

# Heat Insulation of Brick Construction

In Japan

## 日本におけるれんがを用いた断熱工法

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## Summary

In the seismic country like Japan, because of severe regulations on using bricks, the history of study on heat insulation of brick building is rather short.

With increased use of bricks in the cold area, the method of heat insulation greatly improved recently.

This paper reports the method of outer insulation in external walls, insulation sashes, floor heating and re-use of ventilated heat.

日本のような地震国では、れんが建築に関する法規制の厳しさのため、れんが建築の断熱工法に関する研究はまだ歴史が浅いが、最近寒冷地におけるれんが建築の増加に伴い、断熱工法も進歩した。

特に外壁の外断熱については、建築物の温度変化の縮小、躯体の熱応力の低減の為に数多く使用されている手法である。

ここでは実例等をまじえ、我国におけるれんがを用いた断熱工法について紹介する。

## 1. Introduction

In North Europe, Canada or North America, heat insulation of brick building is well developed, but in the seismic country like Japan, because of severe regulations on brick masonry, the history of brick construction itself is comparatively short.

The traditional heat insulation method was to apply heat-insulating material inside of the wall, but this method allowed heat to escape from connecting parts of pillars, beams and slabs. It caused problems such as frost damage, cracks or condensation on the interior wall.

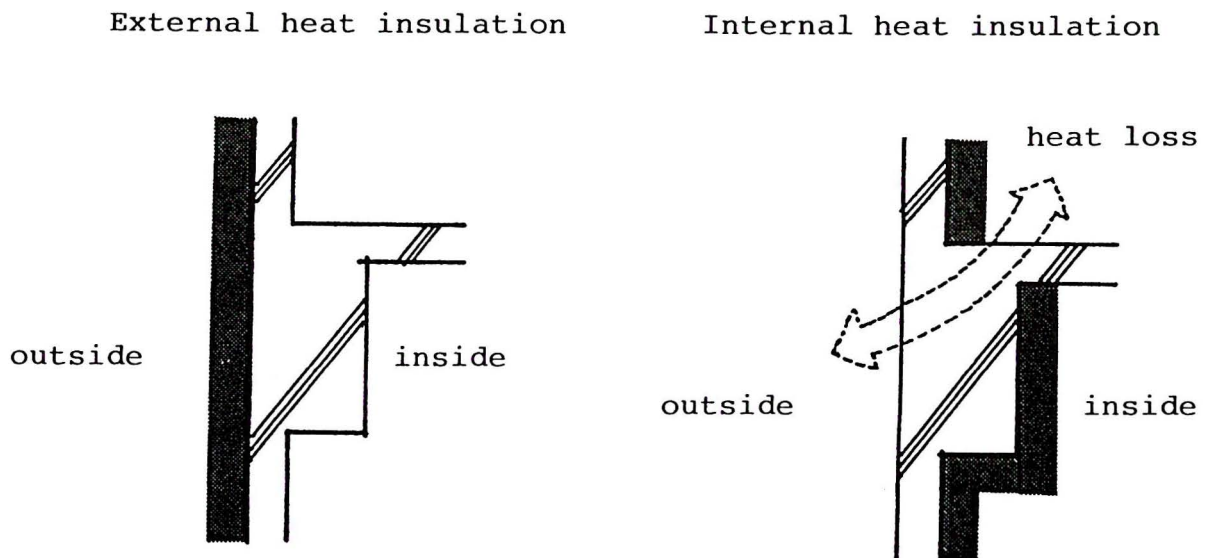
With increased use of bricks in the cold air, the external heat insulation method greatly improved recently.

This paper reports on the external heat insulating brick walls which are effective for energy conservation. The paper also reports the example of construction.

## 2. Comparison of External Heat Insulation and Internal Heat Insulation

Fig. 1. shows the difference between the external heat insulation and the internal heat insulation.

Fig. 1.



### 3. Merits and Demerits of The External Heat Insulation

#### Merits:

- (1) As the influence of the outside temperature change is small, it is easy to keep the room temperature.
- (2) Condensation on the inside wall can be prevented.
- (3) It can prevent cracks or neutralisation of concrete caused by the temperature change of the inside wall.

#### Demerits:

- (1) It requires the improved technics to secure safety against earth-quakes or strong wind.
- (2) As the heat insulating materials are generally flammable, it is required to apply fire-proof construction.
- (3) It costs slightly higher than the internal heat insulation.

