VITROCSA®

TECHNICAL DOCUMENTATION
VITROCSA – 3001

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Introduction

This document is a summary of the technical features of the VITROCSA - 3001 sliding window system. It is a detailed presentation of the main components and summarizes the performances of the window. This document is a guide. It will help you understand the VITROCSA – 3001 system but can not replace the practical training required for the manufacture and assembly of the window. For further information, please contact the VITROCSA technical personnel. Orchidées Constructions SA is a highly innovative company. Therefore, the elements presented in this document correspond to the current status of technology at the time the report was compiled.

Reference documentation

1 Standards

EN ISO 10077-1	Thermal performance of windows, doors and shutters. Calculation of thermal transmittance. Part 1: simplified method.
EN ISO 10077-2	Thermal performance of windows, doors and shutters. Calculation of thermal transmittance. Part 2: numerical method for profiles.
EN 1191	Windows and doors – Resistance to repeated opening and closing – Test method.
EN 12400	Windows and doors – Mechanical durability – Requirements and classification.
EN 14608	Windows – Determining the resistance to a vertical load (racking).
EN 13115	Windows – Classification of mechanical properties – Racking , torsion and operating forces.
EN 1026	Windows and doors – Air permeability – Test method.
EN 12207	Windows and doors – Air permeability – Classification.
EN 1027	Windows and doors – Watertightness – Test method.
EN 12208	Windows and doors – Watertightness – Classification.
EN 14024	Metal profiles - Aluminium profiles with thermal break in PA or PU - Technical specifications.
EN 14024	Metal profiles - Aluminium profiles with thermal break in PA or PU - Specifications.
EN 1627	Windows, doors, shutters – Burglar resistance – Requirements and classification.
EN 1628	Windows, doors, shutters – Burglar resistance – Test method for determining the resistance under static loading.
EN 1629	Windows, doors, shutters – Burglar resistance – Test method for determining the resistance under dynamic loading.
EN 1630	Windows, doors, shutters – Burglar resistance – Test method for determining the resistance under manual burglary attempts.
EN 356	Glass in building – Security glazing – Testing and classification of resistance against manual attack.

2 VITROCSA - 3001 documentation

VITROCSA	Profile drawings VITROCSA - 3001 documentation (please use current versions) in dxf or dwg format.
VITROCSA	documentation Catalogue of VITROCSA - 3001 profiles (please use the current versions).
Documentation VITROCSA	3001 Curves of static proportioning of VITROCSA profiles – TH+ (please use current versions).
VITROCSA	documentation U value of VITROCSA - 3001 profiles (please use the current versions).

3 Accredited test report

7211-PB-01 (May 2005)	Air permeability – test report. HSB, Facades Department, CH-2504 Bienne.
7211-PB-02 (May 2005)	Air permeability – test report. HSB, Facades Department, CH-2504 Bienne.
7251-PB-01 (May 2005)	Mechanical durability – test report. HSB, Facades Department, CH-2504 Bienne.
7251-PB-02 (May 2005)	Racking, torsion and operating forces – test report. HSB, Facades Department, CH-2504 Bienne.
7581-PB-01 (August 2007)	Burglar resistance – test report. HSB, Facades Department, CH-2504 Bienne.

Definition of the technology

4 Descriptions of the sliding window system (understanding the window system)

The VITROCSA – 3001 window system is used for external fitting. It permits the use of sliding and fixed elements. The special features of this system are summarized in the following points:

- The elements (fixed or sliding) comprise U profiles which are stuck to the perimeter of the insulating glass. On the sides, The U profile is covered with a connector profile which ensures the doors are watertight and rigid. The maximum dimension of a sliding element is limited to 6 m^2. The thickness of the insulating glass is 26 mm.

- The frame comprises one or more rails equipped with a ball bearing system in the sliding areas. This ensures the weight of the glazing is distributed to the structure of the building.

- The iron fittings used in this system are all manufactured by Orchidées Constructions SA (cf. VITROCSA - 3001 catalogue).

These special features enable large dimension windows to be made with very slim profiles. The picture below presents a model tested by CSTB in Paris in the context of a request from ATEX, during the week of 27 to 31 March 2006.

