1 INTRODUCTION

LUNAX Door Systems are fire-resistant or non fire-resistant single or double door systems with or without adjacent fire rated glazing partitions meeting the requirements of EN 1363-1 (EN 1364-1 and EN 1634-1). LUNAX Door Systems are transparent with a high light transmission and provide protection from the spread of smoke and flames in a case of fire from either direction. In the event of a building fire, LUNAX Door Systems' fire-resistant interlayers build a heat shield and additional protection from hazardous heat radiation.

The fire-rated glass components of LUNAX Door Systems are generally subject to the standards EN ISO 12543 and EN 14449 (laminated glass and laminated safety glass) and EN 1279 for the non-fire rated product line, upon which the CE-marking of the glass components are based.

For special product make-ups or glazing components, the respective basic standards of each glass applies, for example: coated glass (EN 1096-1), pattern glass (EN 572-5), etc., as well as the product-specific properties and production-related characteristics.

2 SCOPE OF APPLICATION

This directive is used to assess the characteristics of all types of the LUNAX Door Systems. The assessment for the glass components is conducted in accordance with the testing principles described under §3. Tolerances and specifications for a quality assessment for fittings, hardware, paint and other components are described under §9.

3 GLASS ASSESSMENT

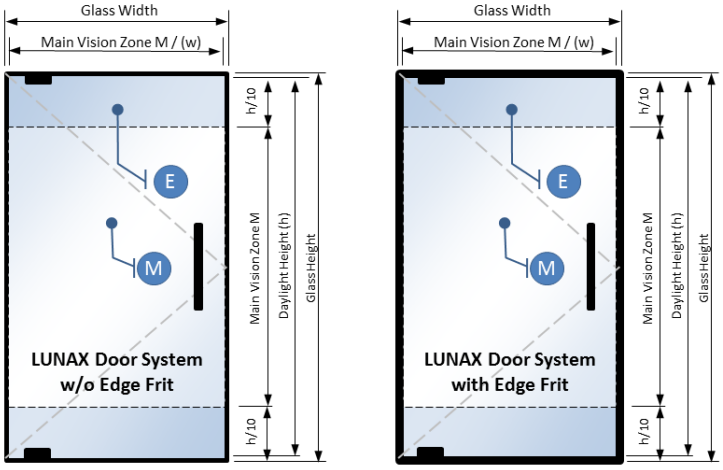
Viewing Conditions for Blemish Detection:

- The glass is being inspected while looking through the glass, focusing on the background; a focus of the glass surface or its reflection is not relevant
- Blemishes shall not be marked in advance
- The viewer must be neutral, meaning not previously in close range of the glass or involved in cleaning and set-up for inspection
- All visual inspections shall be made with 20/20 vision (naked eye or corrected)
- Use diffuse daylight conditions without direct sunlight, spot light or strip lights only, or alternatively other uniform diffused background lighting that simulates daylight, see 12543-6:2011, §4
- Basis for the table of Permissible Defects in section 4 below is a glass with one fire-resistant interlayer
- For combinations with pattern glass, security glass, coated glass, heatable glass, etc., each of the specific product standards and guidelines are to be added

Inspection Process:

- View glass in 90° vertical position, parallel to the light source
- The viewer shall be positioned at a distance of 2 meters perpendicular to the glass surface
- A blemish shall be readily apparent to the viewer, meaning a pattern or defect that is visible to the neutral observer within 20 seconds
- After its detection, use table of Permissible Defects per section 4 below for assessment