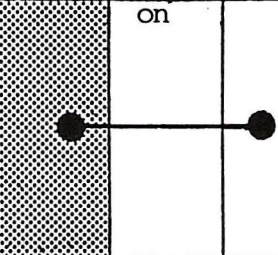
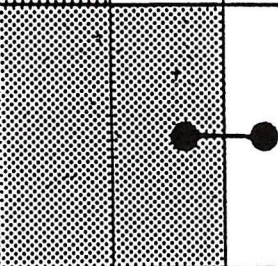
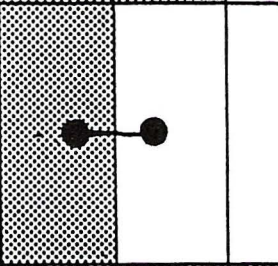
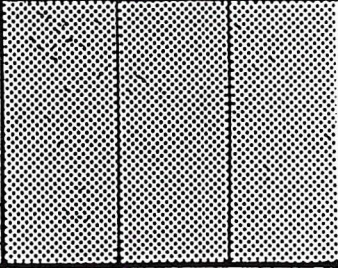
However, in the cold district where heating is necessary for long time of the year, by saving the heating expence, the slightly higher construction cost will not be considered as demerit.

### 4. Kinds of The External Heat Insulation

Table 1. shows varieties of the external heat insulation methods.

In these methods, heat insulating materials are applied onto outside of the construction body of concrete blocks, prefabricated concrete boards or bricks. The surface wall boards are fixed by the special metal ties set in the structure, leaving air space between the heat insulating material and the surface wall boards.

Table 1. Varieties of the external heat insulation

Type of Insulation	Explanation	Examples	Wall composition		
			surface	insulation	wall
External insulation	Popular insulating method Metal ties are used to fix surface walls	lath mortar external insulation Double masonry wall			inside
Heat Insulating Finish Method	Need heat insulating construction material Metal ties and adhesive agents are used to fix surface wall	Insulation bricks			
Heat insulating structure	Structure is made by heat insulating material and facing wall is bonded or fastened by metal ties	Foam concrete grouted at the construction site			
Monolithic insulating wall	Structure and surface wall are monolithic	External heat insulating brick masonry External heat insulating curtain wall			



## 5. The External Heat Insulation of Brick Masonry

### a. Brick-laying

The brick wall forms the surface for the structure with air space between the brick wall and the insulating material attached to the structure. The brick wall is reinforced for securing strength. In order to exhaust water by penetration through bond and condensation, flushing pipes and holes were inserted and pressure equalization between outside and air space was made by making ventilation through coping.

Fig. 2 shows the example of the building by this method and Fig. 3 shows the brick used.

