules for possible changes within components and for additions to the system description when materials and components are substituted. This BF Information sheet is intended to explain the major changes in DIN EN 1279:2018-10 and particularly the substitution rules, as well as, e.g. provide guidance for insulating glass and component manufacturers on how to deal with this.

This BF Information sheet contains only excerpts from DIN EN 1279:2018-10. The original standard text always applies. Changes to the parts of DIN EN 1279 were taken into account up to and including 2021.

2. Basis

2.1 What has changed in DIN EN 1279:2018?

Standard part	Changes in comparison with the previous edition (excerpt)
DIN EN 1279-1:2018-10 Generalities, system description, rules for substitution, tolerances and visual quality	<ul style="list-style-type: none"> - Example for system descriptions was added - Annex B: Examples of IGU systems (previously in Part 6) - Annex C: Compatibility of components was added - Annex D: Rules to substitute materials and components were revised and combined in this part - Anhang F: Annex F: Visual quality requirements were added
DIN EN 1279-2:2018-10 Long term test method and requirements for moisture penetration	Measurement of the dew point was removed (moved to part 6), storage duration before and after testing was reduced, various tolerances and specifications were adjusted, various Annexes with test descriptions were moved to part 4, addition of a full test specimen description
DIN EN 1279-3:2018-10 Long term test method and requirements for gas leakage rate and for gas concentration tolerances	Requirements for gas leakage rate have been changed, test method is also applicable to triple insulating glass, addition of a full test specimen description, various adjustments and updates
DIN EN 1279-4:2018-10 Methods of test for the physical attributes of edge seal components and inserts	<ul style="list-style-type: none"> - For sealants physicochemical characterization has been added and requirements were changed - For desiccants in bulk physicochemical characterization, test methods and requirements have been added - For polymeric matrices incorporating desiccant and inserts requirements have been added - Annex C: Fogging test was transferred (from Part 6, Annex C), now at 60 °C instead of previously 55 °C - Annex E: Measurement of bulk desiccant moisture content (previously in part 2, Annex B), now at 540 °C instead of previously 950 °C and measurement of T_c (previously in Part 2, Annex D) - Annex F: Measurement Karl Fischer method (previously in part 2, Annex C) and measurement of T_c (previously in part 2, Annex D) - Annex H: Volatile content test (previously in part 6, Annex G)
DIN EN 1279-5:2018-10 Product standard	Requirements for insulating glass units specified for use in SSG systems, further additions and adjustments to the EU Construction Products Regulation (CPR)
DIN EN 1279-6:2021-05 Factory production control and periodic tests	<ul style="list-style-type: none"> - Annex B: Tables were restructured and new systems added - Annex K: Dew point measurements added (previously in part 2) - Previous Annexes partially moved to other standard parts.

Table 1: Changes in the 6 parts of DIN EN 1279:2018 in comparison with the respective previous edition

Information and guidance notes on DIN EN 1279:2018-10

2.2 Expectations for the service life of insulating glass

The foreword of DIN EN 1279-1 states: "This standard is written on the assumption of a 25 year period of use for IGUs."

The service life (period of use) of an insulating glass unit is determined by two factors during the manufacture of the pane: the quality of the components used and the quality of workmanship. It is therefore per-

fectly reasonable and advisable to carefully check all components which have a major impact on the durability and thus the service life. This is also provided for in the standard but does not yet cover all component types.

2.3 Key terms in DIN EN 1279

Terms and definitions	Found in	Definition
Insulating glass unit (IGU)	DIN EN 1279-1, 3.1	Assembly consisting of at least two panes of glass, separated by one or more spacers, hermetically sealed along the periphery, mechanically stable and durable
Gas-filled IGU	DIN EN 1279-1, 3.51	Insulating glass unit in which the cavity is filled with gas(es) usually for improving thermal insulation
Structural glazing	DIN EN 1279-1, 3.2	Assembly in which glass products are fixed to the structural seal frame by means of a sealant that has been demonstrated to be capable of withstanding the load actions applied to the glass products of the structural seal frame (former designation: "Structural sealant glazing")
System	DIN EN 1279-1, 3.3	Range of insulating glass units with a common edge seal design, edge seal materials and edge seal components as described in the system description, the range having a similar edge seal performance Note 1 to entry: Examples of edge seal performances are moisture penetration index, gas leakage rate.
System description	DIN EN 1279-1, 3.4 as well as Annex A (normative)	Description of components and the edge seal of the insulating glass unit in terms relevant to identification, and in terms relevant to edge seal performance, e.g. moisture penetration index, gas loss rate.
Cavity	DIN EN 1279-1, 3.7	Gap between the panes of an insulating glass unit
Edge seal	DIN EN 1279-1, 3.10	Assembled edge of an insulating glass unit, designed to ensure that water vapour and gas transmissions between the inside and outside of the unit are limited, with a certain mechanical strength, and with a certain physical and chemical stability
Single seal system	DIN EN 1279-1, 3.14	Edge seal system made of one single sealant
Double/dual seal system	DIN EN 1279-1, 3.13	Edge seal system made of at least an inner (primary) sealant placed towards the cavity of the insulating glass unit and an outer (secondary) sealant in contact with the environment outside the insulating glass unit
Sealant	DIN EN 1279-1, 3.11	Polymer material that, after application, has sufficient mechanical and physical properties of cohesion and of adhesion to glass and/or spacer for use in edge seals
Desiccant	DIN EN 1279-1, 3.9	Component added to the system to absorb or adsorb immersing water vapour in the cavity over time

Terms and definitions	Found in	Definition
Spacer	DIN EN 1279-1, 3.15	Component used to separate the panes and control the width of the cavity at the edge of the insulating glass unit (classification of spacers, see Figure 4 in following Section 3.2.1)
Hollow spacer	DIN EN 1279-1, 3.16	Spacer intended to be filled with desiccant
Rigid spacer frame	DIN EN 1279-1, 3.17	Set of hollow spacers, that provide enough rigidity to be preassembled prior to application and applied against one pane of the insulating glass unit before the assembly Note 1 to entry: examples of rigid spacer frames are frames bent with joint piece or connected with corner keys, or a welded frame
Hollow metallic spacer	DIN EN 1279-1, 3.18	Hollow spacer, painted or not, where at least 1/4 of the inner sealant adhesion height r (see Figure 3 and in following Section 2.5) and all of the contact surface with outer sealant must be metallic adhesion surface
Joint piece	DIN EN 1279-1, 3.19	Piece that connects parts of a spacer
Corner key	DIN EN 1279-1, 3.20	Joint piece that acts as a corner of the spacer frame
Hot applied flexible spacer	DIN EN 1279-1, 3.21	Polymer-based spacer which is applied at elevated temperature
Prefabricated flexible spacer	DIN EN 1279-1, 3.22	Polymer based flexible spacer which is supplied as a profile to the insulating glass unit manufacturer
Adhesion surface	DIN EN 1279-1, 3.23	Contact surface between spacer and one or both sealant(s)
Metallic adhesion surface	DIN EN 1279-1, 3.24	Spacer adhesion surface made of rolled or extruded aluminium, galvanised steel, stainless steel, without organic surface treatment Note 1 to entry: organic surface treatments are painting, organic coating, organic film, or organic overspray
Edge deletion (stripping)	DIN EN 1279-1, 3.30	Process to remove the coating at the edge of a coated glass, which is intended to be the adhesion surface of the sealant(s)
Water vapour transmission rate WVTR ($\text{g} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$)	DIN EN 1279-1, 3.43	WVTR (en: water vapour transmission rate). Quantity of water vapour steadily transmitted through a 2 mm sealant film at specified conditions of temperature and water vapour concentration
Gas permeation rate GPR ($\text{g} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$)	DIN EN 1279-1, 3.44	GPR (en: gas permeation rate). Quantity of gas, steadily transmitted through a 2 mm sealant film at specified conditions of temperature and gas concentration
Moisture penetration index I (%)	DIN EN 1279-1, 3.48	Amount of available moisture adsorption capacity consumed under specified conditions
Available water adsorption capacity AWAC (%)	DIN EN 1279-1, 3.49	AWAC (en: available water adsorption capacity). Quantitative determination of the capacity of a desiccant to adsorb water under specified conditions
Essential characteristic	DIN EN 1279-5, 3.3	Characteristic of the construction product which relates to the basic requirements for construction works. Note 1 to entry: Basic requirements for construction work are given in the Regulation (EU) No 305/2011, Annex I.

Table 2: Key terms in DIN EN 1279

Information and guidance notes on DIN EN 1279:2018-10

2.4 Definition of insulating glass types A, B and C in accordance with DIN EN 1279

Since the October 2018 revision, DIN EN 1279-1 distinguishes three types of insulating glass unit (IGU, see also Figure 1).