Picture1 : experimental model, dimensions in mm (height / width) (7000/3700)

4.1 General principle, specifications and field of application

Sliding elements (fixed)

VITROCSA – 3001 windows are intended to be used in facades but can also be used inside the building. By virtue of its constitution, VITROCSA – 3001 window applications are extremely flexible and exist in a variety of sliding configurations.

Closing elements

There is a very wide variety of locking options, defined together with the person in charge of the project. The most common type of locking system is the closing button (cf. VITROCSA - 3001 profiles drawing). Orchidées Constructions SA also supplies locking systems which comply with the WK2 burglar resistance requirements.

Insulating glass

The insulating glass used in VITROCSA – 3001 glazing has a total thickness of 26 mm. Thicknesses and the type of glass sheets (Float, ESG or VSG) are defined in accordance with the dimensions and requirements of the project. The thermal performances of the glass (type of gas, film) are defined by the person in charge of the project.

Draining chamber

Draining the frame is carried out vertically and rain water is collected in a stainless steel chamber. This is equipped with a draining foam which reduces the pressure of the wind. The chamber also contains PVC weight-bearing elements which distribute the forces (dead load) of the glazing to the concrete structure.

4.2 Definition of window components

4.2.1 1) Frame

N°	Identifications	Materials		Functions
1.1	Rail (frame)	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		Holds the doors in position; ensures connection between the doors the concrete structure; enables iron fittings to be fitted; support for the profile (1.5) of the ball bearings.
1.2	Thermal break bars	Polyamide 6.6 with 25% (+/- 3%) short glass fibres, max. length 1mm		Thermal break
1.3	Thermal break seal	EPDM		Hides area between the frames (estheticism)
1.4	Brush (Self-stick)	Brushes: polypropylene silicone-treated; support: polypropylene reinforced with a HDPE sheet cemented with a contact adhesive		Air permeability; watertightness; reduces air noise penetration; absorbs aluminium contact noises.
1.5	Interior profile	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		With rollers: used to support ball bearings and enables loads to be transported (dead load) in the rail (1.1) in the structure. No roller: hides the rail (1.1) (estheticism).
1.6	Ball bearing	EISI440C stainless steel, deep-groove ball bearing, dimensions 5x16x5mm, 2 rubbing seals, normal precision.		Roller mechanism allowing conveyance of the doors ; element enabling loads (dead load) of the glazing to be transferred to the lower profile (1.5) in the rail (1.1).
1.7	Ball bearing axis	Bar turning-grade stainless steel		Ball bearings (1.6) fitted in lower profiles (1.5) ; distributes loads (dead load) of the ball bearings in the lower profile (1.5).

4.2.2 2) Glass element

N°	Identifications	Materials		Functions
2.1	Insulating glass	Composition: variables Thickness: 26 mm		Transparent closing element; airtight and watertight; acoustics; thermal insulation; UV-protection; etc.
2.2	U profile	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		Profile of the window; protects the edge of the insulating glass; enables the connector profile to be fastened (3) ; in lower area, it distributes load (dead load) in a linear fashion on the brass profile (2.4).
2.3	Adhesive 444	MS polymer-based adhesive		Adhesive for connection between the glass and the U profile.
2.4	Profile for brass	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		Reinforces the U profile (2.2) in the lower area; position of the brass (2.5).
2.5	Brass	Brass –EN CW614N (CuZn39Pb3) ; H130/R480 (hard)		Reinforces the brass profile (2.4) so as to avoid recessed fitting of ball bearings.
2.6	Handle profile	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		Enables first door to be operated; stiffens the U profile (2.2).
2.7	Thermal break bars for handle	Polyamide 6.6 with 25% (+/- 3%) short glass fibres, max. length 1mm		Thermal break

4.2.3 3) Connector profile

N°	Identifications	Materials		Functions
3.1	Connector profile	Aluminium, alloy EN AW-6060 [Al MgSi], Status: T66		Watertight and airtight; in closed position, links the doors together.