Fig. 2      The building by external heat insulating brick masonry



Fig. 3      The brick used

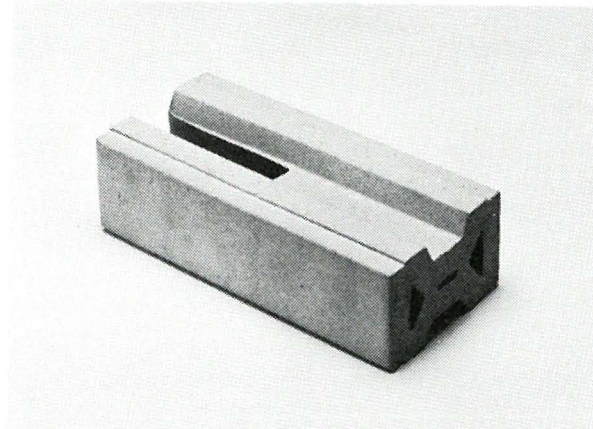


Fig. 4 Detail of reinforcing

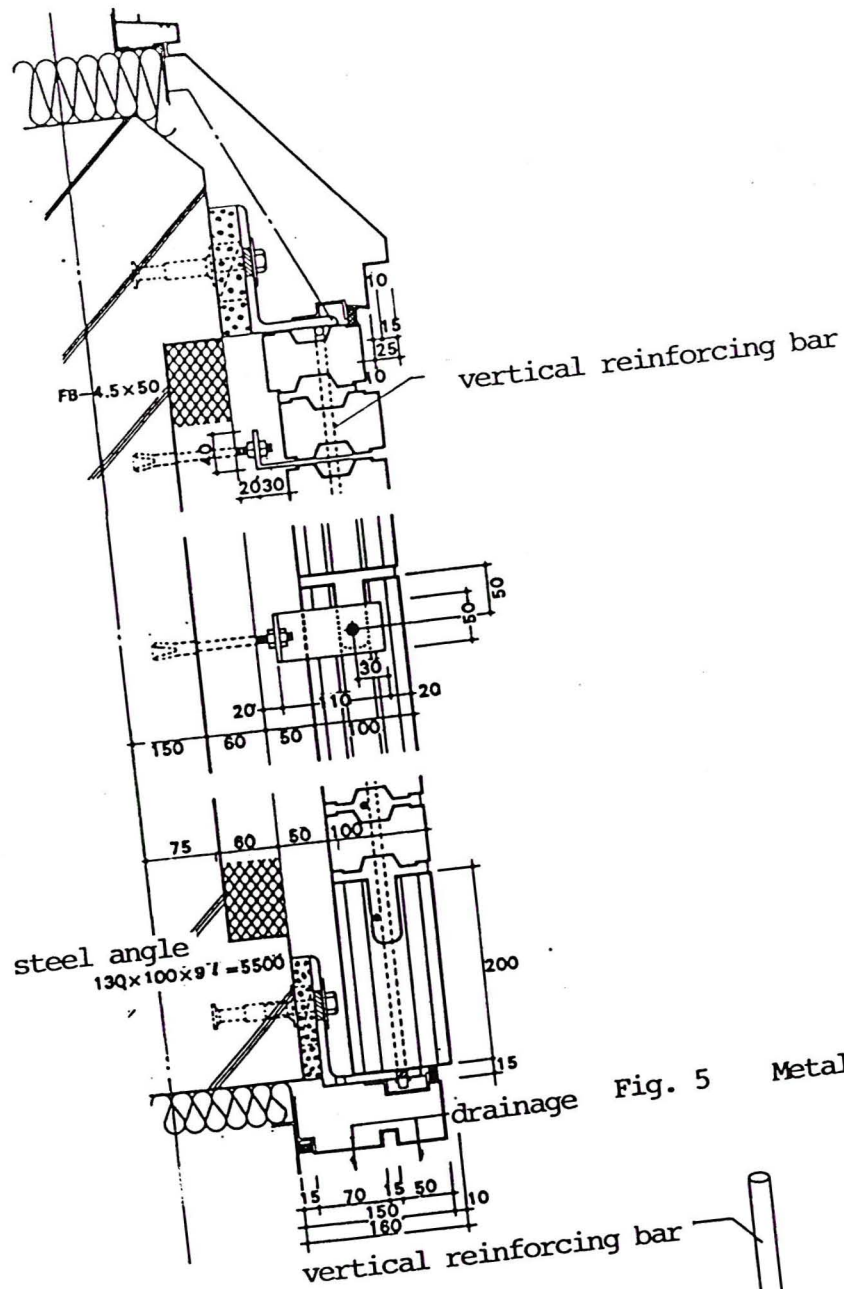


Fig. 5 Metal ties

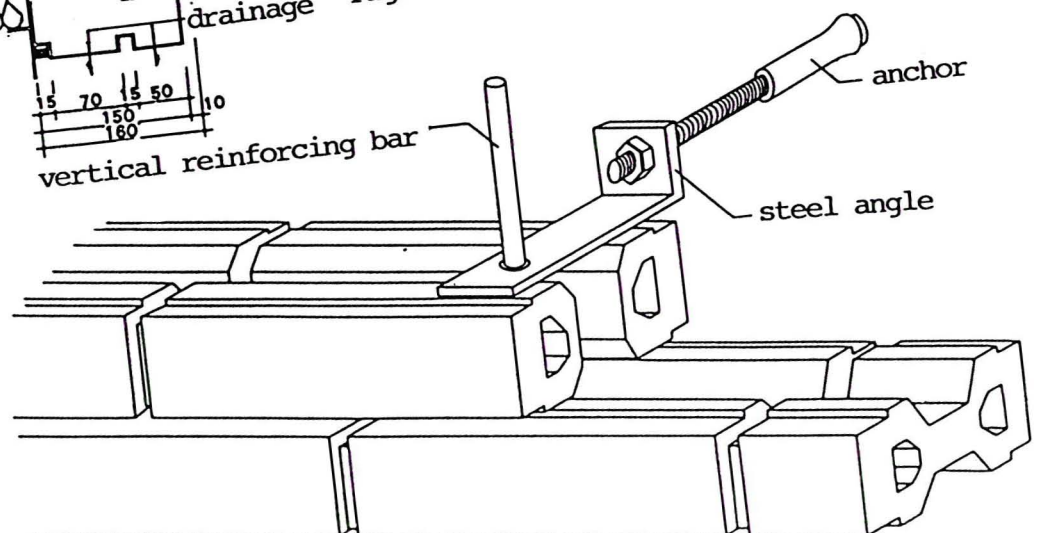




Fig. 6 Wall plan

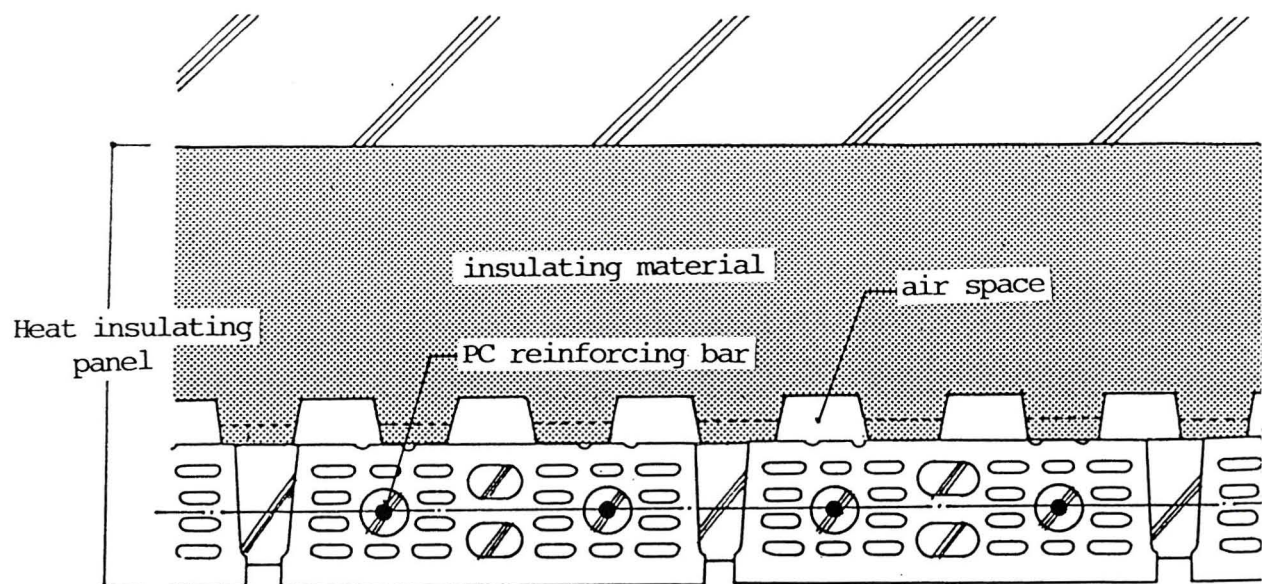
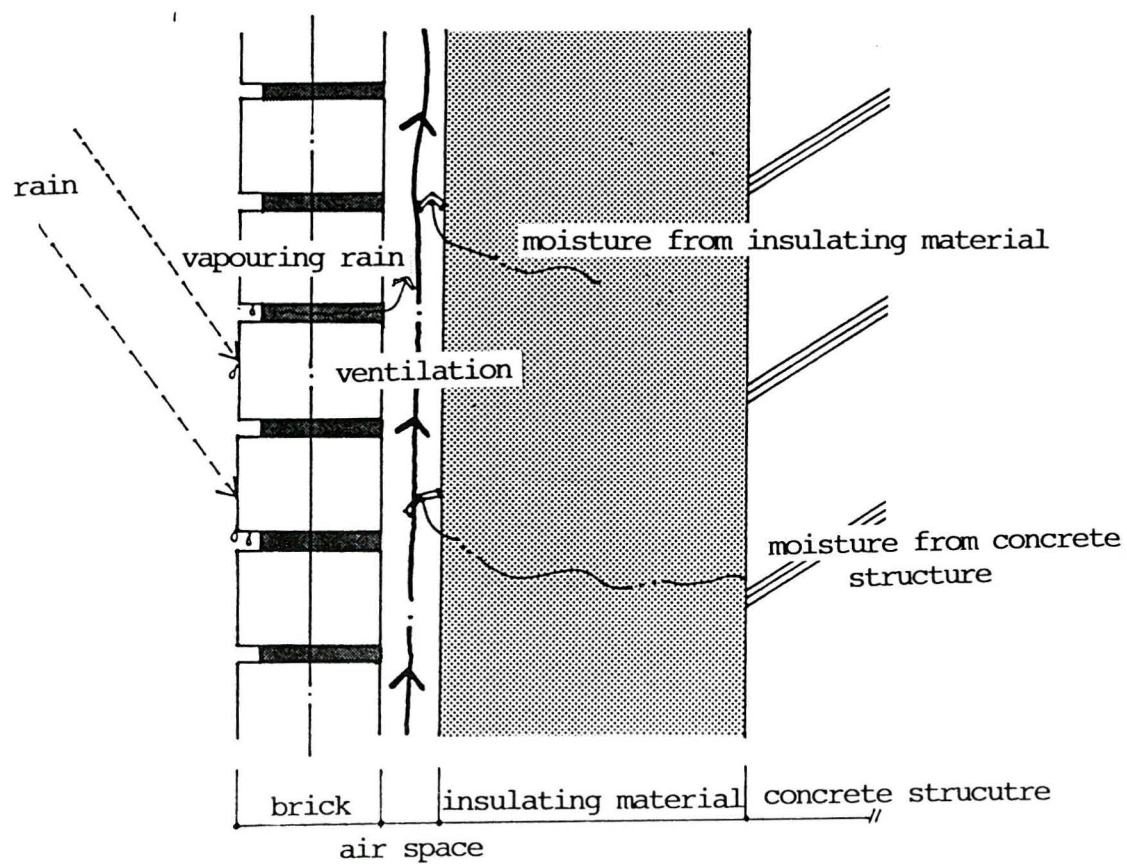