IGU Type A

Insulating glass unit, when used for installation without permanent shear load in the sealant and protected against direct UV exposure on edge seal (DIN EN 1279-1, Clause 3.1.1)

IGU Type B

Insulating glass unit, when used for installation with at least one edge not completely protected against direct UV radiation without permanent shear load in the sealant (DIN EN 1279-1, Clause 3.1.2)

IGU Type C

Insulating glass unit, when used for installation as bonded glazing for doors, windows and curtain walling with possible permanent shear load on edge seal with or without direct UV radiation exposure (DIN EN 1279-1, Clause 3.1.3)

Note 1: Permanent shear load can be avoided by using sill bars as mechanical support.

Note 2: For IGU type B and C additional requirements in accordance with EN 15434 and EN 13022-1 may apply.

Most of the specifications of DIN EN 1279 apply equally to all three IGU types. As types B and C are subjected to additional loads compared to type A, further requirements apply (see Section 2.5 below).

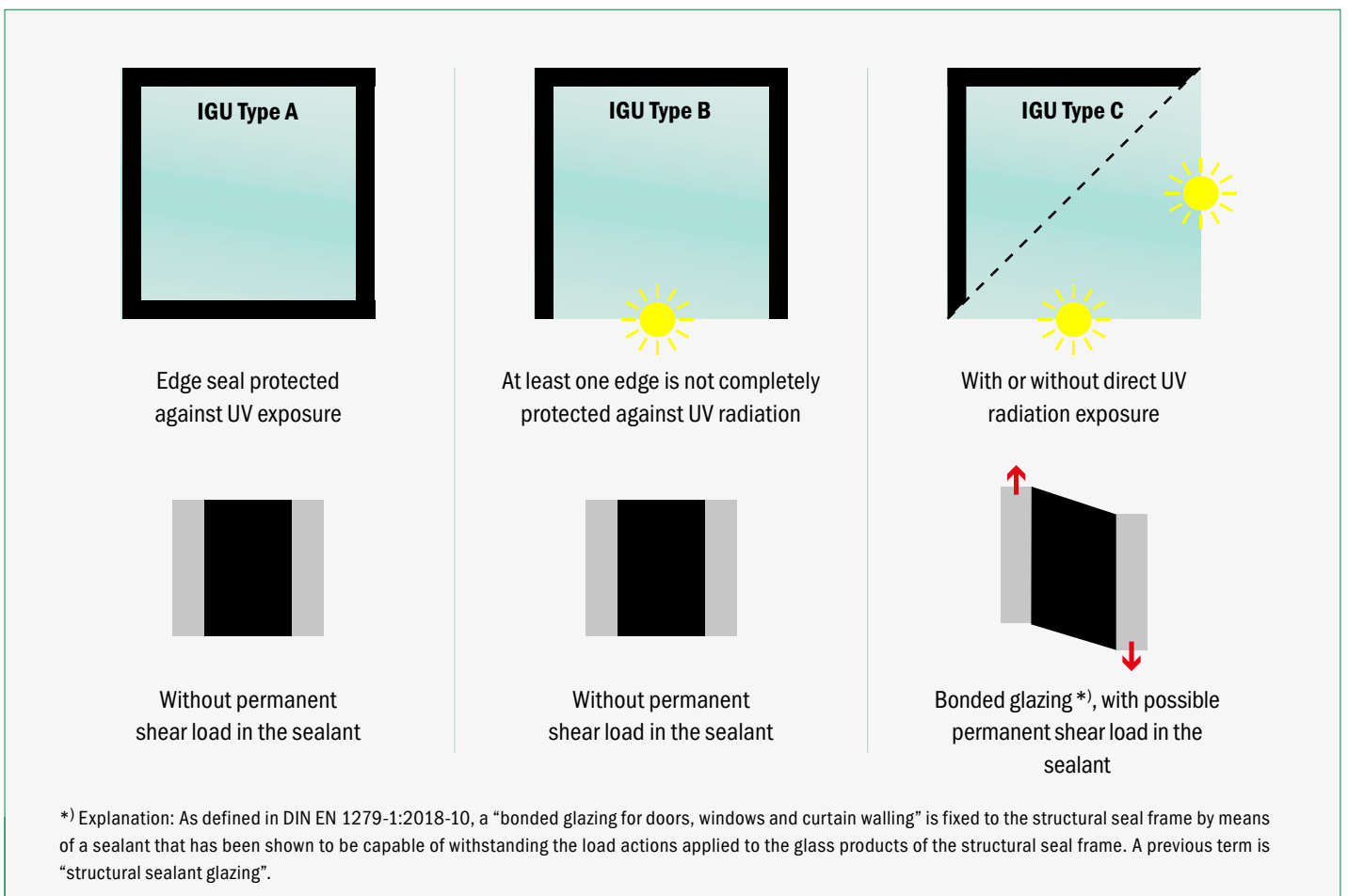


Figure 1: Definition of IGU types in accordance with DIN EN 1279. Source: [10]

2.5 System description, type test and durability

As part of factory production control documentation, an insulating glass manufacturer must describe his system in a SYSTEM DESCRIPTION. The normative Annex A of DIN EN 1279-1 sets out the minimum contents of the system description.

In this document the insulating glass manufacturer details his insulating glass system including the configuration and tolerances of the edge seal and lists the components used by him. The component description must include a drawing of a cross section of the edge seal of the insulating glass unit to scale (see Figures 2 and 3). The components must be listed by name with manufacturer and product designation in line with the drawing. With the system description, the insulating glass manufacturer commits to the use of specific materials from defined manufacturers or suppliers. The system description may contain more than one insulating glass system.

The insulating glass manufacturer assembles the components for the manufacture of insulating glass units. By drawing up the declaration of performance and the CE marking, the manufacturer must assume responsibility for the conformity of the construction product with the declared performance characteristics. For verification of durability, the insulating glass manufacturer requires a TYPE TEST (TT) for each product type described by him. This type test confirms the conformity of the product with DIN EN 1279.

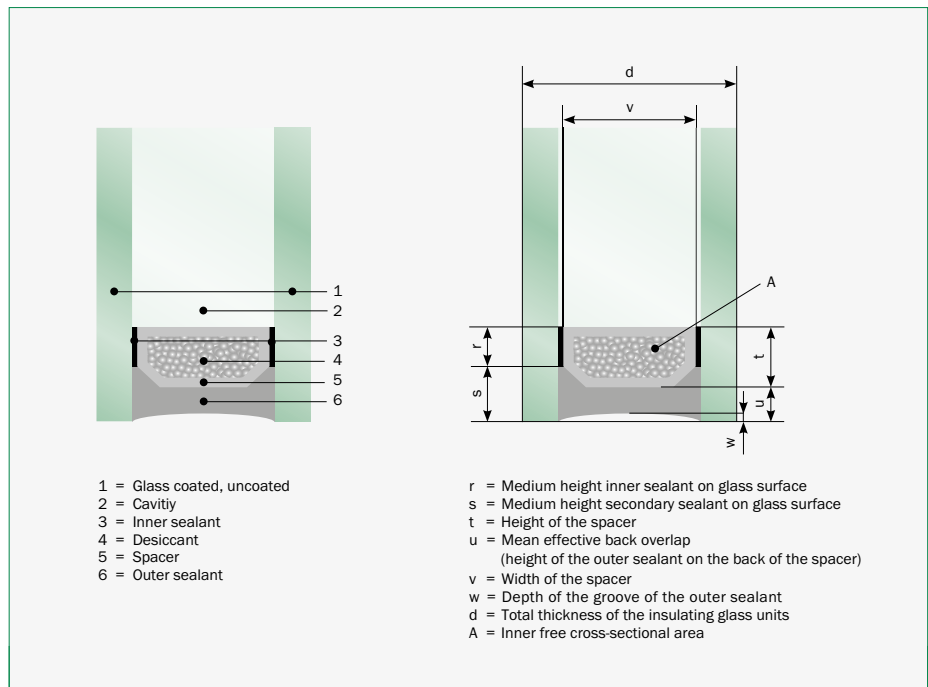


Figure 2 (left) and Figure 3 (right): Schematic illustration of organic sealed insulating glass unit with hollow spacer. The numbering in Figure 2 refers to the components of the insulating glass unit to be specified in the system description. The letters in Figure 3 refer to the geometric data which must be provided with tolerances. Source: [11]

DIN EN 1279-5 specifies the details for type testing. Clause 4 details all requirements and mandatory tests for verification of the declared “essential characteristics”, such as fire safety, security, sound insulation, thermal insulation.

