

1. System characteristics

NEBESYS is a transparent roof system designed to create daylighting areas in pitched roofs. It brings natural daylight into attic spaces while preserving the character and appearance of the roof envelope. The system is intended especially for the renovation of historic and architecturally valuable buildings, buildings in heritage-protected areas and other structures requiring a sensitive roof daylighting solution. It can also be used in new-build projects. The transparent part of the system consists of insulating laminated triple glazing integrated into a load-bearing aluminium structure. From the exterior, the transparent part is covered by a perforated aluminium cover element that visually relates to the surrounding roof covering.

2. Structural solution

The system structure consists of NEBESYS aluminium profiles anchored to the existing or new load-bearing roof structure. The structural solution allows the system to be adapted to the actual condition of the roof structure and to compensate for normal geometric inaccuracies of existing rafters. The ideal centre-to-centre spacing of existing rafters for application of the system is approximately 800–1200 mm. The specific structural solution is always determined according to the actual dimensions, build-up and structural condition of the roof. The transparent part consists of laminated insulating triple glazing. The non-transparent part of the system is formed by thermal insulation and a sheet-metal roof layer, finished with a perforated aluminium cover element.

3. Materials

The system's basic materials are aluminium profiles, laminated insulating triple glazing, thermal insulation, a sheet-metal roof layer, a perforated aluminium cover element, system seals, joining components and anchoring elements. The perforated aluminium cover element is manufactured by pressing in forming tools and is subsequently finished with powder coating. The standard finish is in the "řezná" shade; other colour options can be specified for the particular project.

4. Thermal and daylight performance

The NEBESYS system uses insulating triple glazing with high thermal-performance properties. The thermal transmittance of the glazing U_g is approximately 0.7–0.8 W/m²K depending on the specific build-up. The system thermal transmittance is declared as $U = 1.05$ W/m²K. The perforated cover element reduces direct solar radiation while allowing diffuse daylight to pass through. The specific daylight and solar properties depend on the type of perforation used and the system build-up.

5. Perforated cover element

The perforated cover element simultaneously provides protective, aesthetic and solar-control functions. Various perforation options are available as standard, for example:

- circular perforation Ø 2 mm / 29.6%
- circular perforation Ø 2 mm / 40.3%
- oval perforation 2.2 × 3.4 mm / 44.5%

The perforated cover element reduces the direct component of solar radiation while maintaining the passage of diffuse daylight. The perforation type is selected according to the requirements of the specific building, the desired appearance and the lighting conditions.

6. Requirements for the load-bearing structure

Before the system is designed, the actual condition of the load-bearing roof structure must be assessed, in particular its geometric accuracy, load-bearing capacity, deformation and the condition of timber elements. For transparent areas of the NEBESYS system, the load-bearing structure must meet the requirements specified in the design documentation and structural design. In renovation projects, the actual condition of the existing roof structure must be taken into account and, where necessary, repaired or locally strengthened. The maximum permissible deformation of the load-bearing structure must comply with the structural design requirements and the specific system build-up.

- recommended maximum deflection values: $\delta_{\max} L / 250$; $\delta_2 L / 350$
- dimensional stability and moisture content of the timber structure: In transparent NEBESYS areas, the load-bearing timber must be solid sawn timber in service class 1, i.e. the average moisture content must not exceed 12%. KVH, BSH and dry sawn timber are dimensionally stable and suitable as support structures beneath transparent NEBESYS areas.

7. Weight

System weight: depending on the specific build-up, max. approx. 70 kg/m². The stated value is indicative; the actual weight is determined according to the dimensions of the transparent and non-transparent areas, the glazing used, the build-up of the cover layer and other structural elements.

8. Durability and operating properties

The system is designed for long-term use under normal weather exposure. The materials and surface finishes used are designed with regard to resistance to corrosion, UV radiation and normal climatic effects. The expected service life of the system is at least 40 years, provided the design conditions and requirements for proper installation, maintenance and operation are observed.

9. Fire safety solution

The transparent part of the NEBESYS system is not declared as a fire-resistant construction. For fire-safety purposes it is assessed as a fire-open area. The transparent part of the system is classified as a DP1 construction in accordance with the relevant provision of ČSN 73 0810. The required fire resistance of the entire roof structure and any measures in the transparent areas must be determined within the fire-safety design for the specific building. The transparent part of the system does not penetrate the roof plane according to the issued Building Technical Approval No. 010 - 045861. If fire resistance is required for the load-bearing structure, then – in the case of a timber roof structure – it is appropriate to choose the correct rafter dimensions from the fire-resistance point of view. This avoids the need for additional cladding of rafters or fire-protective coatings. In the areas of glazed NEBESYS surfaces, the rafters are exposed to fire from four sides. Fire resistance values of timber structures are given in the document "Fire resistance values of building structures according to Eurocodes (TP 1.6.1)" at the following link:

<https://profesis.ckait.cz/dokumenty-ckait/tp-1-6-1/#s-1-4>

10. Additional elements

The NEBESYS system can be equipped with additional elements according to project requirements, in particular:

- electrically operated internal BLACKOUT shading
- electrically sliding ventilation module

The additional elements are designed with regard to the structural solution, the way the space is used and the requirements of the specific building.

11. Design and installation

Each NEBESYS system is designed individually according to the specific roof geometry, roof build-up and project requirements. Before production, manufacturing documentation is prepared, including in particular the survey, dimensions of individual elements, structural solution and material specification. The system must be installed in accordance with the NEBESYS design and manufacturing documentation and the manufacturer's installation instructions.

12. Warranty

The NEBESYS system is provided with a 5-year warranty unless a longer warranty period is agreed in the specific contract. Warranty conditions are governed by the relevant contractual documentation.

13. Standards and certifications

NEBESYS – Building Technical Approval No. 010 - 045861

Timber structures according to ČSN EN 1995-1-2

Basis of structural design ČSN EN 1990

Design of timber structures ČSN EN 1995-1-1