VI–2. Thin Facing Bricks and Additional Insulation of Old Houses

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ABSTRACT

The need to improve heat insulation in houses, erected when the energy costs were of minor importance, has increased in many countries, especially in the northern ones.

During the last years in Sweden there has been a keen urge to cut down the energy consumption in old houses. One step is to diminish the heat transport through the walls. Known is that in most cases external insulation is preferable. Then the wall must have a new facing.

During many years it has been common to use bricks in connection with additional insulation in one-family wood houses. The method has not been so common in blocks of flats even though it has been used there.

One reason has been the difficulties to get a cheap and excellent anchorage of the brick to the existing stonewall.

During the last years we have brought forward a new simple anchorage method. It is based on a steel wire which gets moulded into a drilled hole in the existing wall.

Based on this inter alia a system for additional insulation with up to 140 mm mineral wool combined with a 60 mm brick facing has been developed.

Different foundation parts are used. Among these is noticeable suspension of prestressed bricklayers in steel cantilevers.

The method has been examined by the Swedish National Board of Physical Planning and Building (Statens planverk) and has been accepted for walls up to 12 m high.

Houses are products with extremely long time of use. In Sweden it is calculated with 60 years for new houses. However many houses are much older. Erection of new houses every year amounts to 2–3% of the existing stock of houses. This also leads to the fact that the overwhelming part of the houses have been erected at times with quite other conditions than those existing today. One example is the heat insulation of the houses. Most houses were built when the costs for the energy were of minor importance. With increasing oil prices the need to improve the heat insulation of the houses has also increased. This fact is especially visible in the northern countries.

During the last years in Sweden there has been a keen urge to cut down the energy consumption in old houses. One step out of many is to diminish the heat transport through the walls. Then it is possible to put the additional insulation either on the inside or on the outside of the wall. Except for the fact that internal insulation reduces the dwelling space there often arises many technical problems. It is hard to avoid points with higher heat transportation at, for instance, connections to the system of joists. The balance of moisture in the wall can be altered in an unfavorable way.

For these reasons mostly an outer insulation is preferable. Using this insulation the wall must be completed with a new facing. Many materials have been used, for instance, light and thin materials as sheet-metal and wood panel. Regarding the freedom from maintenance it has also been very interesting to get the opportunity of using facing brick.

Before entering upon solutions of problems I will in a more general way take up the differences between problems in new-erection and alteration in old houses.

By new-erection, in most cases, the decision-takers are technically rather qualified while the decisiontakers/owners in old houses are a very heterogeneous group. To avoid mistakes in the planning therefore it is necessary to use very carefully worked-out safety solutions. By new-erection every detail is designed to fit the totality. By rebuilding or extension you stand with an existing construction and have to search good connections between the old and the new parts, for instance, a new facing.

During many years it has been common to use brick in connection with additional insulation in one-family wood houses. The results have been good. On the contrary, the method has not been so common in blocks of flats even though it has been used there.

Most bigger houses in Sweden have a framework of stone material (concrete, lightweight concrete or brick). To get an anchoring of the facing brick to the framework in new houses has not been a major problem. But is has been hard to find a technically satisfactory and also cheap method for anchoring in old walls. Certainly there exists different types of expanding anchors that could be used. These could carry considerably higher loads than those needed for taking up windloads on the facing brick but meanwhile they were unnecessarily expensive.

To a brickwork facing it was needed cheap anchorings which did not need to be designed for too high loads. 0,25–0.50 kN on each anchoring point could be enough.

Some years ago the idea arose by the Federation of Swedish Brick and Tile Manufacturers. It ought to be possible to work with anchorings grouted in the existing wall. The method ought to have good aging qualities. After introductory tests which indicated that the idea was feasible a testing and development programme was established. It proved that the idea fulfilled the expectations.

Based on this idea a new system for facade restoration was established. To explain it in a simple way we have in Sweden two types of checking that a construction complies with the requirements of the society

1. the local housing committee scrutinizes the designs and the work referring to the common directions

from the National Board of Physical Planning and Building

2. a manufacturer or other person can demand a scrutinizing by the National Board to solve if the building detail lives up to the demands. Then a typecertificate is issued. For the facade-restoration system it was natural to search a typecertificate.

DESCRIPTION OF THE SYSTEM

The most common size of bricks in Sweden is 250 × 120 × 62 mm. To a small degree two modulized sizes are used, 287 × 87 × 87 mm and 287 × 87 × 62 mm, and finally a thin size 250 × 60 × 62 mm. The latter is firstly meant for facings. The National Board has in its general directions accepted brick facings down to a thickness of 85 mm independent of the height of the wall whereas an upper limit of 6 m has been put on 60 mm bricks.

