Supplementary heat insulation using profiled and coated steel sheet

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Supplementary Heat Insulation using Profiled and Coated Steel Sheet

Isolation thermique additionnelle utilisant des tôles profilées traitées

Zusätzliche Wärmeisolierung unter Verwendung von profiliertem und beschichtetem Stahlblech

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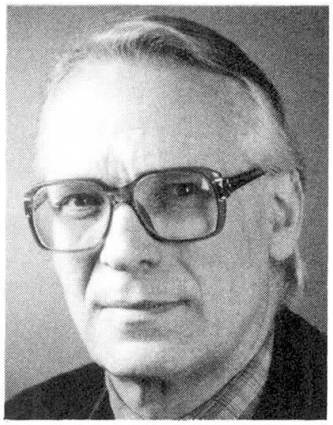


B. Franklin is a consulting architect in Luleå. He was the chief architect for the construction of the new Technical University in Luleå. He has also designed churches, officeblocks, workshops and sports centres. In 1978 he received the award «Silverbeam» from the Swedish Institute of Steel Construction for his contribution to research and development of steelbuildings.

SUMMARY

After the war many houses were built in a great hurry in Sweden. The quality was not the best. Oil was cheap and the heat insulation ineffective. These buildings now need maintenance and improved heat insulation. The most economic way is by overcladding together with supplementary heat insulation. But how do we tackle the aesthetic problem?

RÉSUMÉ

Après la deuxième guerre mondiale, il a fallu construire rapidement de nombreux logements, en Suède. La qualité de construction n'était pas des meilleures. Le mazout était alors bon marché et l'isolation négligée. Ces bâtiments nécessitent actuellement une rénovation et une amélioration thermique. La solution la plus économique consiste en l'adjonction d'un revêtement supplémentaire en tôle muni d'une isolation. Cependant, un problème se pose: comment traite-t-on l'esthétique des façades?

ZUSAMMENFASSUNG

Nach Kriegsende wurden in Schweden innert kurzer Zeit viele Häuser gebaut, die jedoch keine gute Qualität aufwiesen. Öl war billig und infolgedessen eine Wärmeisolierung weniger nötig. Diese Häuser benötigten jetzt Unterhalt und bessere Isolierung. Die wirtschaftlichste Methode ist die Einkleidung mit profilierten Stahlblechen zusammen mit einer zusätzlichen Isolierung. Doch wie kann das ästhetische Problem gelöst werden?

1. INTRODUCTION

Even in Sweden, after the war, we had a housing shortage. We built many houses quickly and the quality was certainly not the best. Oil was cheap and therefore a good heat insulation was not thought necessary. Today these buildings are in need of maintenance. They are mostly rendered and built with light concrete blocks. The most economic way to renovate the facades is by overcladding with coated profiled steel sheet combined with heat insulation.

The swedish government gives subsidies when improving the insulation of permanent dwellings. The thickness of the insulation must be at least 95 mm mineral wool or equivalent.

