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RENOVATION OF BUILDINGS USING STEEL TECHNOLOGIES

(ROBUST)

RFSR CT 2007-0043

WP2: Renovating industrial buildings: Energy efficiency strategies - Solutions for Overcladding and Re-Cladding -

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Content

1 OVERCLADDING SYSTEM

A solution for overcladding of industrial buildings made of steel frame with porous concrete plates as façade elements was developed. The overcladding consists of steel sandwich panels. The principle is shown in Figure 1.1 (left), details for corner and other junctions are shown in Figure 1.1 (right), Figure 1.2 and Figure 1.3.

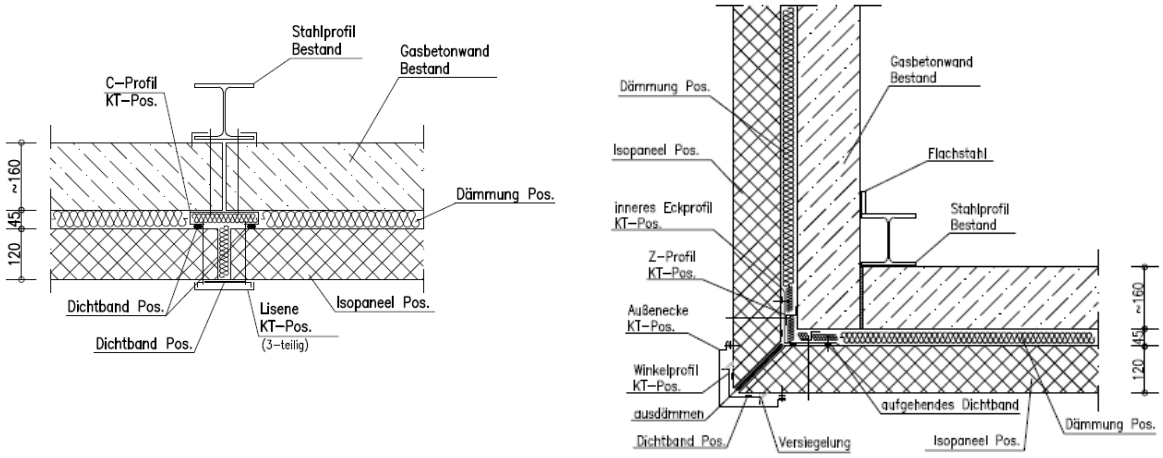


Figure 1.1 *Use of steel sandwich panels for overcladding (left: regular section, right: corner)*

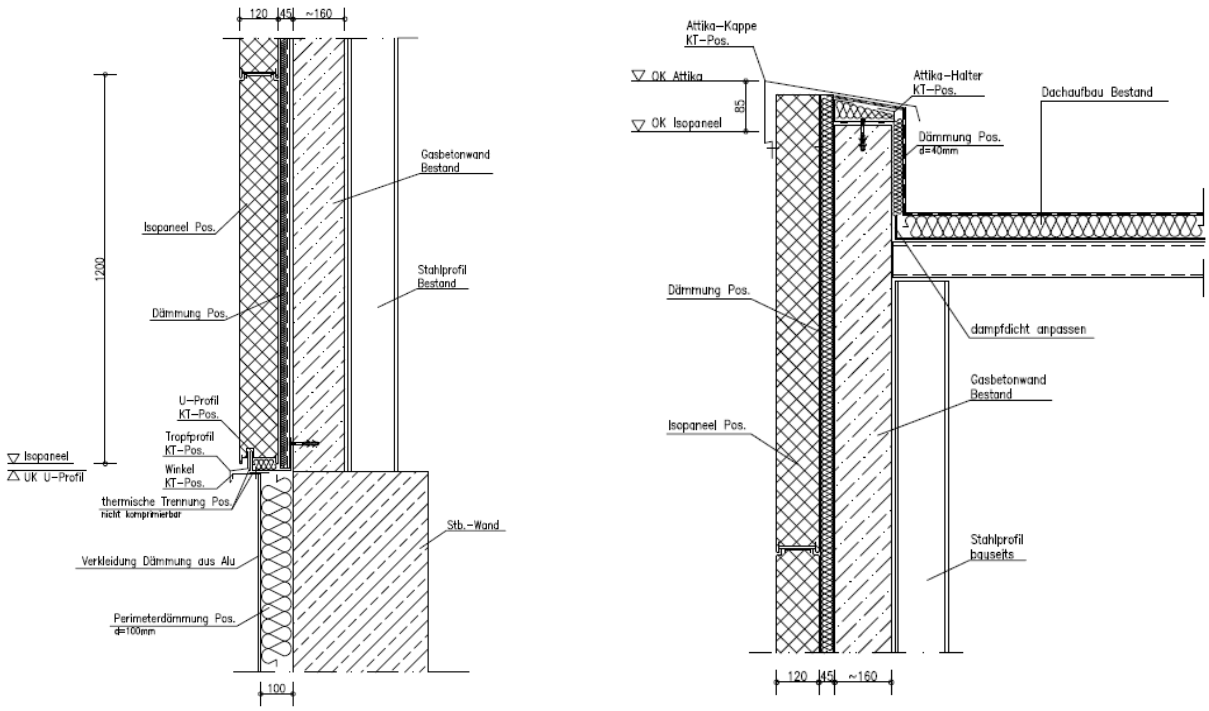


Figure 1.2 *Details for use of steel sandwich panels for overcladding (left: base plate, right: attic)*