Fig. 7 Cross section



## b. Brick Panels

Fig. 8 and Fig. 9 show the special bricks for the brick panel external heat insulating construction, and installation work of the panel.

Fig. 8            Bricks

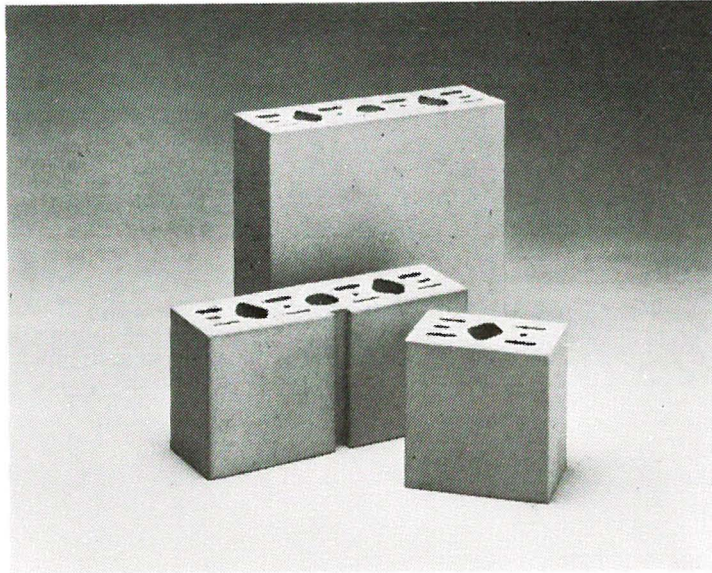
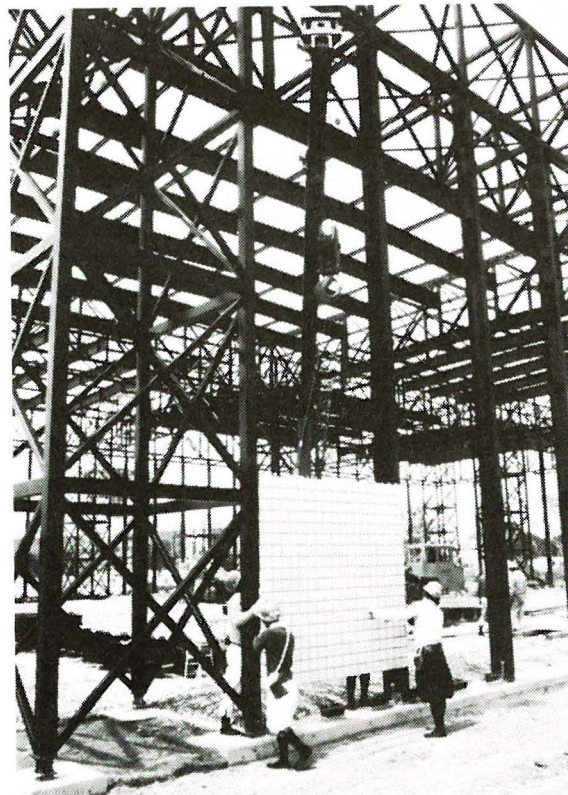


Fig. 9            Installation of the brick panel





For the brick panel, light-weight bricks are preffered, but they are less heat insulating. Therefore, the method to sandwich heat insulating material in the surface wall panel is developed. This method can also simplify the work at the construction site.

The heat insulating material should be moisture permeable, and rockwool or glasswool is generally used.

When the surface panel is heated by sunshine, the natural ventilation releases vapour to outside. The panel is also effective to prevent summer heat coming into the inside of the building.

The pre-fabricated panel will lower the cost and will help diffusion of this method.