4.2.4 4) Draining

N°	Identifications	Materials		Functions
4.1	Draining chamber	X10CrNi18-8 stainless steel.		Collection and draining of rain water (draining); ensure watertightness in the lower area of the frame.
4.2	Draining foam	Polyester foam (polynapore) controlled pores.		Disseminates pressure of the wind in the draining chamber (4.1) to aid flow of rain water.
4.3	Support element	PVC		Load transmittance (dead load) in concrete structure.
4.4	Cache	Aluminium, alloy EN AW-1050A AlMg1(Al99.5)		Dissimulation of draining chamber.

4.2.5 5) Closing mechanism

N°	Identifications	Materials		Functions
5.1	Closing cylinder	Kaba key cylinder		Locking.
5.2	Closing button	Contact pin: Aluminium, alloy EN AW-6060 [Al MgSi 0.5], Stem: Aluminium, EN AW-6082 [Al Mg Si 1]		Closing.

4.2.6 6) Surfacing, fixing and watertightness

N°	Identifications	Materials		Functions
6.1	Surfacing	Natural aluminium, eloxed aluminium, powder coating protected aluminium.		Surface protection, estheticism.
6.2	Wedging the frame	Expanded PVC (Forex)		Wedging the frame (1)
6.3	Retaining screw	Sheet metal countersunk head screw A2 ; DIN 7982 C, ISO 7050 ; in stainless steel A2		Fastening on frame (1) on brickwork
6.4	Double-sided assembly tape	MS polymer-based G-2000, closed cell PUR foam support, black		Brass fastening
6.5	Silicon	Sikasil -C : Mono-component silicon mastic - translucid, neutral hardening.		Sealing material
6.6	Primer	Sika cleaner-205 : monocomponent solvant-based sealing agent.		Cleaner and adhesive agent for sealing joint.

4.3 Description of frame assembly (1)

The frames are cut with a mitre and interlocked with an aluminium corner plate. The corner plate is fixed in the frame with stainless steel screws.

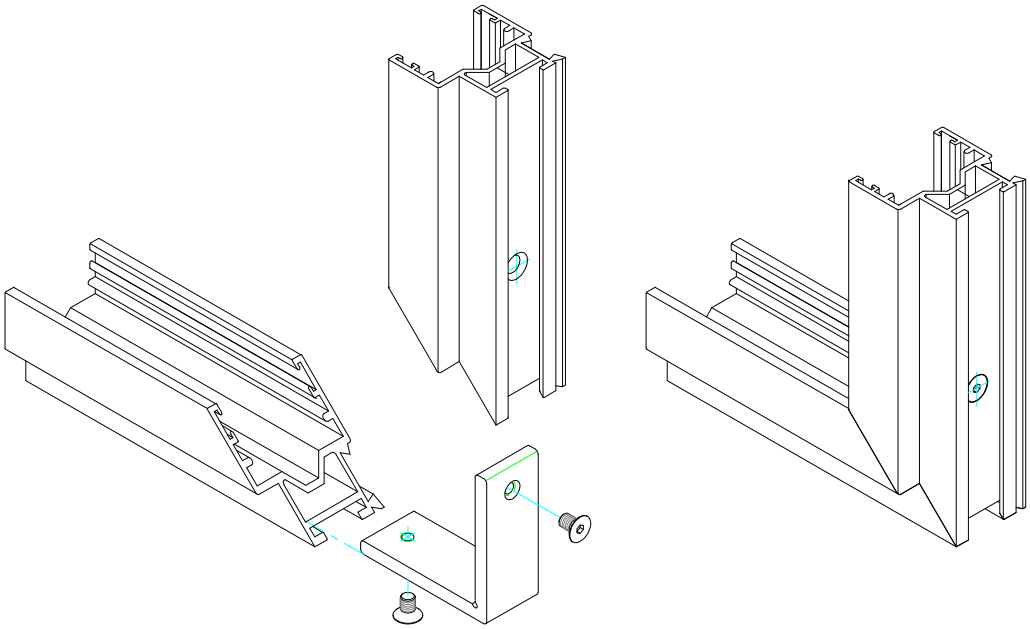

Figure 1 : assembly principle for frames

4.4 Standard ball bearing rail

The ball bearing rail is the main mechanism for operating the doors. It is located in the conveyance areas of the lower rails (1.1). The standard length of these elements is one metre. The number of bearings per m' depends on the weight of the glazing.