It has been important to reduce the thickness of the wall by facade-restoration as well as the weight. These were the reasons why we tried to get a typecertificate for using the 60 mm brick for higher walls if special designing advises were followed.

The system has been certified for walls up to a height of 12 meters with insulation up to 140 mm thickness.

FOUNDATION

Different types of foundations have been used during the past years. One imperative demand you have to put on these is that they shall have such a resistance that they stand in working order during the expected rest-life of the house.

New concrete base

In the existing base holes are drilled with a diameter of 33 mm. In these are placed so-called perfo-tubes and studs of 20 mm reinforcing bars are cast. Using these as mountings a new concrete base is reinforced and cast.

Basewall

In the cases a new insulated wall is wanted in the basement it can be designed according to a more complicated method shown in the typecertificate.

Prestressed bricklayers

As base for the construction is also allowed prestressed bricklayers. These are fixed to stainless angleirons. The angleirons are attached to the existing wall with bolts.

In a further development of this solution the prestressed bricklayer and the angleirons are prefabricated to one unit that is attached to the wall.

Anchoring of the facing

In the existing wall holes are drilled with diameter 12 mm to a depth of about 100 mm. The holes are blown clean from drilldust. The holes get prewatered by rich injection about 20–30 minutes before moulding the holes.

The grouting can be carried out in two ways.

a the hole is filled completely with cement mortar 1:1. Then the steel anchor is applicated.
b the steel anchor is applicated first. Then the cement mortar is inserted through a nozzle at the side of the anchor.

The anchor must be fixed until the mortar begins to stiffen.

At a temperature of plus 12–15°C the mortar must harden at least one day before the anchor may be charged. To warrant a good adhesion between mortar and anchor the latter has been furnished with bendings on the part that gets grouted.

The part of the anchor that is meant to be used in the facing can be given different designs.

If the anchor has sufficient length it can be bent in a 90° angle in connection with the bricklaying. If the anchor is ended with a loop it can be completed with a movable part that gets masoned into the new brickfacing.

As regards the grouting into the old wall and the free length of the anchor (between old wall and new facing) following forces are allowed in every anchoring point.

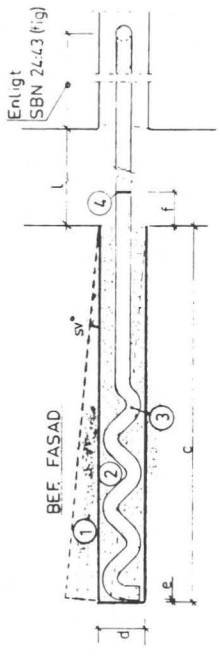
Material in old wall	Free length 60 mm	100 mm	140 mm
Concrete	0,40 kN	0,40 kN	0,40 kN
Lightweight concrete	0,55 kN	0,55 kN	0,40 kN
Brick	0,70 kN	0,70 kN	0,40 kN

Regarding the fact that 60 mm bricks are allowed to be used out over the usual limits the demands of anchoring have been put a bit keener than usual.

Maximum distances between anchors are put to 500 mm vertically and 1000 mm horizontally and normally shall about 4 anchors on each m^2 be used.