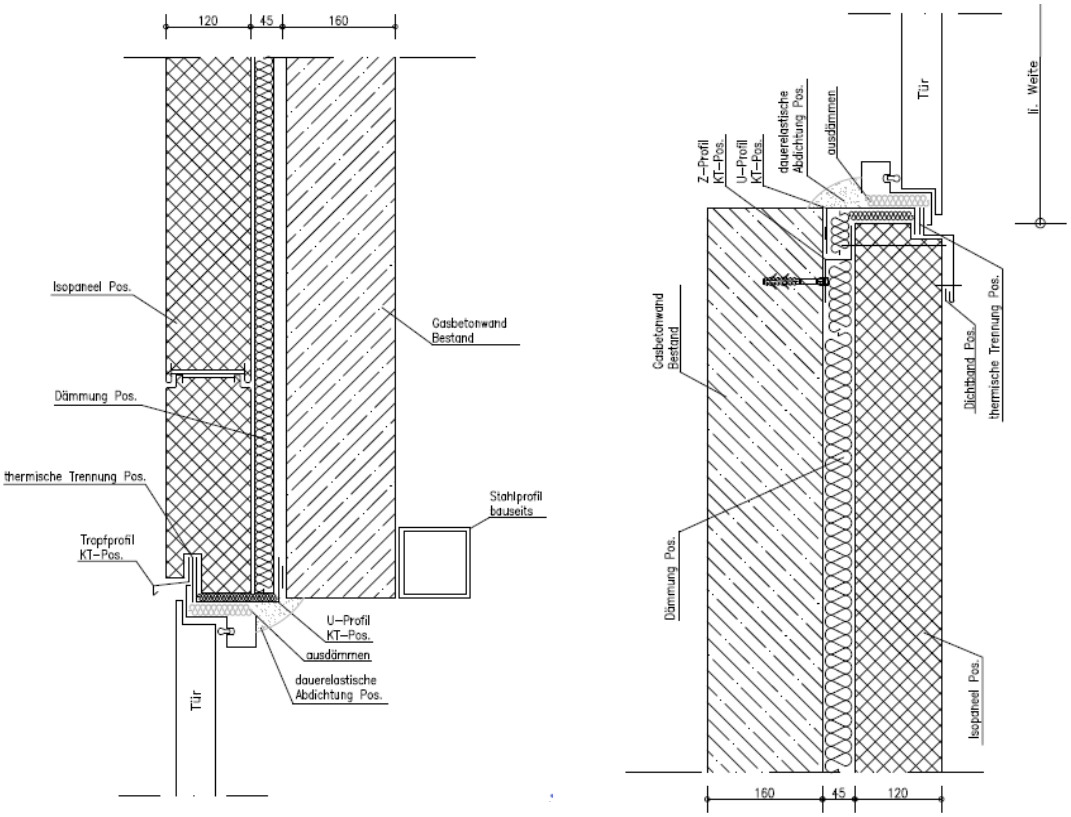


Figure 1.3 *Details for use of steel sandwich panels for overcladding, junction door – facade (left: top, right: lateral)*

A very important additional benefit of this solution is, that the existing façade can be discharged from wind loads. In case of weak fasteners or increased wind loads this option should be considered.

2 ANALYSIS OF IMPROVED THERMAL INSULATION OF OVERCLADDING

For the proposed solution as seen above the following assumptions were made:

Table 2.1 *U-Value, gas concrete wall before renovation*

Material	thickness	heat conductivity	therm. Resistance
	[mm]	[W/mK]	[m²K/W]
Heat transfer internal			0.13
Gas concrete	160	0.3	0.53
Heat transfer external			0.04

Total thermal resistance R [m²K/W]	0.70
Heat transfer coefficient U [W/m²K]	1.42

Table 2.2 *U-Value, regular area of overcladded gas concrete wall*

Material	thickness	heat conductivity	therm. Resistance
	[mm]	[W/mK]	[m²K/W]
Heat transfer internal			0.13
Gas concrete	160	0.3	0.53
Mineral wool	45	0.045	1.00
Steel	1	50	0.00
PU-Foam	120	0.04	3.00
Steel	1	50	0.00
Heat transfer external			0.04