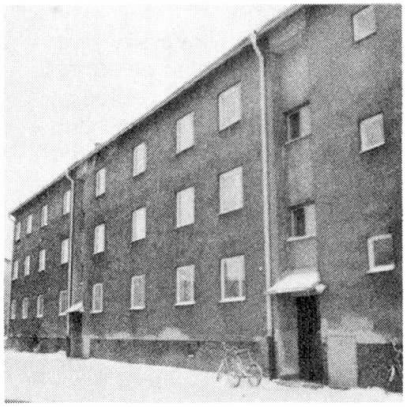


Fig. 1 Typical building from the fifties ready for renovation

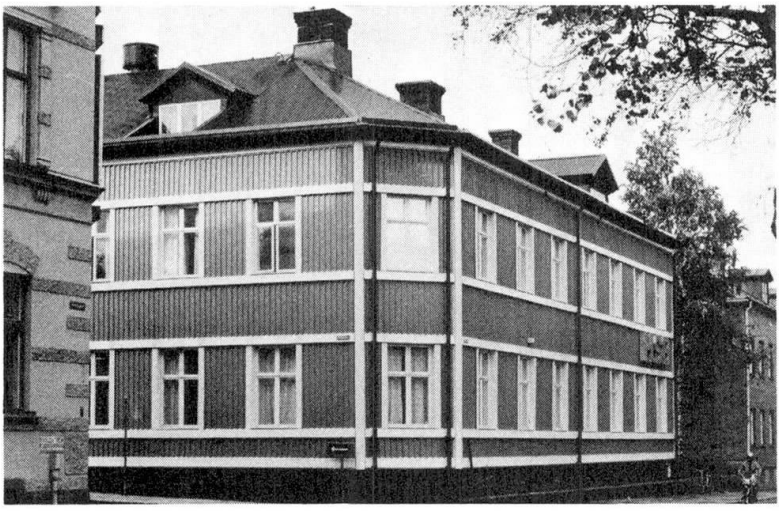


Fig. 2 The new facade must blend into the existing environment

2. ARCHITECTURAL PROBLEMS

2.1 Adaption to the surroundings

When we improve the insulation outside the wall, we change the appearance of the house. It doesn't matter if we try to imitate the original facade or not, or which cladding material we choose. We always increase the thickness of the wall and change the relation between wall and window, wall and the eaves etc.

Before we start a facade-renovation we have to look at the surroundings. If the facade is a part of a continuous row along a street, you must be especially careful when choosing colours. It is important that the new facade blends into the existing environment and does not become a monument of its own.

If the building is located in a landscape or park, surrounded with trees and bushes, we have more freedom. We can choose a brighter colour and emphasise the building in its own right.

2.2 To renovate or change the facade

We have come to the conclusion that it isn't possible to make an exact imitation. Instead we have to study the elements of the original facade. How are the scale and the dimensions of the elements related? We try to follow the lines and the shadows of the old facade. If we do that in an artistic way, I am convinced that it is a better way than trying to create a perfect imitation. I also believe it is the best way in an urban environment.

It is always a temptation and a challenge to make a new facade. To create a contrast. But in an urban environment it can be a disaster. In a landscape, or if we have a group of buildings, we have other conditions to consider. It is always dangerous to mix styles and colours. Therefore, it is important to have a clear plan.

2.3 Interesting renovationobjects

During the fifties and sixties in Sweden many houses of poor quality were built, both architecturally and technically. They were of three stories or multistories. The aim now must be, to improve them in both ways. Presently we have the opportunity.

2.4 Multistorey-buildings

I think these buildings are the best to renovate with steel sheet. We need fresh-looking colours. Reflections give lightness and that is what we can get from coated metal-sheet. These buildings have no old tradition and are sometimes already clad with metal-sheet.

Remember to be careful and use light colours. A failure is visible from a long distance and difficult to change.