4 PERMISSIBLE DEFECTS

ZONE	Permissible Defects Per Glass Pane
Edge Seal Zone without Edge Frit	For LUNAX Door System without edge frit, the different materials used for sealing and spacer may exhibit slight color variances along the glass perimeter. These range from black to dark grey and do not constitute reason for complaint. The overall width of the edge seal in relation to the edge of the glass is nominal $12^{\pm 2}$ mm for machine-produced glass. In case of manual fabrication (e.g. over- / undersize lites, extra thick glass, glass with shapes or curves, bent/radius glass, etc.), a locally wavy appearance of the edge composite and a tolerance of $12^{+4/-2}$ mm is typical and shall be accepted on account of the process.
Edge Seal Zone with Edge Frit	For LUNAX Door System with edge frit, the width of the printed edge enamel on the door lites is nominally 14 mm parallel to the glass edge. The tolerance is ±1.5 mm with respect to the width, the positioning to the glass edge and parallelism to the glass edge. Along the interface between enamel and glass vision area, max. 3 defects of max. 1 mm in diameter per glass edge is permissible. Max. 3 enamel imperfections such as blemishes, voids or bubbles, each less than 3 mm x 3 mm, are permitted, but shall not exceed 9 mm² in total. Slight non-homogeneities in the color appearance are permissible. Light colors will remain partially translucent. The 'Guideline for assessing the visual quality of enameled glass' by BF Bulletin 015/2013 applies (refer to 10.1). A prior sample or mock-up review is highly recommended.
Edge Zone E	10% of the daylight height (h) at the top and bottom of the glass. Optical irregularities such as inclusions, streaks, bubbles, discoloration and non-homogeneities in the fire protection interlayer, that do not significantly obstruct the view through the glass: Glass area ≤ 1 m²: max. qty. 4 of ≤ 3 mm Ø Glass area > 1 m²: max. qty. 1 of ≤ 3 mm Ø per linear meter of relevant glass perimeter **Scratches:** Sum of individual lengths max. 90 mm – individual length: max. 30 mm **Hairline scratches:** Not permissible in 'high concentration'
Main Vision Zone M	Inclusions, spots, marks, bubbles, etc. in the fire protection layer that do not significantly obstruct the view through the glass: Glass area ≤ 1 m²: max. qty. 2 of ≤ 2 mm Ø Glass area ≤ 2 m²: max. qty. 3 of ≤ 2 mm Ø Glass area > 2 m²: max. qty. 5 of ≤ 2 mm Ø **Scratches:** Sum of individual lengths max. 45 mm – individual length: max. 15 mm **Hairline scratches:** Not permissible in 'high concentration'
Zones E + M	Max. number of permissible discrepancies as in zone E. Inclusions, bubbles, spots, marks, etc. of ≥0.5 and ≤1.0 mm are permissible without any area-related limitation unless they appear in a 'high concentration'. A 'high concentration' constitutes at least 4 defects of described kind in a circular area measuring ≤ 200 mm.
Definition of Zones	

PERMISSIBLE DEFECTS (cont.)

Permissible Defects for Insulating Glass Units (IGU)	Impurities in the **air space** between the panes of a double glazing unit (DGU): **Punctiform** impurities / blemishes: Glass area ≤ 1 m^2: max. qty. 4 of ≤ 3 mm Ø Glass area > 1 m^2: max. qty. 1 of ≤ 3 mm Ø per linear meter of relevant glass perimeter **Laminar** impurities / blemishes: max. qty. 1 of ≤ 3 cm^2
General	In case of more than one fire-rated and/or plastic interlayer (> 2 mm), the permitted number of defects increases by one defect per layer. Defects ≤ 0.5 mm are not taken into account. The optically distorted fields they may cause (corona) must not exceed 3 mm. In case any one of the glass panes in the product make-up has cracked or shattered, a proper fire-protection function will no longer be provided and requires the immediate replacement of all fire protection door and glass units affected.