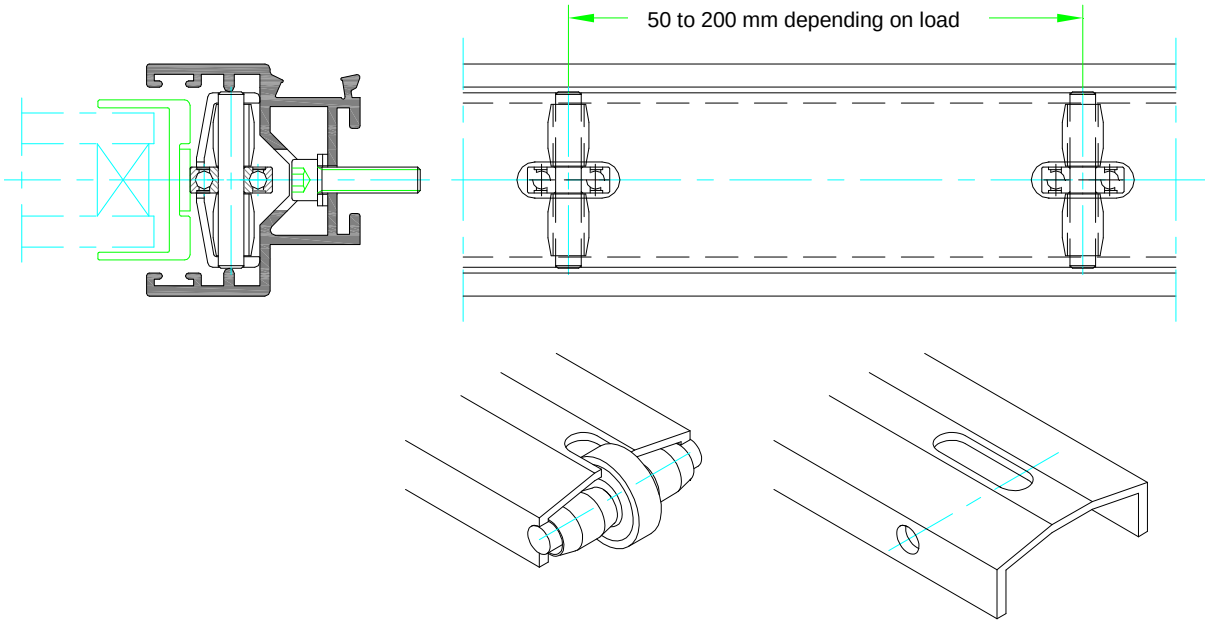

Figure 2 : standard ball bearing rail

4.5 Draining system

Rain water is collected in the lower rails, then drained in the draining chamber (4.1) by vertical perforations. A detailed procedure for this draining system is illustrated by the picture below.