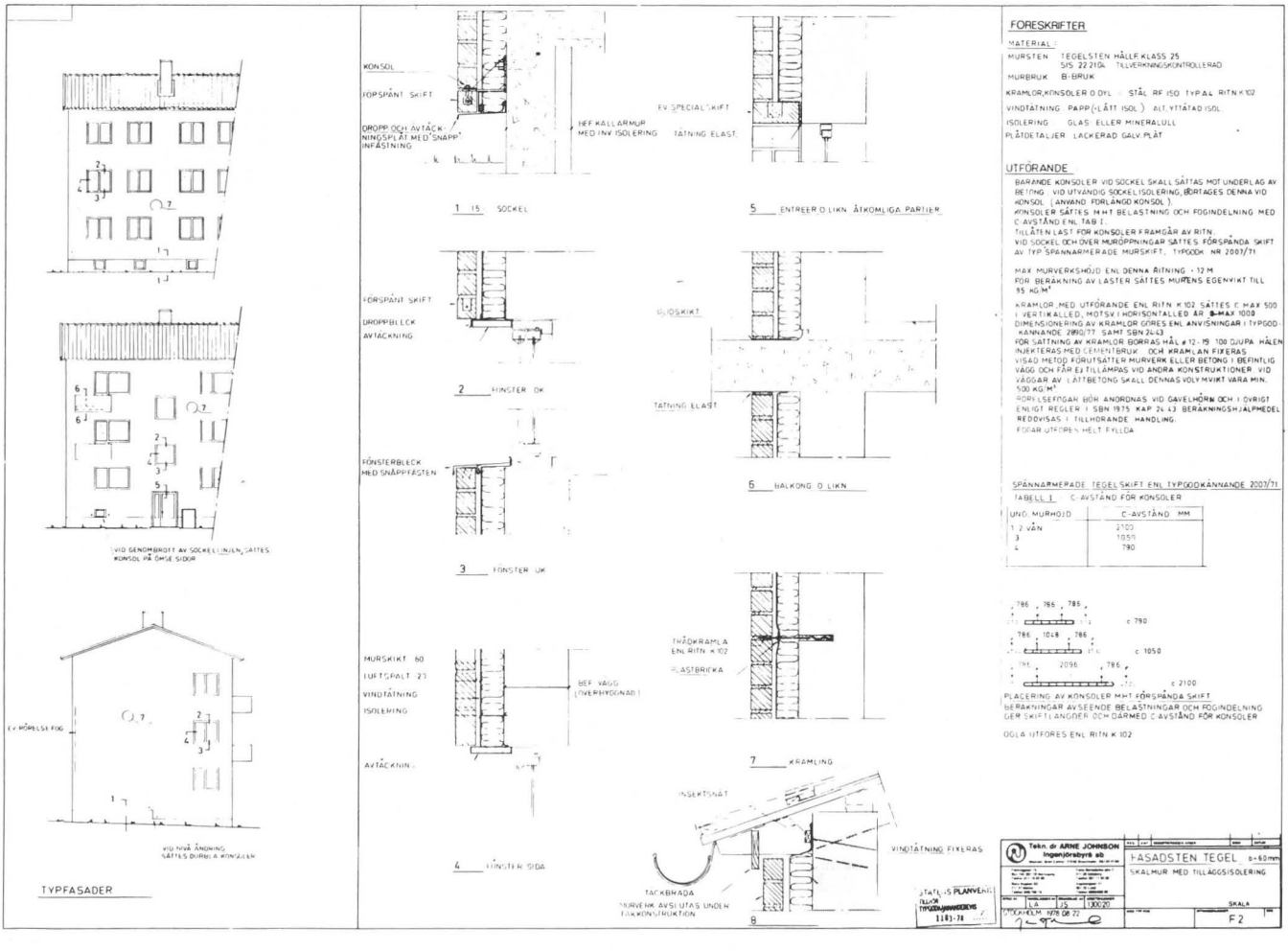
Movement joints

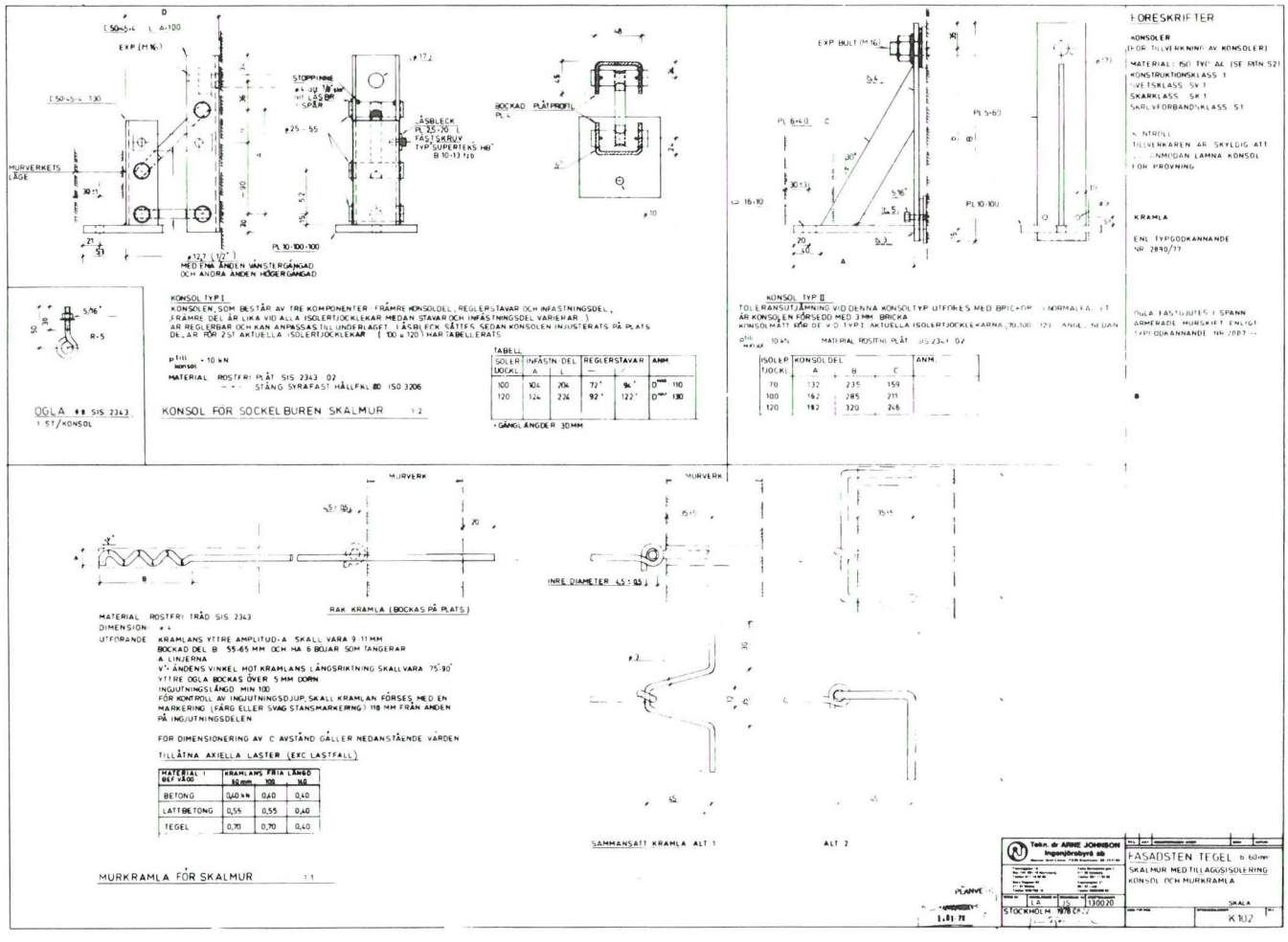
Vertical movement joints shall be designed to diminish movements in anchoring points and to diminish the risk of damages. The distance between these may not exceed about 20 meters.