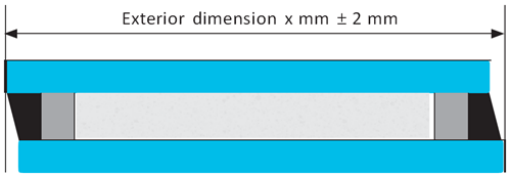
4.1 Other Quality Characteristics

Optical Characteristics	Excessive ambient temperatures (e.g. heating, IR radiators, direct sun- light, heat traps in louvers/blinds, curtains, awnings, etc.) can cause negligible signs of hazing in the product – depending on the number of fire-protection and other layers as well as the lighting conditions and the conditions in which the glass is viewed – though a threshold of 5% per fire-protection layer (in accordance with ISO 13468, 14782) is usually not exceeded. Optical phenomena do not affect the fire-protection function.
Characteristics of Fire Protection Interlayer	If activation or foaming of the fire-protection interlayer(s) outside a fire incident occurs in the product due to an excessively high heat exposure, it does not constitute reason for complaint. In such case, a proper fire-protection function will no longer be provided and requires the immediate replacement of all fire protection glass units affected. If, during the cold season of the year, an optically perceptible freezing phenomenon occurs in the fire-protection interlayer(s) during transport, storage or after installation, it must be assumed that the threshold temperature of -10 °C was exceeded. This does not constitute reason for complaint. The fire-protection function stays intact.
Product and Production Characteristics	Micro-bubbles in the fire-protection interlayer of up to 3 mm in size, are production process related and dissolve completely within a few weeks or months after delivery. The corner seal of the fire-protection interlayer fill opening(s) can extend up to 15 mm from the edge of glass into the Edge Zone. This production related characteristic will not constitute reason for complaint. LUNAX Door System door lites have a polished edge finish according to EN 12150-1: 2015, §7.2, fig. 15. including permissible edge defects per this standard. The edge seal of LUNAX door leaves is visible along the vertical glass edges and has a smooth finish on the handle side only. Minor surface imperfections and voids are related to the production process and do not constitute reason for complaint. The pivot side edge seal has a standard cleaning surface.

5 GLASS TOLERANCES

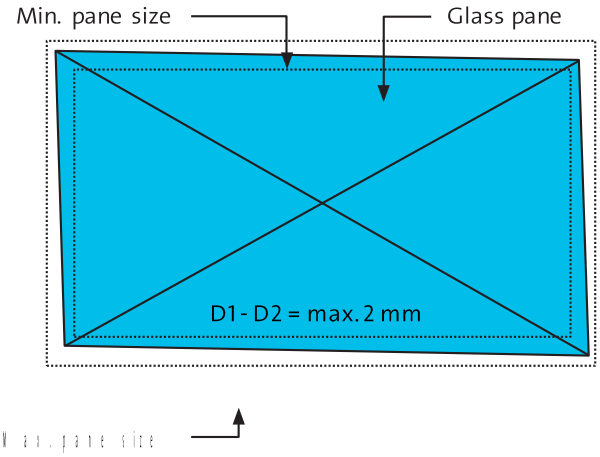
5.1 Glass Dimensions and Offset

The dimensional tolerance on the vertical glass edges (door lite width) for all LUNAX Door Systems is ±2 mm.



5.2 Glass Rectangularity

The dimensional accuracy and angularity of LUNAX Door Systems glass lites is determined in compliance with EN 572-2 for cut-size glass. Each rectangular pane must be enclosed by a rectangle, whose sides comply with the largest and smallest permissible dimensions.



The angularity is verified by measuring diagonals D1 and D2. The absolute difference must not exceed 2 mm. This limit value also applies to insulating glass units.

5.3 Glass Deformation / Waviness / Edge Lift

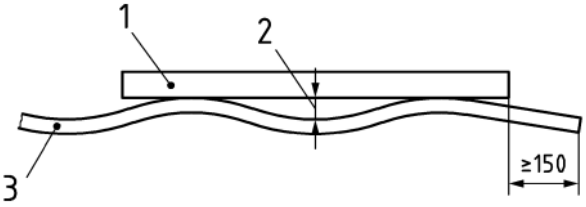
LUNAX Door Systems glass lites consist of several layers of toughened glass panes. By the very nature of the toughening and laminating processes, it is not possible to obtain a product as flat as annealed float glass, thus the finished product shows minor optical irregularities. This deviation in the straightness depends on the type of glass, its dimensions, its aspect ratio, the toughening process used as well as the number of layers in the final product make-up, which can multiply the deviation in planarity.

5.3.1 General Deformation (Overall Bow)

Measuring method: Glass must be positioned vertically. The deformation must be measured at room temperature along the glass edges and along the diagonals as the largest distance between a straightedge or a tensioned wire and the concave or convex surface of the glass panel. The permissible distance, divided by the measured length of the glass edge or the diagonals, must not exceed 3 mm/m in each case. Each glass surface is measured separately.

