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Durability of Protecting Layers on Steel Cladding Sheets

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Summary

The necessity of improving heat insulation in existing buildings, especially those erected before 1991, arose as a result of changes of the thermal insulation standards as well as from the tendency decrease heating costs. This may be realised in several ways. One of the methods frequently used is applying cladding steel sheets with painting protective layers. Observations show that their durability is limited. Maintenance carried out at proper times can reasonably elongate the service life of cladding sheets.

Keywords: durability, facade, heat insulation, residential buildings, cladding sheets, corrosion, protection layers, profiling.

In the last few years, requirements for the insulation properties of external building walls were raised in order to decrease heat loss in buildings. Heat insulation is being performed in many existing buildings. One of the methods of insulating the external walls is using mineral wool insulation shielded from the external side by profiles made of steel sheets. This method was used particularly in the case of high multifamily buildings, in which, apart from energy savings, fire safety considerations are also important.
The durability of the sheets is determined by three essential factors:

- the quality of protecting layers on the surfaces of the sheets,
- usefulness of the sheets for processing,

- corrosion aggressiveness of the environment.

Protection layers on typical sheets consist from two elements: zinc coating and lacquers coating.
Only sheets with a thickness of zinc not less than 275 g/m^2, which corresponds to 20 μm from each side or Al-Zn alloys of the same thickness are accepted in Poland for making facade surfaces.
In the framework of work performed in the Building Research Institute investigations were carried out for more than one hundred objects exploited in various environments.
Investigations were carried out for residential, industrial and municipal objects. The range of damages of the protection layers and the degree of the environment aggressiveness were determined.
Investigations were performed in characteristic spots of facade sheets: bends of flat surfaces of sheet edges of cuttings and in mechanically damaged places. On the basis of investigation results obtained according to the classification given below, the relative shortening of the service life of coating in different places of the sheet profiles were determined. The results are given in table 1.

Table 1

Relative shortening of the service lives of coating on profiles from cladding sheets (in relation to the durability of the coating on a flat surface)

Position on the profile	Relative durability of coatings
Flat surface	1
Sheet bending arising at profile forming	0.7 -0.9
Cut edges of elements	0.5 - 0.8
Mechanical damage of protection layer: scrapes, scratches, indents	0.3 - 0.5

As can be seen from the Table the durability of facades are effected not only by the quality of coating but also the method according to which profiles are made. In practice deferent profiles occur, for which the bending radiuses are very small. In these cases indications of damages to the organic coating are observed in just a few years.
Exploitation investigations carried out in Poland were performed for sheets used for less than 20 years. The sheets were usually covered with an acrylic paint layer, practically not in use anymore. The results of the investigation consisted of determining the estimated durability of sheets given for different aggressiveness of the environment.

Table 2

Estimated durability of protection coating on sheets

Degree of aggressiveness of the environment	Durability in years
Very weak corrosion interaction	30 - 50
Weak and strong corrosion interaction	8 - 20
Strong corrosion interaction	1 - 4

Cladding sheets are finding broader use in Poland. Many investors are interested in making facades from such sheets. Up to now the sheets were considered as a product of great durability. However the investigations have shown that the durability of the sheets is limited to approx. 20 years. Extending at the durability can be achieved by applying specially developed renovation coverings. The durability is defined by the durability of the coating itself on flat surfaces and methods of making profiles and cutting sheets.