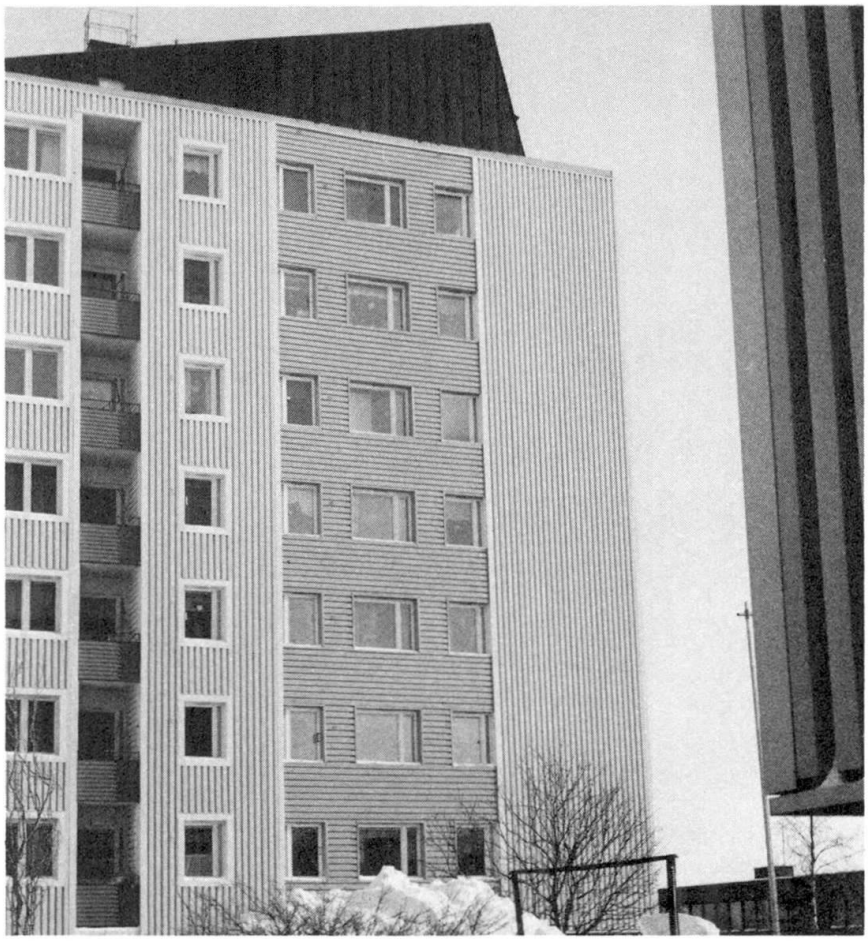


Fig. 3 High-rise-buildings are simple to renovate with steel sheet

2.5 Two or three storey houses

These houses are the most common in Sweden.

Which type of profile is best? If you want the facade to look as if it is clad with wooden boards, that is easy. Our common profiles are often asymmetric and you can apply them with the wide flange out- or inwards.

If you prefer the wooden appearance, it is important to be consistent when making the surrounds of doors and windows and the flashing of corners, etc.

2.6 One-family houses

These houses can be treated more individually and be handled more freely.

2.7 Type of profile and the direction

Profiles with the same partitions per unit look similar, even if the depth is the same.

Symmetric profiles are monotonuous compared with asymmetric.

Horizontally applied profiled sheets produce more pronounced lines than the same profiled sheet installed vertically, as most light comes from above.

The pattern of the profiling is more pronounced on horizontally applied sheets and does not disappear when viewed from a distance or at an angle.

Fig. 4 Horizontally applied profiled steel sheet gives more pronounced lines than vertically

2.8 Colour

The colour is more important than the profiling especially when viewed from a long distance. Of course, in a town, when you walk near the building, the profiling is also important.

There has been a tendency to use many strong and bright colours. To do that needs a skilful artist. It is safer to use just a few-colours and prefereably the lighter ones. My suggestions are to:

- Choose light colours rather than strong
- Use just a few colours than many
- Have the whole situation in mind and remember the neighbourhood
- Check colours with large samples
- Take advice from professionals
- Take coatings of first quality

3. TECHNICAL DETAILS

3.1 The entrance

The entrance is the most important part of the building. It should make you welcome and also reveal the owners attitude.

In living houses the surrounds of the entrance is often clad with marble or real stone. It is important to take care of these decorations and use them together with the new material. Steel sheet cladding around the entrance is easy to damage. It is better to use wood or real stone. Bricks are also useful, but the combination with profiled steel sheet is dubious due to the fact that the brick-pattern do not compliment the line-pattern of the profiling. They are similar but not similar enough.

Fig. 5 It is important to take care of the entrance, balconies etc

3.2 Balconies and bay-windows

What charactaristics of the house must we take care of? Such elements are balconies and bay-windows. Keep them and brush them up. Perhaps you can paint them in a contrasting colour.

3.3 Mouldings and joints

All joints and mouldings must be planned and sometimes used as decorative elements.