The requirements for the “essential characteristics” of DURABILITY are defined in Clause 4.2.2.15. This states: “Products shall conform to the definition, to the manufacturer’s system description and fulfil the requirements of insulating glass units as defined in EN 1279-1:2018. Type testing applies to the product aspects listed in Tables 2 and 3.”

For verification of the system durability, Table 2 of DIN EN 1279-5 requires tests in accordance with DIN EN 1279 Parts 2 and 3 for moisture penetration or gas leakage rate/gas concentration. Table 3 of DIN EN 1279-5 defines additional requirements for the performance of sealants and desiccants. It refers to various Annexes of DIN EN 1279-4 and other standards, which describe the mandatory component tests in detail.

Note: Assessments based on the previous versions of DIN EN 1279-2 and -3 remain valid in accordance with DIN EN 1279-5, Clause 5.2.1. Other party type test results can be used in accordance with the rules of Annex D (normative) of DIN EN 1279-5 – see following Section 2.7.2.

Information and guidance notes on DIN EN 1279:2018-10

The following table summarises the evidence required for type testing of the durability performance characteristic of insulating glass units specified in Tables 2 and 3 of DIN EN 1279-5:

	IGU Type A	IGU Type B	IGU Type C
Seal performance			
Moisture penetration	DIN EN 1279-2:2018 Long term test methods and requirements for moisture penetration		
Gas leakage rate and gas concentration	DIN EN 1279-3:2018 Long term test methods and requirements for gas leakage rate and for gas concentration tolerances		
Edge seal performance			
Adhesion sealant / glass	DIN EN 1279-4:2018, Annex A Adhesion test for outer sealants and metal edge seals	DIN EN 1279-4:2018, Annex A (see Type A) DIN EN 15434:2010, Annex D Outer seal of insulating glass category differentiation ¹⁾	DIN EN 1279-4:2018, Annex A (see Type A) DIN EN 15434:2010, Clause 5.4 Environmental influences ²⁾
Adhesion: - Sealant / coating - Layers of coating	DIN EN 1279-4:2018, Annex B Adhesion on coatings and interlayer adhesion of coatings	DIN EN 13022-1:2014, Clause 5.2.3 Coated glass ³⁾	DIN EN 13022-1:2014, Clause 5.2.3 Coated glass ³⁾
Permanent shear load			DIN EN 13022-1:2014, Clause 6.3.2 Calculation of the height of the outer seal to bear the permanent shear loading ⁴⁾
Desiccant: - T _C -value - Gas desorption	DIN EN 1279-4:2018, Annexes E, F or G DIN EN 1279-4:2018, 6.3.2, Annex E		
Table 3: Overview of the mandatory verification for type testing of insulating glass units based on Tables 2 and 3 of DIN EN 1279-5:2018. Source: [10]			

¹⁾ DIN EN 15434:2010 is the product standard for structural and/or ultra-violet resistant sealants used for the manufacture of insulating glass units with UV resistant edge seal or edge seal with reduced UV exposure or for the industrial production of elements for bonded glazing or for the installation/insertion of glass products with requirements for UV resistance. Annex D describes, e.g. the UV resistance test for outer seals without load transfer for insulating glass units, and the subdivision of Type B into three subcategories with high, medium and low UV exposure in accordance with EN 1279-1.

²⁾ Clause 5.4 of DIN EN 15434:2010 describes tests to determine the cohesion/adhesion properties of structural sealants after exposure to artificial light through glass and to water. It also specifies tests for additional exposure conditions such as salt spray, an SO₂ atmosphere, façade cleaning agents and high temperature.

³⁾ DIN EN 13022-1:2014 sets out the requirements for the suitability for use of glass products for use in Structural Sealant Glazing (SSG) systems. This applies to monolithic and multiple glazing. For IGU, a distinction is made for installation situations with and without structural function in the outer seal (secondary sealant) of the IGU. Clause 5.2.3 addresses the suitability of IGU with coated panes for use in SSG systems exposed to UV radiation. The tests of DIN EN 1279-4 are described in greater detail or in modified form.

⁴⁾ Clause 6.3.2 of DIN EN 13022-1:2014 covers the height of the outer seal of the unsupported IGU edge seal for the mechanical weight support required for bearing the permanent shear loading. Here the height of the outer seal as seen from the outside is measured parallel to the glass surface.

2.6 Marking of insulating glass units

Insulating glass units are usually permanently and visibly marked on the spacer frame located in the cavity. Here a distinc-

tion must be made between the requirements set out in the product standard DIN EN 1279-5:2018 and voluntary information (see following Table 4).

	IGU Type A	IGU Type B	IGU Type C
Mandatory marking and/or labelling in accordance with DIN EN 1279-5, Clause 6	No requirement	Must be marked on the spacer, on the product label or on accompanying documentation (choice of the manufacturer) with Type B or “B”	Must be marked on the spacer, on the product label or on accompanying documentation (choice of the manufacturer) with Type C or “C”
Voluntary marking	Voluntary marking must be in conformity with DIN EN 1279-5, Annex E, Clause E.3, i.e., it should not be confused with marks and/or labels that are required for regulatory purposes. If necessary, the format of the label and where it is affixed are to be agreed between the manufacturer and the independent body involved.		
RAL Quality and inspection regulations for insulating glass units	Minimum marking: Producer or GGF number of the production site, date, order identification or similar (reference to the product). Permanently visible marking with “IGU RAL-GZ 520”	See Type A. In addition, the rules of DIN EN 1279-5, Clause 6 must be observed	See Type A. In addition, the rules of DIN EN 1279-5, Clause 6 must be observed

Table 4: Overview of mandatory and voluntary marking of insulating glass units depending on IGU type. Source: [10]

Information and guidance notes on DIN EN 1279:2018-10

2.7 Simplified verification

2.7.1 Enterprises with multiple lines / multiple sites

If a manufacturer has one and/or more lines and/or sites, the number of mandatory type tests can be reduced as set out in DIN EN 1279-5, Clause 5.2.4. Multiple type testing is unnecessary if:

- the manufacturers' technical documentation for a product specifically covers all sites and/or lines,
- the manufacturer establishes a direct relationship between production control, type testing and on-going internal audit testing and if

- the manufacturer designates a responsible individual to ensure product compliance based on:
 - The operation of a consistent factory production control system on all applicable sites and/or lines
 - The manufacturer having obtained evidence that shows the product to be consistent, with respect to both product characteristics and intended use characteristics,
 - The manufacturer has in place an internal auditing scheme, including product consistency (evidence of conformity)

2.7.2 Rules for the use of other party type test results

Type tests can also be transferred by other parties, e.g., by marketing organisations or associations (glass groups/licence groups) to the manufacturing companies. This transferability of test reports is regulated in DIN EN 1279-5, Annex D (normative). This includes specific requirements for both the manufacturer who supplies the other party type test results and the manufacturer who wishes to use the other party type test results. An appropriate agreement must be concluded by the parties (licence, contract, or any other type of written agreement).

For type tests in accordance with DIN EN 1279-2 and -3, the test specimens must have been produced by the manufacturers themselves or, for shared or group solutions, by a group member. In addition, the insulating glass manufacturer who wishes to use the other party type test results, must observe the rules for the substitution of components and the subsequent tests set out in DIN EN 1279-1, Annex D.

The manufacturer supplying the other party type test results must undertake, via specific agreement, to provide the following:	The manufacturer using the other party type test results must, subject to the specific agreement, undertake the following:
A system description that details the IGU	The manufacturer manufactures the IGU according to the given system description, using the components and constituents specified therein and according to the given factory production control procedure.
Details of the “essential characteristics” to be met by the IGU.	The manufacturer claims for his IGU only the “essential characteristics” as per the agreement.
Test reports from notified bodies on type testing in accordance with DIN EN 1279-2:2018 and DIN EN 1279-3:2018 if required for an IGU that is representative of the system description.	The manufacturer prepares his own declaration of performance and is responsible for any problem with the product.
Test reports by a notified body in accordance with DIN EN 1279-4: 2018 for the components of the system description.	The manufacturer must keep a copy of the type test report which complies with the detailed requirements and which contains the information ²⁾ needed for verifying that the IGU is manufactured according to the agreement (evidence of the results, joint retention of all test reports made available to the relevant bodies).
Fully documented factory production control system in accordance with EN 1279-6:2018 specific to the system description and directly related to the production facility that is being operated.	
Details of all components and constituents necessary to produce an IGU to the system description.	
The manufacturer supplying the type test results must verify ¹⁾ , that the user meets all the requirements set out in DIN EN 1279-5, Annex D, Clause D.3 (= right column of this table).	The manufacturer must conduct periodic testing in accordance with DIN EN 1279-6:2018 Annex B.