5.3.2 Deformation Due To Roller Waves (Local Bow)

Measuring method: The straight edge (1) shall be placed at right angles to the roller wave and bridging from peak to peak of the waves. The thickness of the feeler gauge shall be recorded to an accuracy of 0.05 mm and the deformation (2) must not exceed the maximum value of 0.3 mm. Each glass surface (3) is measured separately.



The roller wave cannot be measured in an exclusion area of up to 150 mm from the edges of the glass pane (see «Edge Lift»).

5.3.3 Edge Lift

Measuring method: The glass (3) must be placed on a flat support with the edge lift overhanging the edge of the support by between 50 mm and 100 mm. Place the straight edge (1) on the peaks of the roller waves and measure the gap (2) using a feeler gauge. The gap must not exceed 0.5 mm.

5.4 Glass Thickness

The thickness tolerances are dependent on the exact product make-up and may be taken from the respective data sheet. Generally, the tolerance of the glass thickness refers to the glass perimeter / rebate zone R only, accessible with a standard caliper or micrometer gauge.

6 ASSESSMENT OF VISIBLE AREA OF EDGE SEAL

In the visible area of the edge seal, and as such outside the visible daylight area of the glass, production-related characteristics may be noticeable at the spacer frames of the LUNAX Door Systems glass lites. These characteristics may be visible where the edge seal is not covered along one or more glass edges, e.g. LUNAX Door Systems glass lites without perimeter edge frit.

The permissible deviation of parallelism for the spacer(s) to the straight glass edge is 4 mm in total over the total edge length.

If the spacer and edge seal of the fire-resistant glass and fire-resistant insulating glass is not covered due to the application design, typical characteristics of the edge seal may be visible, e.g. waviness, which are regulated in this directive under 4.1 Production Characteristics.

7 GENERAL INFORMATION GLASS

This guideline applies to the assessment of the visible quality of architectural glass units. When evaluating an installed glass product, it is assumed that, in addition to the visual quality, additional features of the product, needed to fulfil all functions, are also taken into account.

Properties and values for glass products, such as noise-reduction, heat insulation and light transmission, which are specified for defined functions, refer to the test panes in accordance with the relevant test standard or calculation methods used. Specified values and optical impressions may vary for differing pane formats and combinations, as a result of the installation or other outside influences.

When evaluating particular characteristics, their specific properties should be noted, e.g.:

- Combinations with coated glass
- Material-related properties, e.g. refractive index of glass to fire-protection layer
- Manufacturer-related and / or batch-related color variances and light scattering, e.g. in the fire-protection layer, intermediate films or coatings
- Color difference in ornamental glass / coated glass / etc.
- For physical reasons, the transmission, color depth and light scattering depend upon the glass pane thickness.

7.1 Physical Characteristics

A number of inevitable physical phenomena that may be noticeable in the clear glass surface is excluded from the evaluation of the visual quality, such as:

- Interference phenomena
- Insulation glass effect
- Anisotropy
- Condensation on the outer pane surface (condensation formation)
- Wettability of glass surfaces

7.1.1 Definition of Terms

7.1.1.1 Interference Phenomena

For insulating glass units made from float glass, spectral color interferences may occur. Optical interference is observed when two or more light waves are superposed when meeting in one point. It can be observed through more or less brightly colored areas, which change when pressure is applied to the pane. This physical effect is enhanced by the plane parallelism of the opposing glass surfaces. This plane parallelism ensures distortion-free view through the glass. Interference phenomena occur randomly and cannot be influenced.

7.1.1.2 Insulating Glass Effect

Insulating glass units have an air/gas volume enclosed by the perimeter edge seal, whose state is essentially determined by the barometric air pressure, the altitude of the production site above sea level and the air temperature at the manufacturing time and place. Installing insulation glass at different altitudes, with temperature differences and fluctuations in the barometric air pressure (high and low pressure) relative to the manufacturing site, inevitably results in concave or convex curvatures in the individual pane surface and optical distortions. Furthermore, multiple reflections may appear on glass surfaces at different intensities. These reflections may be more noticeable if the glazing unit background is dark, for example. This phenomenon is a law of physics.