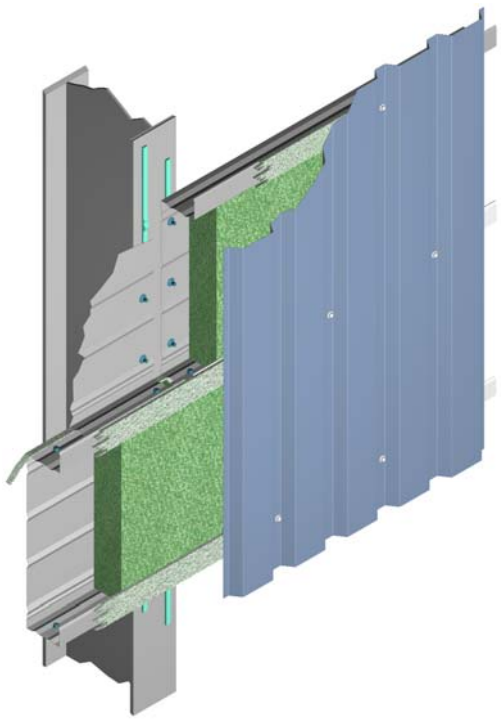
Total thermal resistance R [m²K/W]	4.70
Heat transfer coefficient U [W/m²K]	0.21

The U-Value can be reduced significantly from about 1.4 W/m²K to 0.21 W/m²K.

3 RE-CLADDING SYSTEM

As shown in previous reports, the thermal performance of cassette walls is weak due to the thermal bridges caused by the steel sheets penetrating the insulation layer. Figure 3.1 shows the typical solution for numerous existing steel buildings and the calculation of U-Values by hand (overoptimistic) and using FEM-calculation (real).

The current situation without any or a weak thermal break between web and outer steel sheet causes U-Values that are not acceptable for the actual requirements. A re-cladding with an insulation thickness of about 40 mm between flange and external sheet reduces the U-Value remarkable.



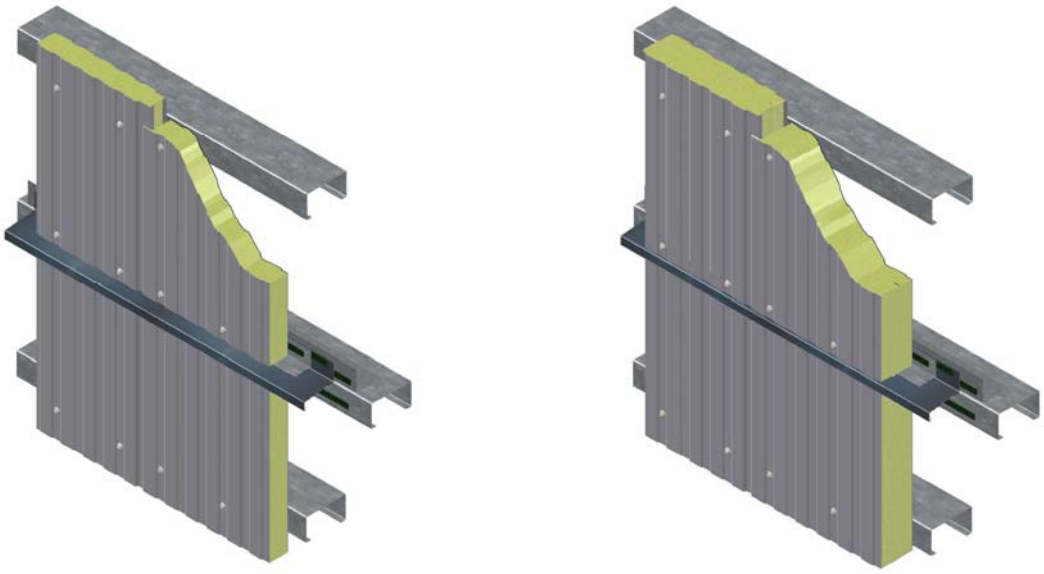
$U_{old,handcalculation}$ = 0.38 W/m²K

$U_{old.real}$ = 0.80 W/m²K

$U_{new,real}$ = 0.33 W/m²K

Figure 3.1 *Solution for re-cladding of cassette wall, reduction of U-Value (results of FEM-calculation)*

For buildings with weak sandwich elements (e.g. 40 mm insulation thickness) recladding means an exchange of the elements by new ones with better insulation (up to 200 mm). Figure 3.2 shows calculation results for an 200 mm sandwich element replacing old 40 mm sandwich elements.



$U_{old,handcalculation}$ = 0.56 W/m²K

$U_{old.real}$ = 0.62 W/m²K

$U_{new,real}$ = 0.13 W/m²K

Figure 3.2 *Solution for exchange of sandwich wall, reduction of U-Value (left: d = 40 mm, right: d = 200 mm, results of FEM-calculation)*