Table 5: Rules for the use of other party type test results in accordance with DIN EN 1279-5 Annex D

- ¹⁾ This means: If, in the case of a glass group/licence group, this assurance task is performed by a higher quality assurance body of the group or by an external testing and monitoring body (e.g. RAL quality mark for insulating glass units), and if all the rules for using the other party type test results are complied with, then the simplification for type testing applies here in the same way as for companies with multiple lines / multiple sites.
- ²⁾ The test report must at least include the following information: manufacturer and manufacturing plant, identification of the construction product in accordance with DIN EN 1279, information about: sampling, date of testing, involved personnel, applied testing methods according to DIN EN 1279, identification of the organisation and personnel executing the test, place and date, the results of the test, including analysis of these, place and date of the issuance of the test report, registration number of the Notified Body or laboratory, signature of the head of the testing laboratory and stamp. The test report must comply with the relevant clauses of DIN EN 1279.

3. What to do if the system needs some modification?

As set out in the normative Annex D of DIN EN 1279-1, the technical documentation, which includes, among others, the system description and the factory production control (FPC) must be updated whenever a substitution or change is undertaken. Substitution of materials and components must be in accordance with Tables D.1 to D.7.

What is not mentioned in these substitution rules is not allowed and a new type test (TT) is required. (DIN EN 1279-1, Annex D, Clause D.1)

3.1 What does “rules of substitution” mean?

Tables D.1 to D.7 define the validation methods and requirements regarding which components may be substituted under which conditions.

In some cases supplier type tests or other party type tests can be used for substitution, sometimes a short climatic test or compliance with specific boundary conditions are sufficient.

Type test reports to be used for the substitution of components must always contain the relevant technical information such as detailed information on the edge seal design and dimensions so that compliance with the requirements of the tables can be verified.

Information and guidance notes on DIN EN 1279:2018-10

Tab. No.	Validation methods and requirements for ...	Applicability	Requirements (the precise evaluation is based on the detailed requirements of Tables D.1 to D.7 of DIN EN 1279-1).
D.1	Substitution of outer sealant	Applies to retention of the same rigid spacer frame, if this spacer system is allowed for substitution according to Table D.4 or for retaining the same glass coating when this is without edge stripping.	Type test report according to DIN EN 1279-2 and -3 from the supplier or another party, with requirements for the edge seal geometry, the I-index and water vapour transmission rate (WVTR) and gas permeation rate (GPR) of the substitute sealant; requirements for the stress-strain profile of the substitute sealant to compare the edge seal strength in accordance with DIN EN 1279-1 Annex E (and, adhesion to coatings in accordance with DIN EN 1279-4:2018 Annex B if applicable).
D.2	Substitution of inner sealant	Applies to retention of the same rigid spacer frame with metallic adhesion surface, if this spacer system is allowed for substitution according to Table D.4.	Type test report according to DIN EN 1279-2 and -3 from the supplier or another party, with requirements for the edge seal geometry, water vapour transmission rate (WVTR) and gas permeation rate (GPR) of the substitute inner sealant and tests to DIN EN 1279-6.
D.3	Substitution of single sealant	Applies to retention of the same rigid spacer frame if this spacer system is allowed for substitution according to Table D.4.	Type test report according to DIN EN 1279-2, -3 and -4 from the supplier or another party, with requirements for the edge seal geometry, water vapour transmission rate (WVTR) and gas permeation rate (GPR) of the single sealant and tests to DIN EN 1279-6.
D.4	Substitution of rigid spacer frame and accessories Applies only to rigid spacer frames with metallic adhesion surface!	a) Substitution of spacer by other rigid spacer frame with metallic adhesion surface, with retention of corner design.	Type test report according to DIN EN 1279-2 and -3 from the supplier or another party, with requirements for the edge seal geometry, I-index and tests to DIN EN 1279-6 D.3.2 Butterfly test.
		b) Retention of spacer, but corner design changed from previously inserted to bent or welded.	Short climatic test in accordance with DIN EN 1279-6 B.4
		c) Retention of spacer, but corner design changed from previously bent or welded to inserted.	Type test report according to DIN EN 1279-2 and -3 from the supplier or another party, with requirements for the edge seal geometry, I-index and available desiccant volume.
		d) Retention of spacer, but substitution of corner key or joint piece.	Short climatic test and gas concentration according to DIN EN 1279-6 Annex B.4, if required
		e) Retention of spacer, but substitution of gas filling holes closing material.	Short climatic test and gas concentration according to DIN EN 1279-6 Annex B.4, if required
D.5	Substitution of glass	Applies to coated glass with and without edge stripping as well as acid-etched and enamelled glass surfaces.	Requirements only for coated glass without edge stripping. Substitution for acid-etched surfaces only permitted for double/dual edge seal with inner sealant.
D.6	Substitution of desiccant	All desiccants	Test report according to DIN EN 1279-4 with AWAC $\geq 16\%$, type test report according to DIN EN 1279-2 from the supplier or another party, if necessary recalculation of I-index with available spacer volume.
D.7	Substitution of gas	Substitution of argon by krypton or argon-krypton mixture	Allowed, Calculation of U-value according to DIN EN 1279-5, Annex B.

Table 6: Overview of Tables D.1 to D.7 with rules for substitution of materials and components according to DIN EN 1279-1, Annex D

3.2. Points to note when the spacer system needs to be substituted?

3.2.1 Range of systems – spacer categories in accordance with DIN EN 1279-1

Insulating glass manufacturers can choose from a large number and wide variety of

spacer products. The reason for this is the objective of continuously improving the thermal insulation in the edge area of insulating glass units, and therefore of window and façade systems using thermally improved spacers. In contrast to aluminium spacers, where a uniform, man-

ufacturer-independent geometry was established after forty years of co-evolution with processing machines, a system consolidation of this kind has not yet occurred for the warm edge. There is a large range, particularly in terms of processing technology.

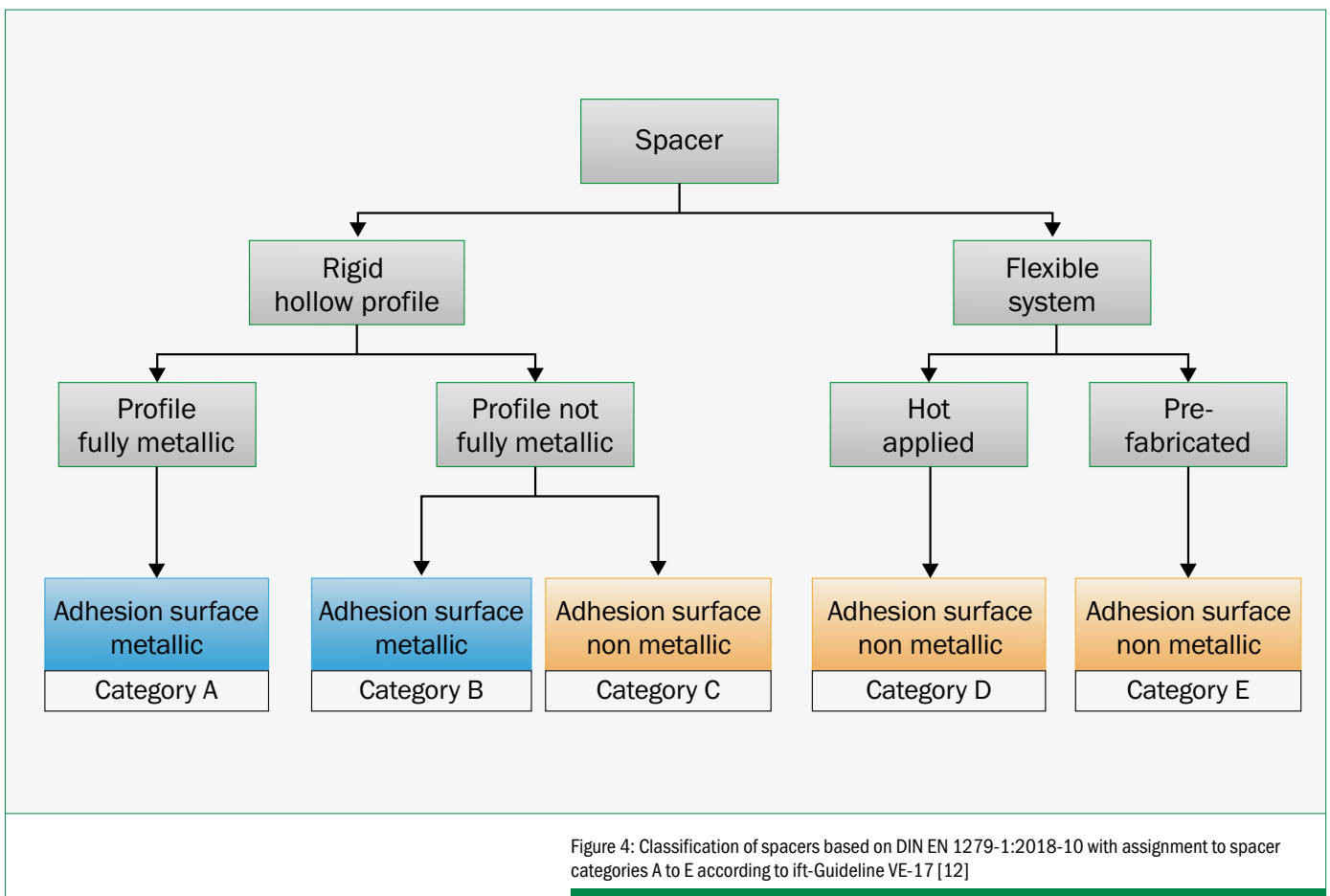


Figure 4: Classification of spacers based on DIN EN 1279-1:2018-10 with assignment to spacer categories A to E according to ift-Guideline VE-17 [12]