7.1.1.3 Anisotropy

Anisotropy is a physical effect of heat-treated glass, resulting from internal stress distribution inside the glass. Depending on the viewing angle, it is possible that fuscous rings or streaks are perceived in polarized light and/or when viewed through polarized panes.

Polarized light is present in normal daylight. The polarization level is dependent on the weather and the position of the sun. Double refraction is more noticeable at flat viewing angles or when glass surfaces are positioned next to one another in a corner.

7.1.1.4 Condensation on the Outer Pane Surface

Condensate may form on the outer glass surfaces if the glass surface is colder than the surrounding air (e.g. fogged vehicle windscreens). Condensation formation on the outer surfaces of a glass pane is determined by the Ug-value, the relative air humidity, the air flow and the interior and exterior temperature.

Condensation forms on the room-side pane surface when air circulation is restricted, e.g. due to low soffits, curtains, flower pots, window boxes, blinds, radiators being poorly positioned or lack of ventilation, among other issues.

On insulating glass units with a high level of heat insulation, condensation may form temporarily on the exterior glass surface if the relative outside humidity is high and the air temperature is higher than the temperature of the pane surface.

7.1.1.5 Wettability of Glass Surfaces

The wettability of glass surfaces may be different due to imprints from rollers, fingers, labels, paper residue, suction cups, sealant residue, silicone components, smoothing agents, lubricants or environmental influences. If the glass surface is damp due to condensation, rain or cleaning water, the different levels of wettability may become visible.

7.2 Visual Properties of Glass Products

7.2.1 Glass Color

All materials used for glass products have inherent colors based on the raw materials and their purity, which may become more apparent with an increased glass thickness. For functional reasons, coated panes are used. Coated panes also have an inherent color which may be noticeable to varying degrees in transmission or reflection. The color impression may vary due to the pane's iron oxide content, the coating process, the coating type, and changes to the glass thickness and pane make-up, and cannot be prevented.

7.2.2 Color Variation of Coatings

For sunlight protection and heat reflection glazing, high vacuum sputtered metal and metal oxide coatings are used. The thicknesses of these coatings measure just a few nanometers and can be perceived differently from one person to the next both in transmission and reflection depending on the angle of view, shade, lighting and weather conditions or other site- or project- specific circumstances in terms of their appearance and color effects from glass to glass or even within the same glazing pan- el. Due to the complexity of the production and coating processes there may be slight batch-related differences in terms of the color effect and perception. This must be taken into account; particularly if coated glass needs to be resupplied within a warranty period or glazing panels are replaced after a longer period of time. Color differences within the measuring procedure and tolerance thresholds described in ISO 11479-2 will not be accepted as a reason for complaint.

7.2.3. Optical Characteristics of Toughened Glass

As the glass is placed on rollers in the furnace during the toughening process, slight surface changes may occasionally occur. This waviness is caused by a physical processes; it is not always avoidable and in certain cases can lead to changes of the images in reflection. As a result of the thermal tempering process, chemical and mechanical changes to the surface finish may occur, such as dot formation and roller imprints.

7.3 Exterior Surface Damage

The cause must be determined if mechanical or chemical exterior surface damage, which is noticed after glazing, has occurred. These complaints can also be evaluated in accordance with section 3.

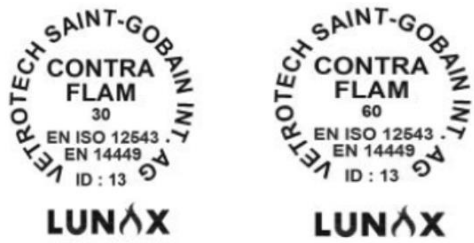
8 GLASS MARKING / IDENTIFICATION

8.1 Stamp

Each pane of LUNAX Door Systems is permanently marked in accordance with the respective General Type Approval.