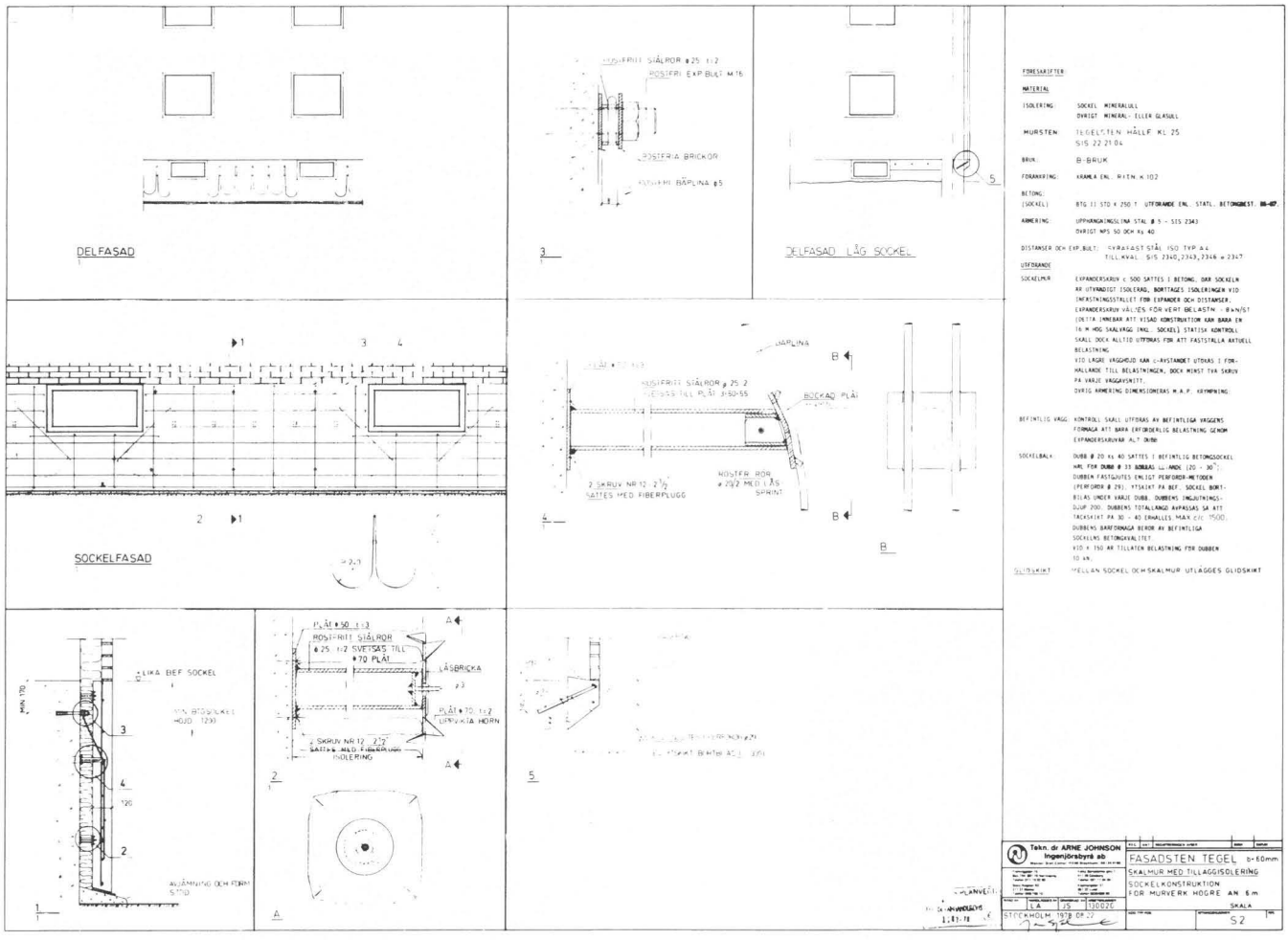


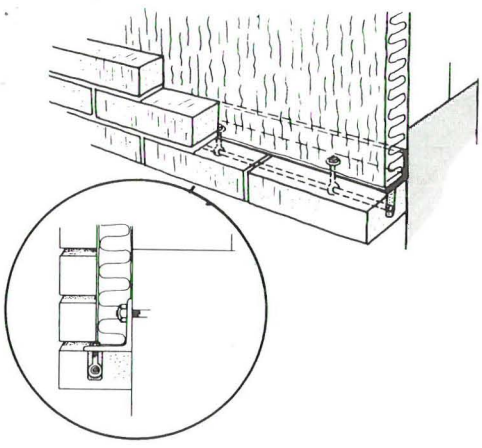
1 = EXISTING WALL — CAN BE CONCRETE, BRICK OR LIGHTWEIGHT CONCRETE
2 = GROUT — SHALL BE CEMENTMORTAR 1:1 WITH GRAINS ≤ 0,75 MM
3 = ANCHOR — LENGTH ACCORDING TO THE PRESENT CONSTRUCTION
4 = MARK
c = DEPTH OF HOLE — SHALL BE 100 ± 5 MM
d = DIAMETER OF HOLE — SHALL BE 12 MM
e = NOT USED PART OF HOLE
f = FORWARDING — SHALL NOMINALLY BE 10 MM, MAY VARY ± 5 MM
l = LENGTH OF ANCHOR — ACCORDING TO REGULATION FROM NATIONAL BOARD
sh = SLOPING HORIZONTAL — MAY BE 5° UPWARDS
sv = SLOPING VERTICAL — MAY BE 5° UPWARDS

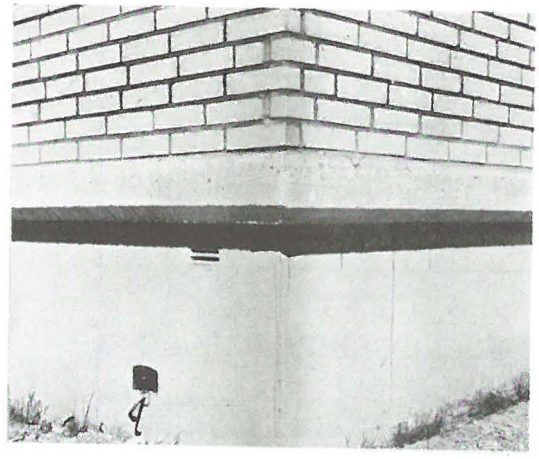
BRICKS BY WINDOW
HÖRNPETTRING = CORNER STONE
SPÄNNARMERAT SKIFT ÖVER FÖNSTER =
= PRESTRESSED BRICKLAYER OVER WINDOW