Joints can be made with

overlap which requires exact profiling

flashing which is more visible than overlap

foldings which are best for the flashings´ joints

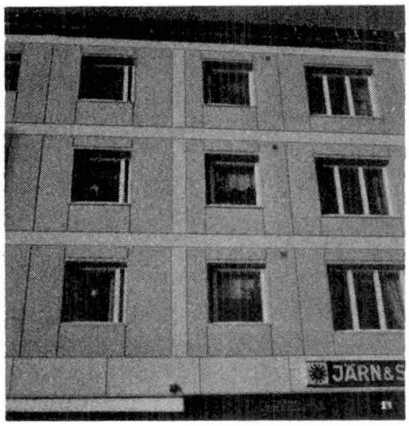


Fig. 6 Steel sheet units are similar to rendering

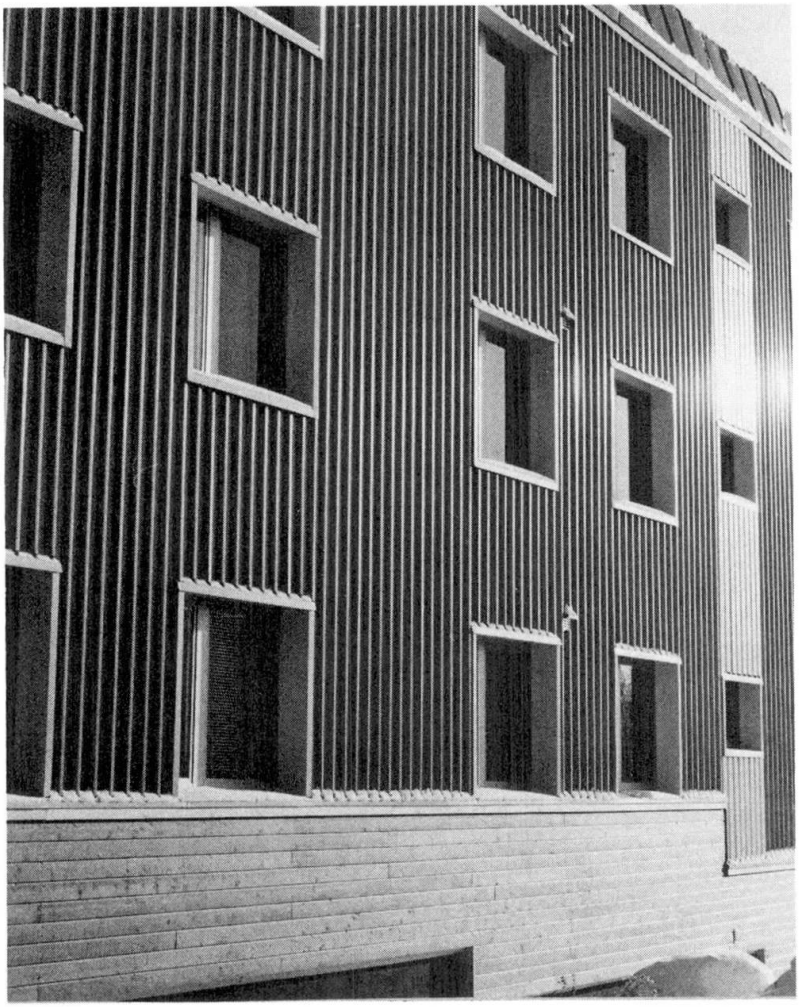


Fig. 7 A base clad with woodpanels is more resistant against damages than steel sheet

3.4 The base

Steel sheet is easy to damage and is not suitable as a base material. We can use a protection-rail of wood or metal. Even bushes can be useful.

An interesting way is by using woodpanels or the ground storey and make this element a part of the architecture.

3.5 Corner

The corner flashing can be accentuated with contrasting colour as in wood-architecture or more anonymous without contrasting colour like a rendered facade.

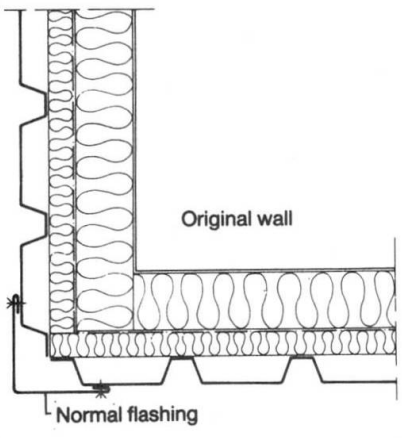


Fig. 8

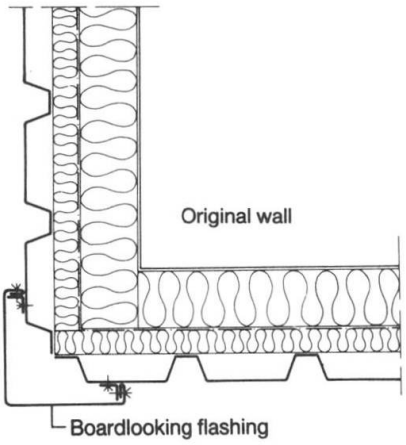


Fig. 9

With horizontal assembly the corner flashing can be the same as with vertical assembly. It can also be bevelled without flashing. But that is difficult and expensive.

The outer corner will often be damaged and need often an underlayer of wood or steel-profile.