Minimum information shown in the stamp

- Name or factory number of manufacturer
- Type designation, e.g. "CONTRAFLAM 30 LUNAX



8.2 Labels / Shipping Documents

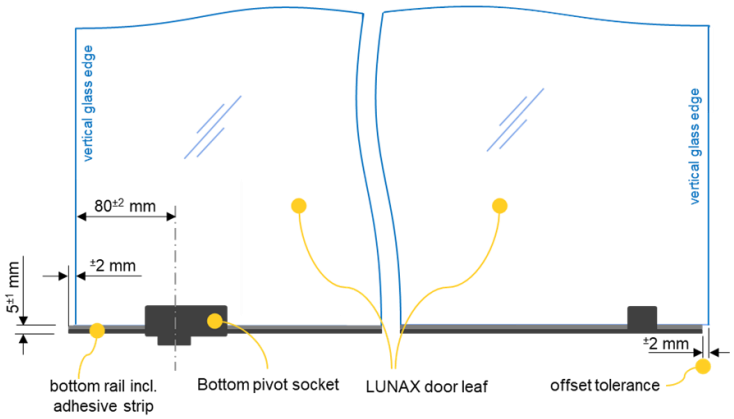
Each LUNAX Door Systems delivery is accompanied by CE-relevant information. Further information can be found under www.vetrotech.com.

9 DOOR HARDWARE & COMPONENTS

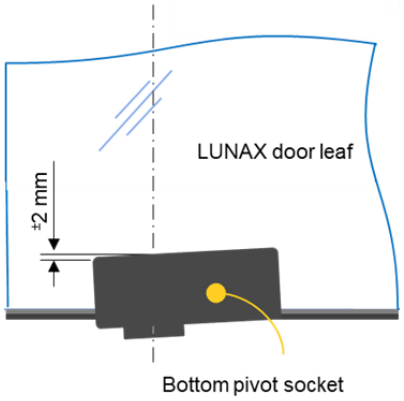
9.1 Alignment and Positioning of Door Hardware

The positioning tolerance for factory installed top and bottom door rails and graphite strips is ±2 mm in reference to the vertical glass edges. As the top and bottom pivot sockets are at fixed positions on the rails, this tolerance transfers to the axis positions of top and bottom pivot points.

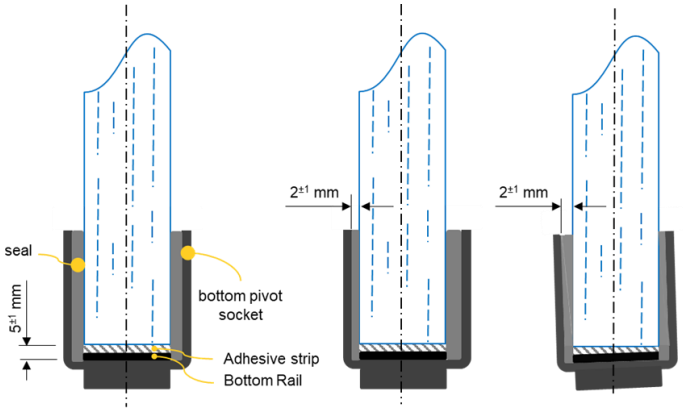
The nominal thickness of top and bottom rails including graphite strip is 5±1 mm.



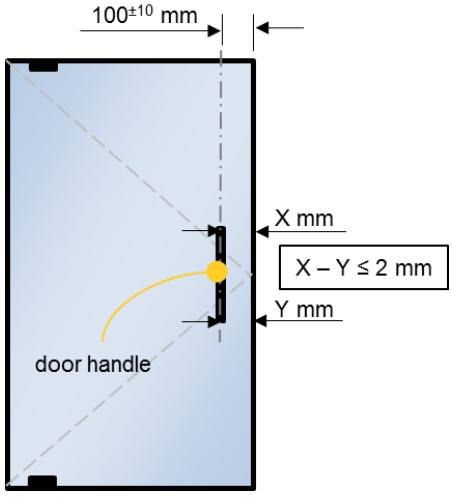
The alignment of the bottom pivot socket relative to the center line ±2 mm.



The alignment of top and bottom rails relative to the glass surface is $2^{\pm 2}$ mm.