Information and guidance notes on DIN EN 1279:2018-10

Rigid hollow profiles are prefabricated into desiccant filled, butylated spacer frames. Here it is of importance whether the profile is made of solid metal, e.g. aluminium, steel or stainless steel (category A), or is a hybrid solution made of plastic with a separate diffusion barrier (categories B or C). As the adhesion surface for the inner and outer sealants, this diffusion barrier is crucial for the durability of the overall IGU system.

All the early hybrid profiles for warm edges featured a **metallic diffusion barrier** (category B). A precise definition of “metallic adhesion surface” is given in DIN EN 1279-1, Clause 3.24 (see Table 2). The solutions which have been successful on the market include diffusion barriers in the form of stainless steel strips of 0.09 to 0.1 mm thickness. This is not only a well-known and suitable bonding base for outer sealants: at these thicknesses the metal also reduces the thermal elongation of the profile base and stabilises the overall structure.

For a number of years, also **multi-layer laminated films** have also been used as diffusion barriers in hollow profiles, with the aim of preventing the passage of water vapour or inert gas by sputtered metal or SiO_x layers. As these film structures do not contribute to profile rigidity and cannot prevent thermal elongation of the plastic base, the plastic material used for these profile

designs must be reinforced with a substantial amount of glass fibre. Laminated films as defined above in DIN EN 1279-1, are therefore very clearly non-metallic adhesion surfaces (category C).

With the **flexible systems**, a spacer is applied to the panes directly at the line using automatic applicators. This is achieved either as in thermoplastic systems (TPS) by coextruding a hot mass from a drum to the glass edge (category D), or premanufactured foamed profiles are unwound from a roll and applied along the glass edge (category E).

3.2.2 Which spacer categories can be substituted?

It is a largely unknown fact that the previous version of DIN EN 1279 only allowed the substitution of purely inorganic, i.e. solid metallic spacers (category A). When this original standard version of DIN EN 1279-1 was developed and published in 2004, plastic spacers with metallic adhesion surface (category B) were almost unknown and rarely used in practice. Hollow profiles with laminated films (category C) had yet not appeared on the market. Nowadays, hybrid profiles with metallic adhesion surfaces (category B) have a long term track record of positive experience. The new standard version DIN EN 1279-1:2018-10 therefore allows substitution in accordance with the rules detailed in Annex D, using the test reports from the sup-

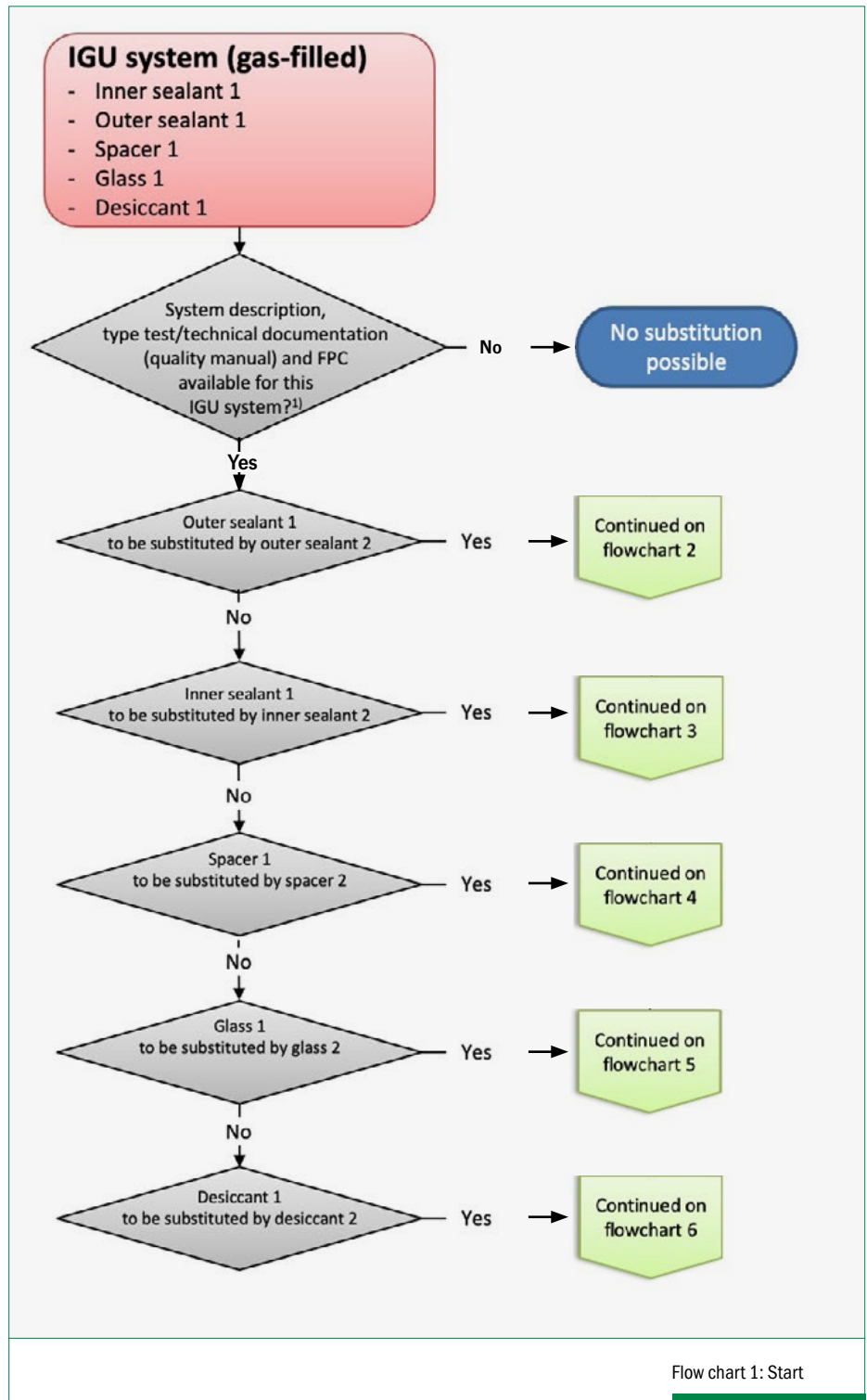
plier or another party, if necessary. However, spacer profiles with laminated films (category C) are relatively new – so new that they have not been included in the revision of DIN EN 1279. Currently, only rigid spacer frames with a metallic adhesion surface (categories A or B) can be substituted in accordance with DIN EN 1279-1:2018-10, Annex D, Table D.4. Spacer categories D and E, where the quality of the insulating glass units is highly dependent on the suitability of the line with automatic application device systems, have always required type testing of the individual lines.

Category C rigid hollow profile spacers as well as flexible spacer systems (categories D and E) cannot be substituted according to the rules of Annex D of DIN EN 1279-1:2018! Neither is the substitution of inner, outer and single sealants allowed for these spacer categories according to the notes in Tables D.1, D.2 and D.3.

Note: In some cases, expert's reports are provided for category C spacers with the objective of avoiding type testing for each individual production site. Different laboratory tests are used to show that the relevant spacer system performs in the same way as spacers with metallic adhesion surfaces and therefore the testing body is of the opinion that application of the substitution rules set out in Table D.4 is justified. This approach is not covered by the standard.

