

INTER-ORGANIZATION CORRESPONDENCE

UNITED STATES STEEL CORPORATION

to Mr. H. A. Parker - 2
Asst. to Admin. Vice President
Steel Production

DATE April 28, 1967

FROM M. W. Lightner - 2
Vice President
Applied Research

SUBJECT EXPANSION PROVISION FOR
DIRECT-BONDED BRICK ROOFS
32.011-001

While direct-bonded brick roofs have generally proved very satisfactory, there still remains some uncertainty as to the best method of allowing for expansion with these brick. Two different approaches to the problem are now being made.

(1) Changes in the design of expansion-providing steel plates to prevent infiltration of kish into brick joints. Observations at Fairfield and Homestead have indicated this should be helpful in maintaining some expansion provision in the later stages of the campaign and also in slowing plate oxidation. At Homestead's request, E. J. Lavino is changing their dimpled expansion plate to provide one continuous dimple at the cold end of the case to seal against both kish and air.

(2) Harbison-Walker, following the improvements made in NUCON and NUCON 60 in the past year, now recognize the need for special expansion provision in direct-bonded brick, and, based on one promising roof at Ensley, have developed a preference for the use of asbestos sheets rather than expansion plates in allowing for plate growth. A roof of NUCON brick with asbestos sheets inside the brick case on two sides will be tried at Homestead in the near future.

In view of these developments, it was considered advisable to conduct some additional pier tests at the Applied Research Laboratory to study the behavior and relative merits of expansion allowances provided by dimpled plates and asbestos sheets. The piers used were composed of two brick pieces, steel plates, and various methods of expansion allowances, and were held for different periods under 25 psi load at 2000 F. (It will be recalled that earlier work indicated that maximum plate oxidation without creep occurred at 2000 F.)

Figures 1 and 2 show the continued permanent growth of brick piers with time at 2000 F when no expansion allowances are made. When either dimples or asbestos are used, however, quite different curves are obtained. As shown, when the piers containing expansion are subjected to load at room temperature, there is an initial deformation of either the asbestos or the steel-plate dimples. This deformation under 25 psi load amounts to about 25 to 35 percent of the asbestos thickness or about 25 percent of the dimple height. These figures are only approximate since there is undoubtedly some deformation (straightening) of the steel plates. When the same piers are heated to 2000 F, the plates and asbestos deform additionally and the asbestos also reacts partially with the steel plates. At this point (50 hours heating) the brick bonded by the steel plates show more adherence to the steel than those with the asbestos joint. Cut-sections of piers after 50 hours indicate that only about 20 percent of the steel was oxidized.

Further heating of the same piers results in a slight growth of both the piers using dimple type and asbestos expansion allowance. After 300 hours, both of these pier types were well bonded at the steel-plate joints and cut-sections showed that they were about 50 percent oxidized.

We would interpret these results as follows:

(1) The asbestos and dimple expansion arrangements appear to give very similar expansion relief. Both of these methods fall somewhat short of ideal, but represent the best type of allowance we have now. For example, after initial relief the piers made with either type allowance show growth from plate oxidation after an initial deformation. In this regard, it must be remembered that each position in the roof brick changes with time in respect to temperature and degree of oxidation.

(2) It is doubtful if asbestos has any advantage over dimples in providing expansion allowance. There seemed to be some feeling by the Harbison-Walker people that the presence of asbestos (unlike a void space) could restrict the growth of plates from oxidation and provide expansion just when it is required. However, we are advised by Bethlehem Steel Corporation that in their experience, asbestos used in conjunction with steel plates induces greater plate oxidation than plates alone.

We have discussed our findings with Harbison-Walker, as a result of which additional studies will be made by both laboratories. In the meantime, from these studies to date, we foresee no difficulties

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with the asbestos expansion trials, and believe such field trials should be continued to determine whether preferences may develop in the plants from other considerations such as bricklaying or patching.

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Attachments

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