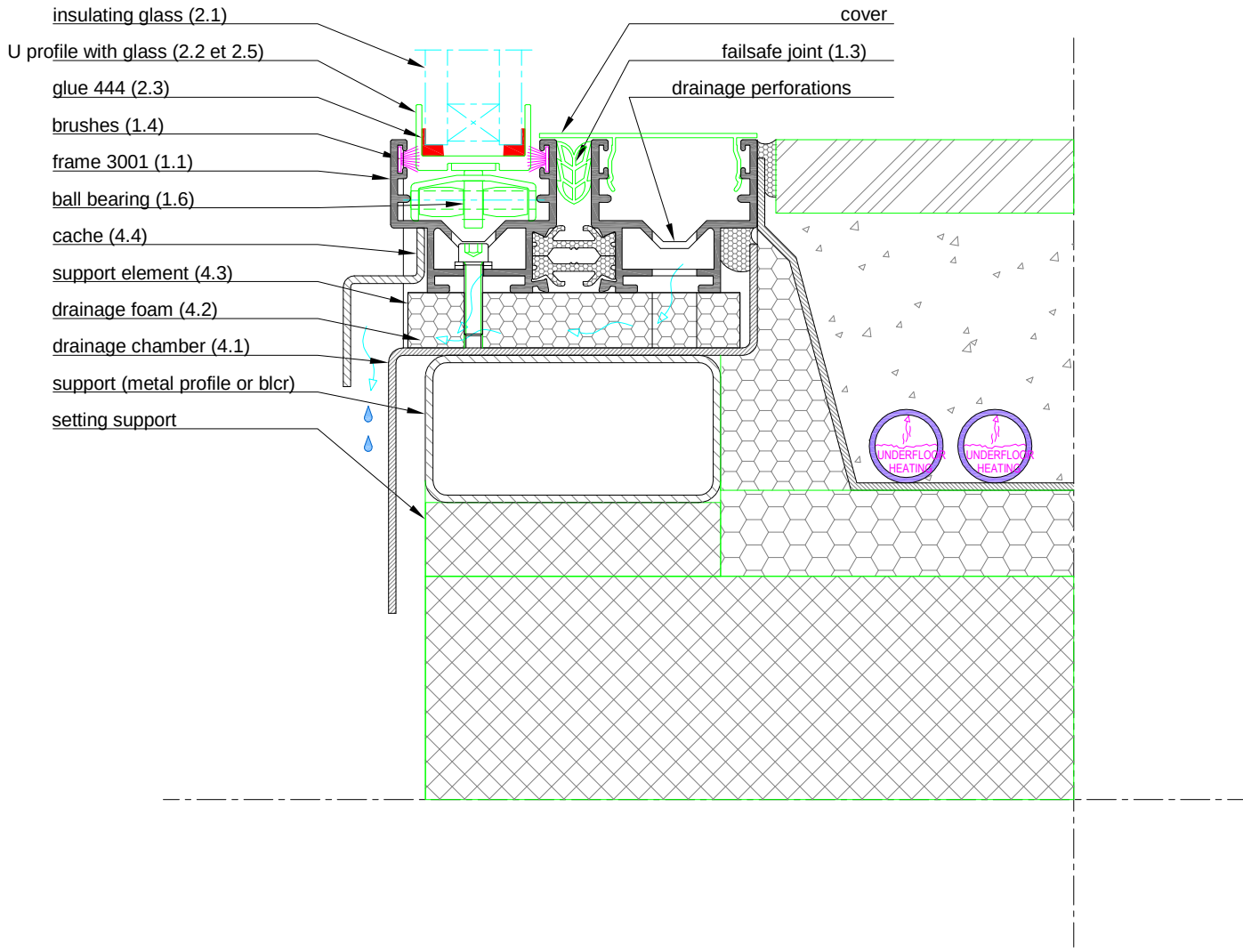

Figure3 : draining principle of the lower rails

The draining chamber is equipped with a support element every 500 mm enabling it to transfer loads (dead load) from the frame to the concrete structure. A draining foam (4.2) is positioned between these elements in order to distribute the pressure of the wind into the draining chamber. The chamber is then fastened to a metal (or wooden) support which has had its level pre-adjusted. This operation is very important, it requires a very high level of precision.

4.6 Connector profile

In closed position, the connector profile creates a link between the sliding elements. It ensures watertightness and resistance to wind forces. The connector profile is also used as a support for the locking elements. The VITROCSA – 3001 system offers a whole range of connector profiles enabling the requirements of the project to be met. The picture below illustrates the H2R profile.

