Box Car Roof Design for Open Hearths

Evaluated at Inland Steel Co.

by P. W. Nutting

FOR many years, it has been the practice in Inland's No. 2 open hearth shop to install port roofs with a slope and hood arrangement similar to that installed in many other shops throughout the country. For example, on 200 ton furnaces, the port slope started at a point slightly in front of the bridgewall (12 ft 9 in. inside end buckstays) rising 3 ft in a longitudinal distance of 5 ft 9 in. The remainder of the port roof (7 ft 0 in.) was then installed as a level hood.

This design is common to many furnaces throughout the country and is probably a holdover from the old producer gas fired furnace. The hood section of the port roof gave very little difficulty, but the corbeled slope caused frequent trouble when it was necessary to do hot patching in this area. Because of this difficulty and also because of the widespread interest in port and port roof design, several roofs were installed with only a slope, omitting the level hood. It was a natural step from this design to the flat port roof or *box car roof* design.

Box Car Roof

The first installation was made on one of the 200 ton furnaces in April 1952, despite the opinion of many of the operators that it would not perform satisfactorily. All subsequent roofs on this furnace have been of the same design. Average savings on the original installation and the repair necessary during the campaign are shown in Table I.

The saving may seem to be of a minor nature when considered for an individual furnace, but when applied to the 24 furnaces in the shop, it becomes a major saving in rebuilding and maintenance cost over a period of a year. It is recognized, however, that this savings would hardly be justified if the change in port roof design resulted in lowered production rates or increased fuel consumption. No. 34 furnace, on which the original box car roof was installed, has always been one of the slower furnaces and it was hoped that the change in port roof design might improve this condition.

Average production rates for the past three months for the furnaces with conventional port roofs was 17.9 tons per hr, tap to tap, while No. 34 furnace averaged 18.4 tons per hr. During the same period, fuel consumption on No. 34 furnace averaged 0.3 gal per ton less than the furnaces with conventional port roofs.

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On the basis of these results, it was decided late in 1954 to extend the installation of box car roofs to all furnaces in the shop. Since then, as each furnace came down for rebuild, the necessary changes in the furnace iron work have been made and box car roofs installed. Production rates on the 200 ton furnaces so altered indicate a higher tons per hr figure on these furnaces than on those with the old type roof and no significant difference in fuel consumption. However, it is felt that sufficient data is not yet available to prove that the change in port roof design has resulted in increased production. The box car design, however, gives at least as good performance in respect to both production and fuel consumption.

Roof Performance

Operators have frequently found that a practice or design which worked satisfactorily when applied experimentally to one furnace, does not prove equally satisfactory when applied to other furnaces. It was found on the original installation that the port section of the roof showed little wear during the full campaign, requiring virtually no patching. On subsequent installations, this has not been true, and on several occasions this section of the roof was replaced at less than 200 heats.

On No. 34 furnace, no excessive wear on the uptakes or end panels was indicated, but on similar installations on other furnaces, particularly in the case of the 175 ton furnaces, uptakes and neck arch supports have actually been washed out. Whether or not this is the result of the change in port roof design or some other operating factor has not yet been determined. There is little question, however, that the path of both the incoming and outgoing gases have been changed, both in the uptakes and under the port roof. This may be responsible for the difficulties being encountered. As a result of the above difficulties, the installation of box car roofs at No. 2 open hearth has been halted until a better evaluation of the program can be made.

Table I. Average Savings Using Flat Port Roof

Cost Item	Savings as Compared to Conventional Roof, \$
Mason	280
Labor	243
Carpenters	517
Material	6969
Total	8009