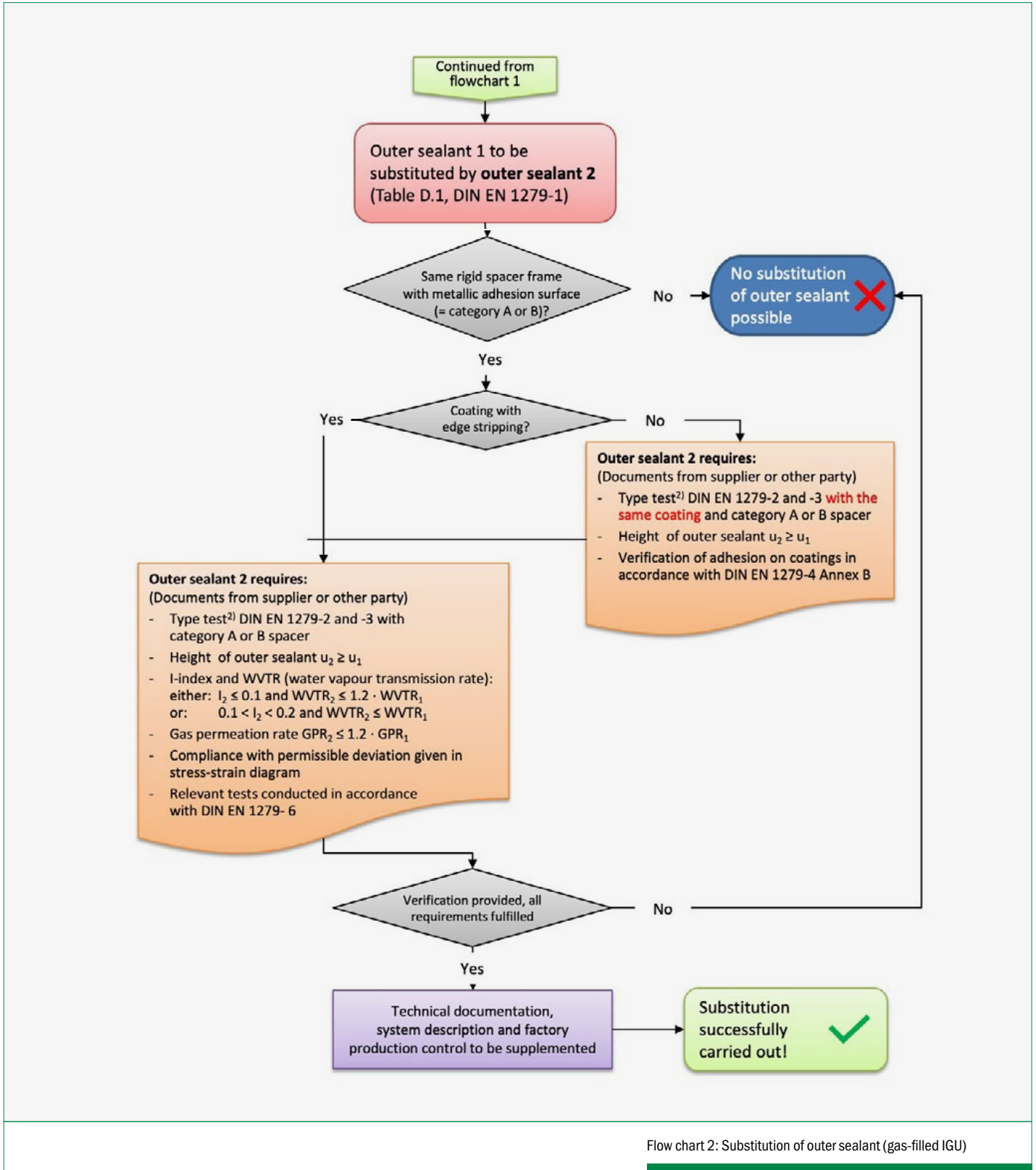
3.3. Flow charts for the substitution of components

In the following illustrations, the validation methods and requirements of Tables D.1 (outer sealant), D.2 (inner sealant), D.4 (spacers), D.5 (glass) and D.6 (desiccants) from Annex D of DIN EN 1279-1 for the substitution of these edge seal components were transferred to the flow charts. For the substitution of a single sealant (Table D.3 of DIN EN 1279-1) and the substitution of gas (Table D.7 of DIN EN 1279-1), please refer to the requirements in the standard.



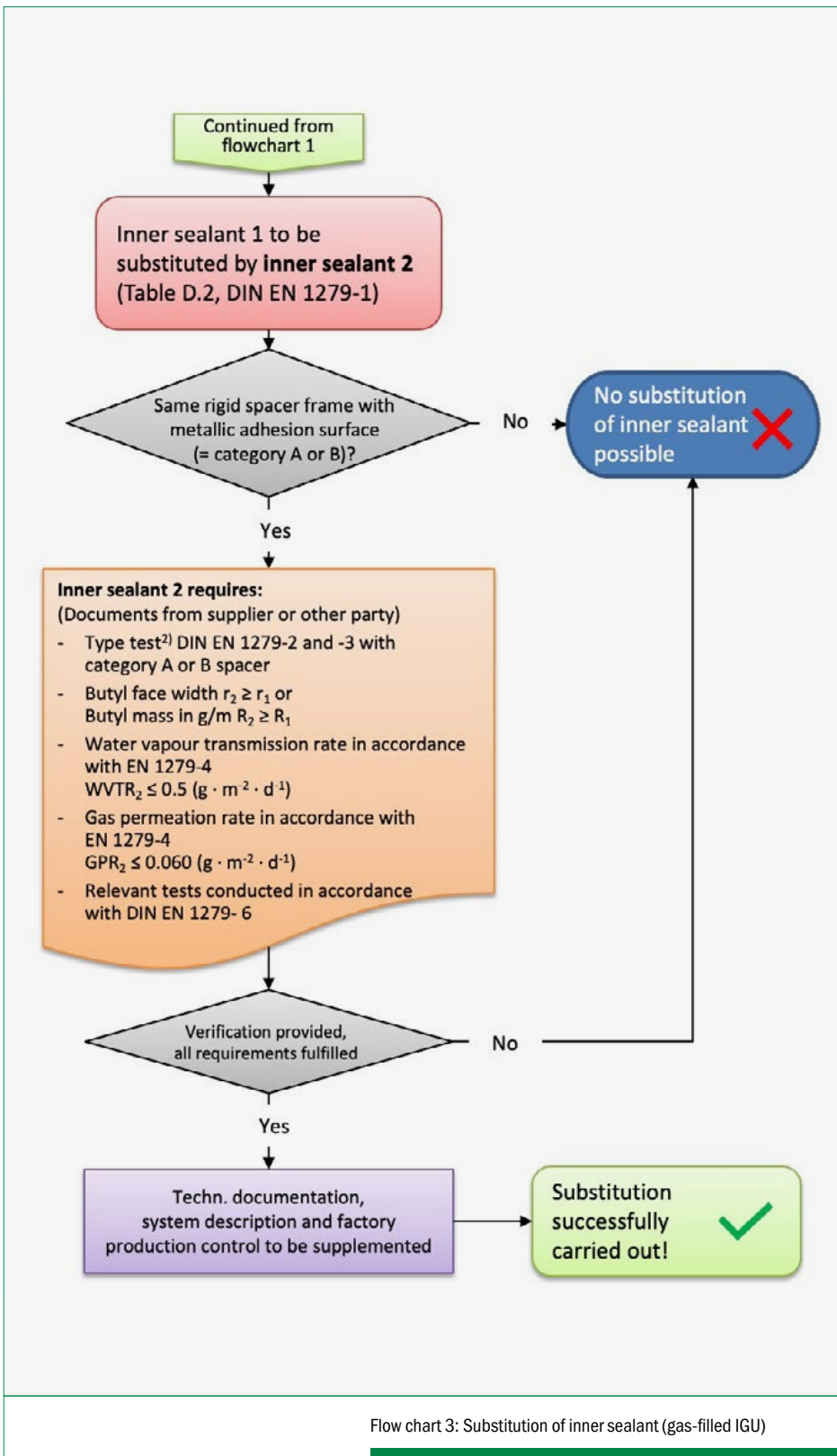
¹⁾ The system description, quality manual and factory production control (FPC) must be updated whenever a substitution or change is undertaken.