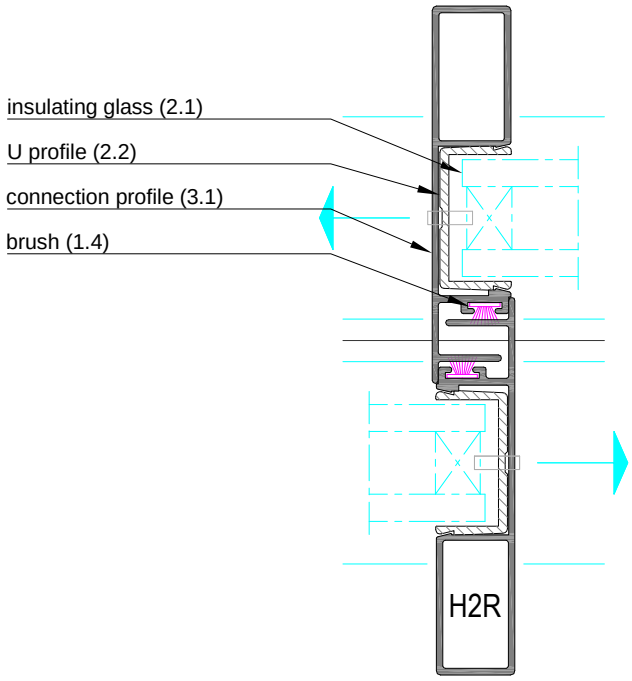

Figure 4 : H2R connector profile

Justifications

5 Reliability and preserving over time

The first VITROCSA – 3001 window was developed at the start of the Nineties. With our current experience, we can confirm that this system presents no hidden defect. The sliding mechanism and the watertightness system operates perfectly on condition the window is installed professionally.
In order to demonstrate consistent operation of the VITROCSA - 3001 window, we have run standardized tests in an accredited laboratory (SERVICE SUISSE D'ESSAI STS 317).
The results of these experiments are presented in the following table:

Type of tests	*Standards (test and classification)*	*Classification*
Air permeability	EN 1026 (test) EN12207 (classification)	Class 4
Watertightness	EN 1027 (test) EN12208 (classification)	Class 7A
Repeated opening and closing	EN 1191 (test) EN 12400 (classification)	Class 3 (20 000 cycles)
Resistance to racking	EN 14608 (test) EN 13115 (classification)	Class 3 (600 N)
Burglar resistance	EN 1628 to 1630 (test) EN 1630 (classification)	WK2 (resistance class 2)
Test element: fixed-sliding approx. dimension 2500/2500 mm		

Table 1 : standardized tests done on VITROCSA - 3001 window

6 Static dimensioning

The dimensioning of connector profiles is carried out based on the local wind pressures. These pressures are defined using construction standards (Eurocode, SIA 261, NV 65, etc.). E.g. for a site in Monaco, the wind load is determined as follows:

- The on-site wind pressure is described in the NV 65 (04/2000) standard with the assumptions: zone 2, exposed site.
- $q_v = 0.6 * 1.3 = 0.78$ [kN/m^2]
- **Choice**: $q_v = 0.8$ [kN/m^2]

Using this indication, Orchidées Constructions SA engineers determine the dimensioning of the glazing. The maximum deflection of the VITROCSA – 3001 window is limited to the following value:

$$w_{max} \leq \frac{L}{150}; \quad w_{max} \leq 15\,mm$$

L : length of connector profile in mm.

The maximum dimensioning stress of the VITROCSA – 3001 profiles (in aluminium) is limited to 120 N/mm^2.

7 Calculating the thermal transmittance U_w of a VITROCSA - 3001 window

7.1 Calculating the U_f coefficient of VITROCSA - 3001 frames

The U_f value is calculated using the **flixo** program and the values of the specifications of the materials (Lambda value) originate from the EN ISO 10077-2 and EN ISO 12524 standard.
As an example, the following picture presents the calculation of the U_f value of a frame detail.