3.6 Windows

Extra external insulation increase the thickness of the wall and the window-reveal appears deeper. Technically it is an improvement, but it can be an aesthetic problem. With white or light colour on the reveal the appearance will be improved. Even piched reveal can be used. The moulding around the window must not be too wide, preferably not more than 100 mm because of buckling.

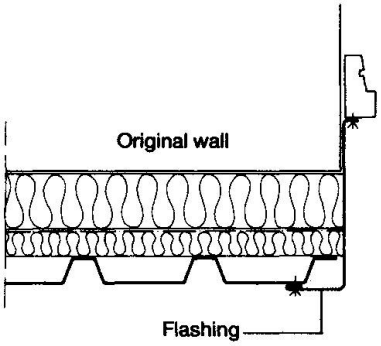


Fig. 10 Side section with normal surrounds

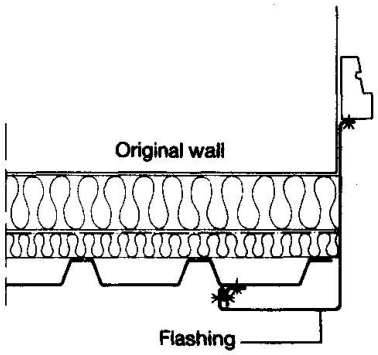


Fig. 11 Side section with boardlike surrounds

4. HEATINSULATION

4.1 Internal insulation

When the building is of historical or cultural interest and you want to preserve it, you must have the insulation internaly, because external insulation changes the appearance.

4.2 External insulation

External insulation is technically the best. Experience has revealed that the improvement is better than calculations show, depending on following criterior.

.22 Airtight walls

The improved insulation reduces the number of unintentional air changes by 0.1 - 0.3 times per hour compared with the original wall. That gives an improvement of 0.2 $W/m^2\ ^oC$.

.23 Reduced thermal bridges

A practical improvement of 0.15 $W/m^2\ ^oC$ is possible due to the covering of the ends of the floor structure.

.24 Dryer walls

The new cladding protects the original wall from water and the insulation-ability increase.

.25 Warmer internal surfaces

Warmer internal wallsurfaces are more comfortable and lower internal air-temperature become more acceptable.

.26 Sound-proofing is improved

5. CONSTRUCTION

5.1 The condition of the original wall

It is important that the surface of the wall is smooth. Ventilated airspace behind the new insulation can take away almost the whole new insulation-effect.

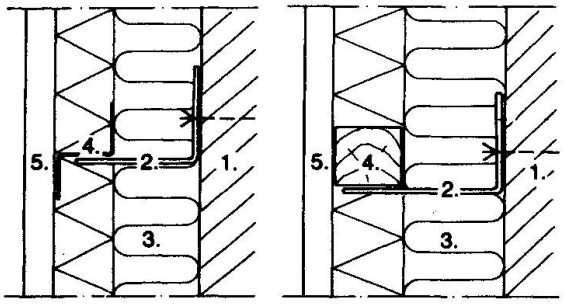
5.2 Heatinsulation

The most common material is mineral wool. It permeates the moisture and there is no risk for condensation inside the insulation. It is inflammable. The most economic thickness depends on the insulation capacity of the original wall.

To give a minimum of thermal bridges the insulation is applied with two layers. Gaps between the insulation and the cladding rails must be avoided.

The inner layer is continuous. The other is applied between rails and has lower air permeability with a papermembrane to protect against wind.

Between insulation and the cladding is a ventilated space and this is normal, when using profiled steel sheet.



1. Original wall
2. Fixing angle
3. Supplementary insulation
4. Cladding rail
5. Profiled steel sheet

Fig. 12

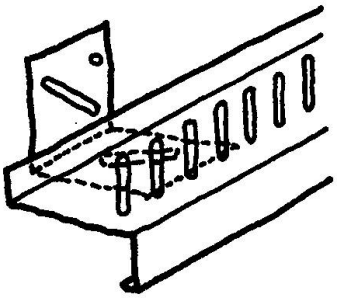


Fig. 13 Adjustable cladding rail

5.3 Cladding rails

The rail material is steel or wood. Most common are zinkcoated z-purlins. Wooden rails are not useful when fire-resistance is needed, as for instance in highrise buildings. In order to compensate for irregularities in the facade adjustable rails can be used.

The rails are normally applied horisontally with a distance between 1.0 - 2.0 m. Normal distance for small buildings is about 1.2 m.