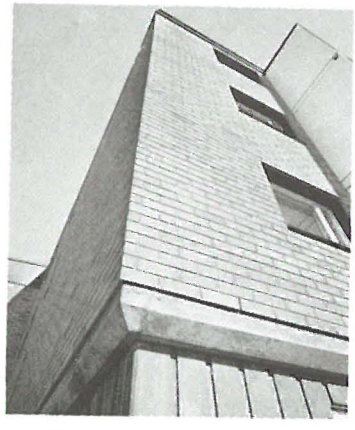


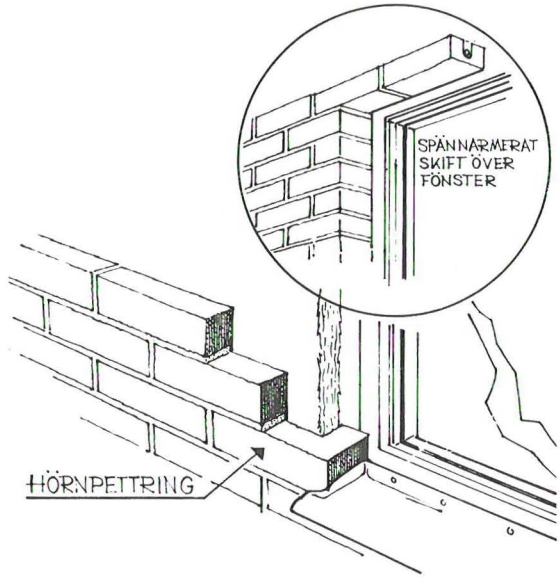

FÖRESKRIFTER
KONSOLER
(FÖR TILLVERKNING AV KONSOLER)
MATERIAL: ISO TYP AL (SE FATN 521)
KONSTRUKTIONSKLASS 1
VETSKLASS SV 1
SKARKLASS SK 1
SKRUVFÖRBANDSKLASS S1
KONTROLL
TILLVERKAREN ÄR SKYLDIG ATT
FÖRANMODAN LÄMNA KONSOL
FÖR PRÖVNING
KRAMLA
ENL TYPGODKÄNNANDE
NR 2890/77
KONSOL TYP I
KONSOL TYP II
KONSOL FÖR SOCKELBUREN SKALMUR
MURKRAMLA FÖR SKALMUR
RAK KRAMLA (BOCKAS PÅ PLATS)
SAMMANSATT KRAMLA ALT 1
ALT 2
FASADSTEN TEGEL
SKALMUR MED TILLÄGGSISOLERING
KONSOL OCH MURKRAMLA
STOCKHOLM

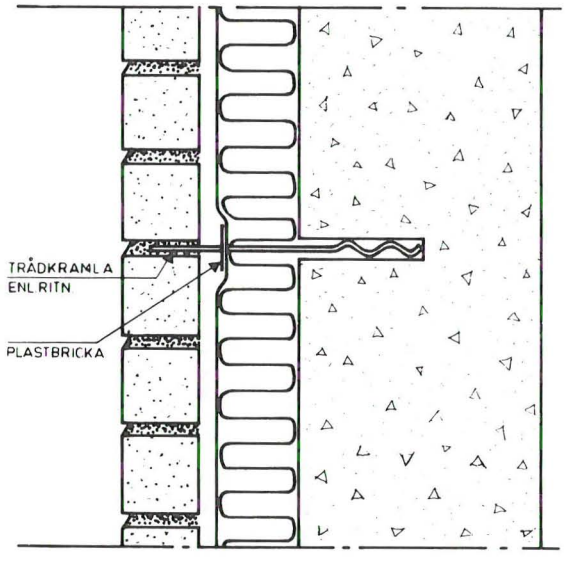

DELFASAD
SOCKELFASAD
DELFASAD LÅG SOCKEL
FÖRESKRIFTER
MATERIAL
ISOLERING
MURSTEN
BRUK
FÖRANKRING
BETONG
ARMERING
DISTANSER OCH EXP.BULT
UTFÖRANDE
SOCKELMUR
BEFINTLIG VÄGG
SOCKELBALK
GLIDSKIKT
Tekn. dr ARNE JOHNSON
Ingenjörsbyrå ab
FASADSTEN TEGEL
SKALMUR MED TILLÄGGSISOLERING
SOCKELKONSTRUKTION
FÖR MURVERK HÖGRE ÄN 6 m
STOCKHOLM 1978 OP 27
S2











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