Information and guidance notes on DIN EN 1279:2018-10



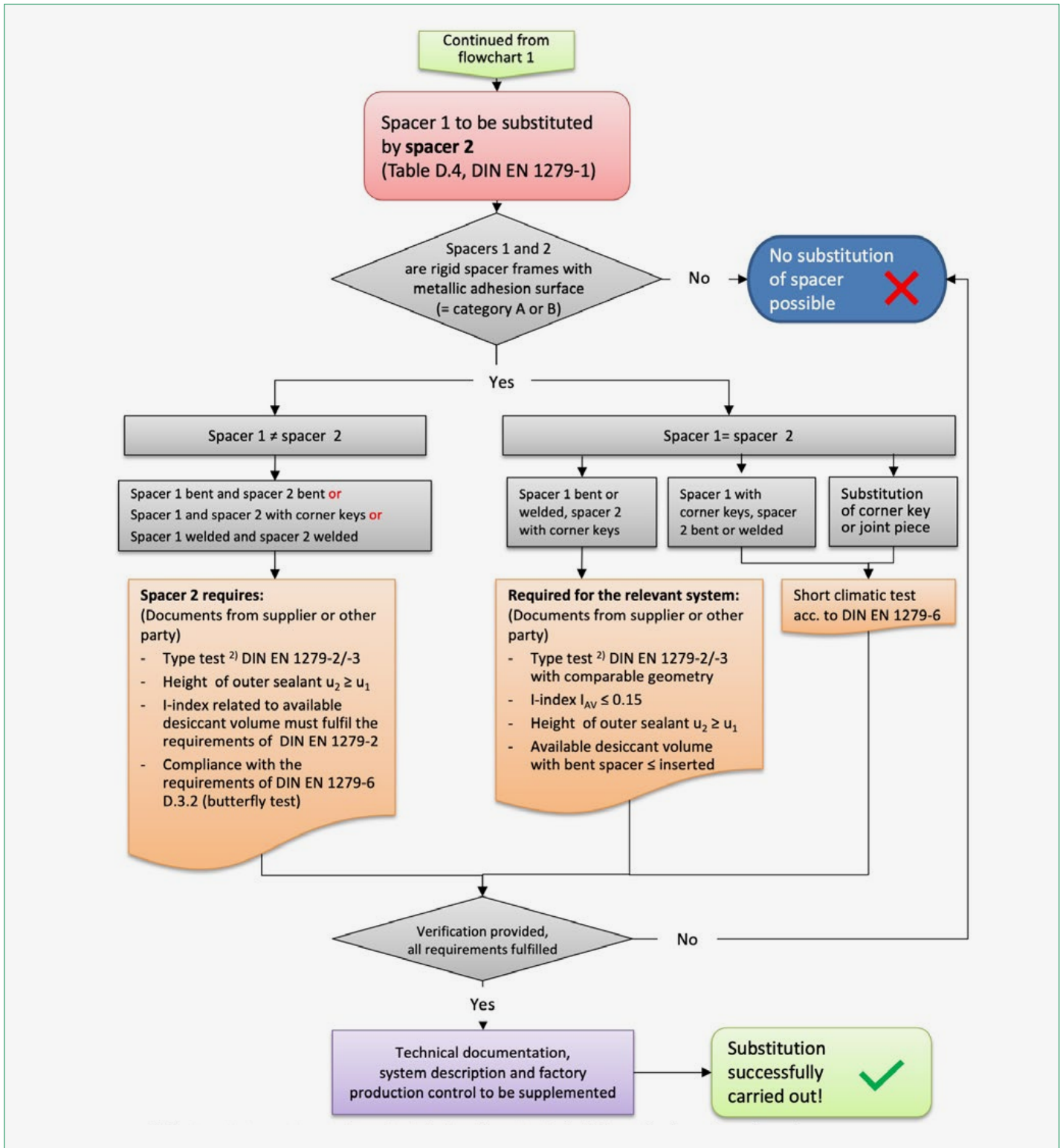
Flow chart 2: Substitution of outer sealant (gas-filled IGU)

²⁾The type test report must also include the relevant technical information (e.g. dimensions of the seal).



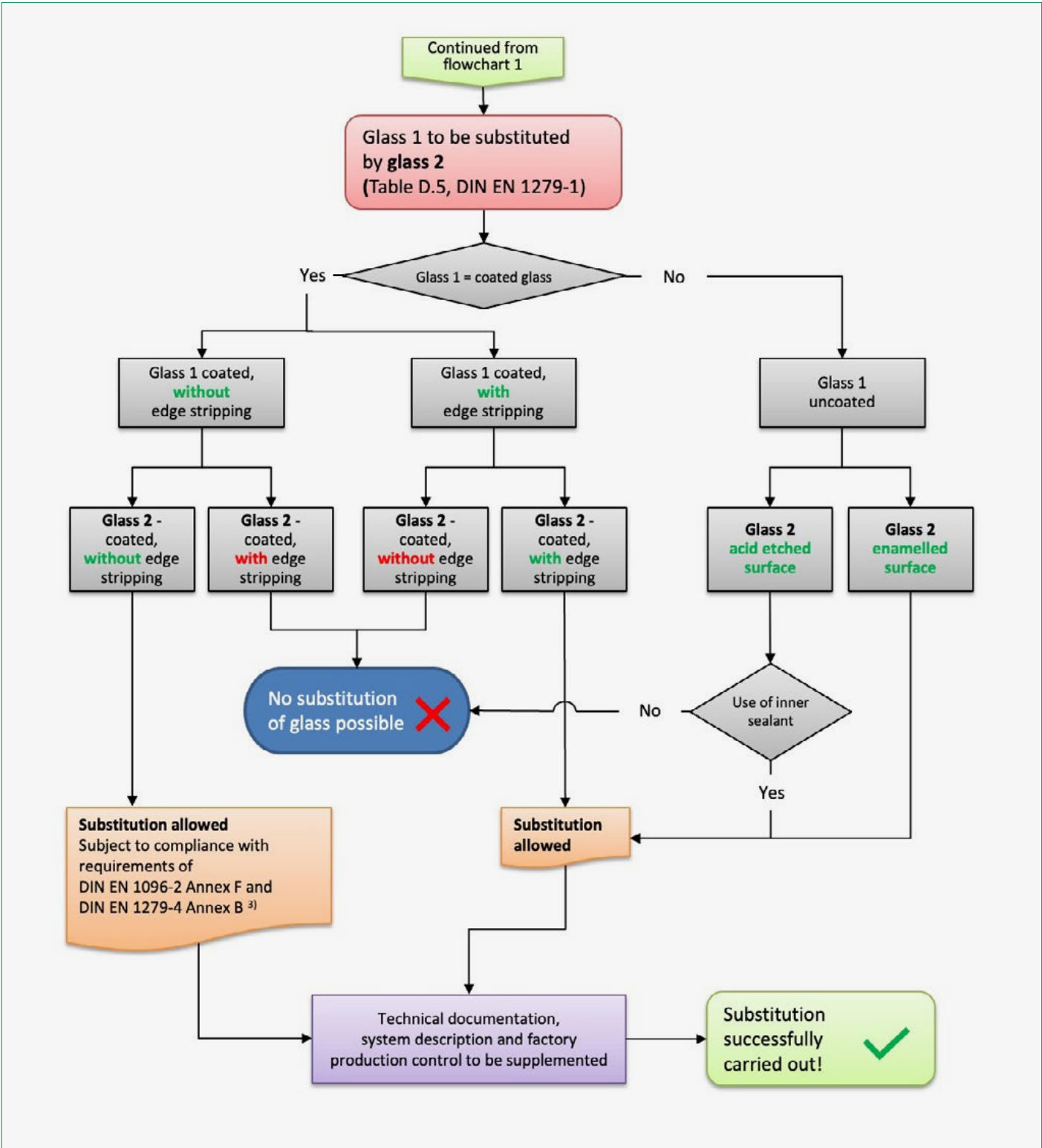
Flow chart 3: Substitution of inner sealant (gas-filled IGU)

Information and guidance notes on DIN EN 1279:2018-10



Flow chart 4: Substitution of spacer (gas-filled IGU)