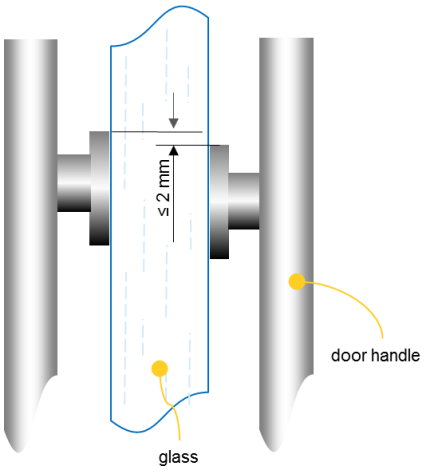
Unless confirmed otherwise, the vertical center line of the door handle is nominally positioned 100 mm relative to the vertical glass edge. Depending on the handle type this position can vary by ± 10 mm.



The alignment tolerance of the door handle relative to the vertical glass edge is ≤3 mm from top to bottom of the handle. The offset between the interior and exterior door handle footings is ≤2 mm.

The positioning tolerance for all other factory installed hardware components is ± 3 mm of nominal or custom dimensions per signed-off order form or custom written agreements respectively.

Some hardware components and fittings are surface finished by powder coating or painted. Minor surface blemishes, such as hairline scratches, dimples, chips ≤2 mm Ø, etc. are permissible unless in high concentration.



9.2 Door Hardware

9.2.1 Door Handles

- Minor surface blemishes in exposed areas, such as hairline scratches, dimples, chips ≤2 mm Ø, etc. are permissible unless in high concentration at the time of delivery.
- In case of overstraining door handles, for safety reasons they might detach from the glass surface to prevent glass shattering. Re-attachment must be conducted by a trained expert using factory provided and approved components only following specific field repair procedures.
- Socket attached door handles may come lose during normal operation and is not considered reason for complaint. Regular checks and proper affixing is to be carried out by end user or installer.
- Where applicable, the door handle attached to the socket may come lose during normal operation. Regular checks and proper affixing is to be carried out by end user or installer.
- Custom, customer provided and customer installed door handles are excluded from this Quality Guideline

9.2.2 Door Closers, Cover Plate and Door Locks

- LUNAX Door Systems are equipped with standard brand floor spring, cover plate and top closer options. For function and maintenance please refer to the manufacturer's Quality and Maintenance Guideline(s).
- All door locks are field installed.
    - For electrical and magnetic locks, please strictly follow manufacturer's wiring instructions for proper function. For malfunctions please consult lock manufacturer or local expert.
    - For the one-way mechanical / key lock, minor surface blemishes of the painted surfaces, such as hairline scratches, dimples, chips ≤2 mm Ø, etc. are permissible unless in high concentration at the time of delivery.

9.2.3 Upper Hinge Pivot Bushing

For durability reasons, the upper hinge pivot must be properly aligned to minimize mechanical loads and excessive wear and tear on the pivot bushing during operation. The replaceable pivot and pivot bushing are subject to wear and tear depending on the frequency of door use and shall not be considered reason for complaint

9.3 Door Components

9.3.1 Rails and pivot sockets attached to the glass edges

Minor surface blemishes of the powder coated or painted surfaces, such as hairline scratches, dimples, chips ≤ 2 mm Ø, etc. are permissible unless in high concentration at the time of delivery.

9.3.2 Graphite Strips and Smoke Seals

Graphite strips for supporting constructions (door perimeter) are field-installed, fit to size and due to their exposure, subject to wear and tear, detachment, misalignment, etc. during day-to-day operation, hence not a reason for complaint. Installation and re-attachment must strictly follow applicable Installation Guideline and Condition of Use.

10 RELEVANT DOCUMENTS

10.1 Further Applicable Documents

In addition to this document, the following documents apply:

- VETROTECH LUNAX® Door Systems Installation Guidelines for the according system
- VETROTECH LUNAX® Door Systems Application Guidelines
- VETROTECH (LUNAX®) General Terms and Conditions of Sale
- Manufacturer's instructions, guidelines and maintenance directions for closers and all other hardware components
- Manufacturer's instructions, storage condition and expiration dates for primer, adhesives, gaskets and other hardware components
- BF Bulletin 015/2013 Guideline for assessing the visual quality of enameled glass by Bundesverband Flachglas
- Technical guidelines issued by local glazing trades
- Product standards for additional glass products incorporated in the glass make-up