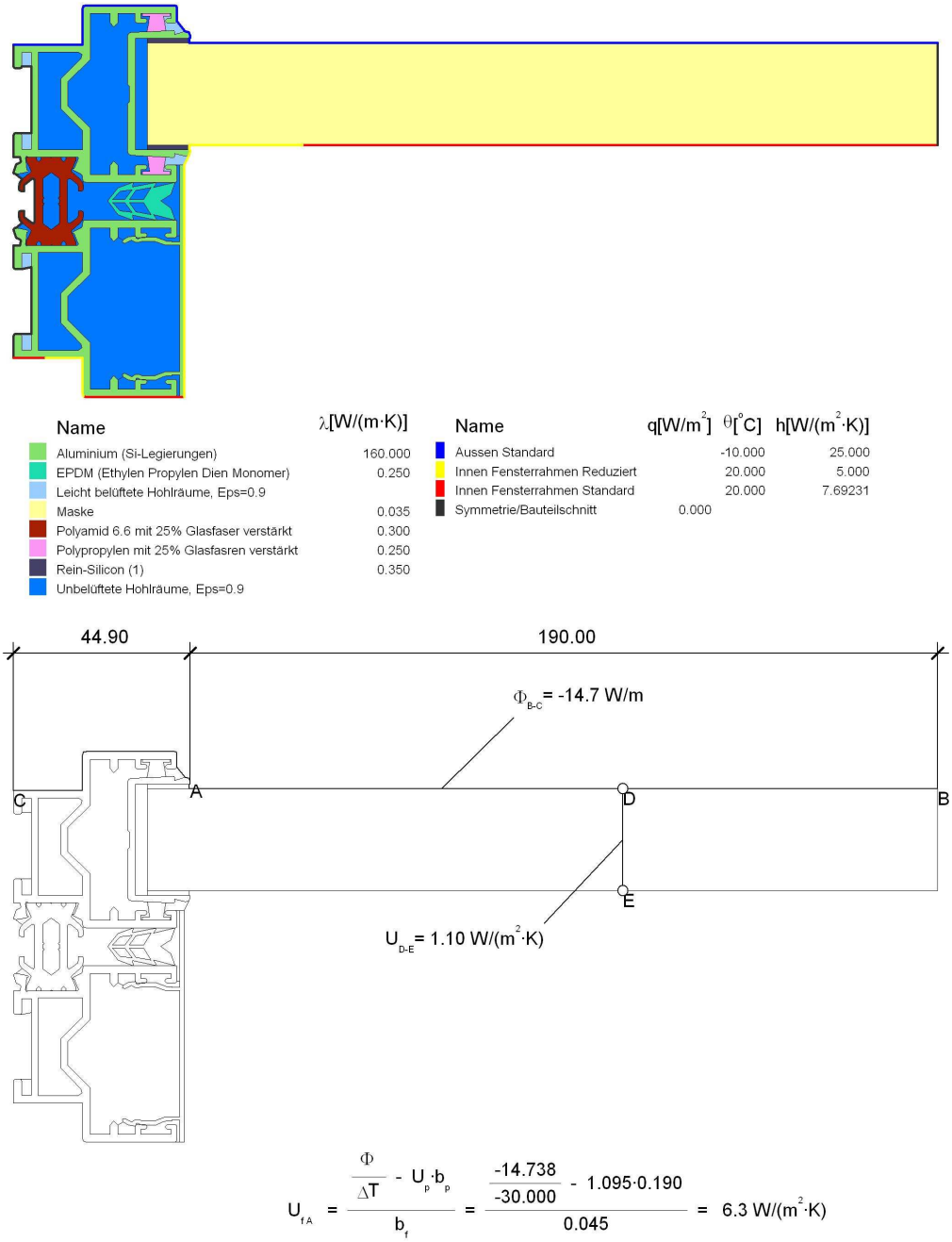

Figure 5 : example of a calculation of the U_f value of a frame

7.2 Calculating the U_w value of the window

The thermal transmittance U_w value of the window is calculated using the following variables:

- Dimensions of the window.
- Surface of the frame projected in the light void of the brickwork.
- Thermal transmittance coefficient of the U_g glazing [W/(m^2K)].
- Thermal transmittance coefficient of the U_{fm} frame [W/(m^2K)].
- Linear transmittance coefficient of the glazing [W/(mK)].

This way, the U_w value of the window depends on the different variables specific to this project. As a result, engineers from Orchidées Constructions SA calculate the U_w values on a case by case basis based on the requirements of the project.

General Provisions

7.3 Contents of report

This report comprises 16 pages, annexes included.

Onnens, 15th October 2008

Illustrations

8 Pictures

9 Figures

10 Tables