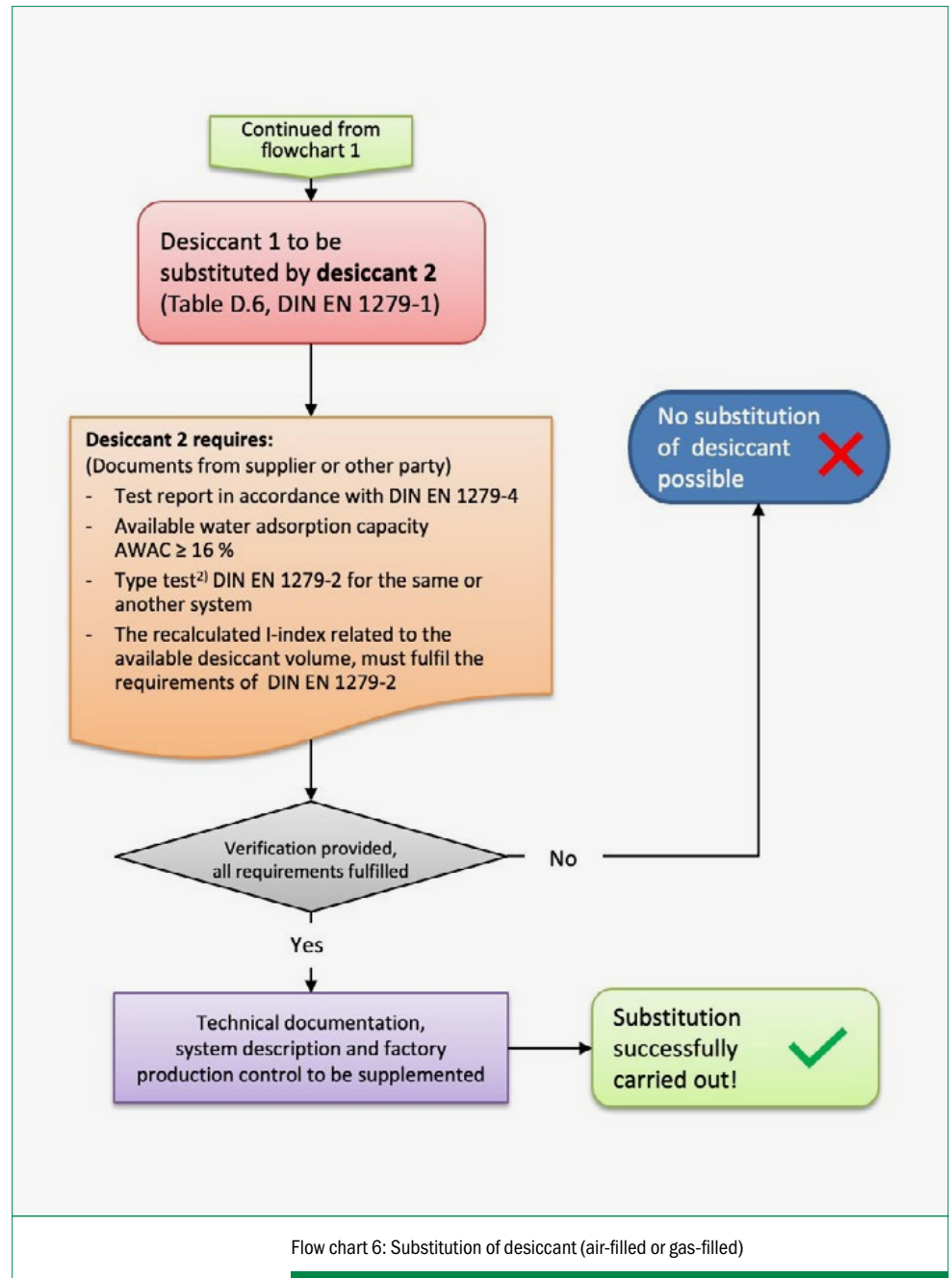
²⁾The type test report must also include the relevant technical information (e.g. dimensions of the seal).



Flow chart 5: Substitution of glass (air-filled or gas-filled)

³⁾ DIN EN 1096-2 Annex F (normative) defines the criteria for verifying the conformity of coatings. DIN EN 1279-4 Annex B (normative) describes tests to demonstrate that the adhesion to coatings (between glass and base layer, between the intermediate layers and between top layer and sealant), is sufficiently strong and durable.

Information and guidance notes on DIN EN 1279:2018-10



²⁾The type test report must also include the relevant technical information (e.g. dimensions of the seal).

3.4. Examples of how to use the substitution rules

Examples are listed below for the substitution of sealants, desiccants and spacers that occur frequently in practice. The application of the substitution rules must always

be based on a type test of the current system version. The examples each refer to the substitution of a component type by another product (sealant 1 by sealant 2, desiccant 1 by desiccant 2, spacer 1 by spacer 2).

Explanation of symbols in the following tables:



Type Test report (TT) for this combination of edge seal components is available



Substitution possible



Substitution not possible

3.4.1 Examples for the substitution of spacers (gas-filled IGU)





Sealant	Substitution of spacer 1 from type test by spacer 2 from category				
	Category A	Category B	Category C	Category D	Category E
Polysulphide (example 1)	 ✓	✓	✗	✗	✗
Polyurethane (example 2)	✓	 ✓	✗	✗	✗
Polysulphide (example 3)	✗	✗	✗	✗	
Silicone (example 4)	✗	✗		✗	✗

Table 7: Examples for the substitution of spacer frames

Explanation of Table 7:

The lines of the table should be viewed individually, in a horizontal direction. In each case, the spacer is substituted, based on a type test report with a specific secondary (outer) sealant that is not substituted.

Example 1. A type test report (TT) is available for the combination of a spacer 1 in category A, e.g. made of aluminium with a polysulphide-based outer sealant. Which substitution is possible?

➔ Substitution by a category C rigid hollow profile is not possible because it is not allowed due to the non metallic adhesion surface. Substitution by another category A profile, e.g. made of stainless steel or by a category B profile would be allowed, if

a type test report in accordance with DIN EN 1279-2 and -3 has been provided by the supplier or another party for spacer 2 and the other requirements of Table D.4 of DIN EN 1279-1 are complied with.

Example 2. A type test report (TT) is available for the combination of a spacer 1 in category B with polyurethane based outer sealant. Which substitution is possible?

➔ Substitution by spacer 2 is possible, e.g. by another category B profile or by a purely metallic category A spacer, if a type test report in accordance with DIN EN 1279-2 and -3 has been provided by the supplier or another party and the other requirements of the Table D.4 of DIN EN 1279-1 are complied with.

Example 3. A type test report (TT) is available for a flexible prefabricated spacer (category E) with silicone sealant. Which substitution is possible?

➔ This type test cannot be transferred to other spacer systems, because substitution is not allowed.

Example 4. A type test report (TT) for a category C spacer is available. Which substitution is possible?

➔ This type test cannot be transferred to other spacer systems, because substitution is not allowed.

Information and guidance notes on DIN EN 1279:2018-10

3.4.2 Examples for the substitution of inner sealants (gas-filled IGU)






Spacer	Substitution of inner sealant 1 from type test by another inner sealant 2		
	Inner sealant x	Inner sealant y	Inner sealant z
Category A (example 5)		✓	✓
Category B (example 6)	✓		✓
Category C (example 7)	✗		✗
Category D (example 7)	✗		✗
Category E (example 7)		✗	✗

Table 8: Examples for the substitution of inner sealants

Explanation of Table 8:

The lines of the table should be viewed individually, in a horizontal direction. In each case, the inner sealant is substituted, based on a type test report with a specific spacer that is not substituted.

Example 5. If a type test is available for a category A spacer profile with inner sealant x, the inner sealants of the categories A and B spacer profiles can be substituted by other

inner sealants, if a test report in accordance with DIN EN 1279-2 has been provided by the supplier or another party for the inner sealants y or z and the other requirements of Table D.2 are complied with.

Example 6. The same applies if a type test is available for a category B spacer profile with an inner sealant y. Then also inner sealants x and z can be used for this spacer profile, if a test report in accordance with DIN

EN 1279-2 has been provided by the supplier or another party for the inner sealants x or z and the other requirements of Table D.2 are complied with.

Example 7. Substitution of the inner sealant is not allowed for categories C, D and E spacer profiles, because these profiles do not have metallic adhesion surfaces. A specific type test is required.

3.4.3 Examples for the substitution of outer sealants (gas-filled IGU)

Explanation of Table 9:

Example 8. If a type test with categories A or B spacer profiles with outer sealant x (or y) is available, substitution by other outer sealants is possible if test reports in accordance with DIN EN 1279-2 and DIN EN 1279-3 have been provided by the supplier or another party for the other outer sealant and the other requirements of DIN EN 1279-1, Annex D, Table D.1 are complied with.

Example 9. Substitution of the outer sealant is not allowed for categories C, D and E spacer profiles, because these profiles do not have metallic adhesion surfaces and cannot be substituted in accordance with Table D.4. A specific type test is required.






Substitution of outer sealant 1 from type test by another outer sealant 2			
Spacer	Outer sealant x	Outer sealant y	Outer sealant z
Category A (example 8)		✓	✓
Category B (example 8)	✓	✓	
Category C (example 9)	✗		✗
Category D (example 9)		✗	✗
Category E (example 9)		✗	✗

Table 9: Examples for the substitution of outer sealants

3.4.4 Examples for the substitution of desiccants (gas-filled IGU)

Desiccant x from the current design of the edge seal can be substituted by another desiccant y if a test report in accordance with DIN EN 1279-4 is available for desiccant y and the AWAC value is at least 16 %. In addition, a type test (this type test for desiccant y may also be for another system) in accordance with DIN EN 1279-2 must have been provided by the supplier or another party. All examples are subject to the requirements of Annex D of DIN EN 1279-1.




Substitution of desiccant 1 from type test by another desiccant 2		
Desiccant x	Desiccant y	Desiccant z
	✓	✓
✓		✓
✓	✓	

Table 10: Examples for the substitution of desiccants

4.0 Literature

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