BASIC OXYGEN FURNACE LININGS AT ALIQUIPPA

Basic oxygen steelmakers have been searching for refractories which will provide lining life at reasonable cost. This article is a progress report on the results of using several types of basic brick at the Aliquippa works of J & L.

Based on a paper by J. N. Albaugh

Since the introduction of the LD basic oxygen steelmaking process to the North American continent in 1954, steelmakers have been investigating refractories with the aim of finding a brick which would be the least expensive per ingot ton, and provide a sufficiently long lining life.

Initial tests at Aliquippa works were run on tar-bonded magnesite brick containing 70 to 74 pct MgO and 10 to 15 pct CaO. The first eight linings averaged 131 heats with refractory consumption of 51 lb per net ton for 54-ton heats with oxygen flow of 3800 cfm. Lining failures on the charging side of the furnace led to the installation of a pilaster 27-in. thick on that side of the furnace; the result was an increase in lining life; however, with improvements in charging techniques, the pilaster has been eliminated. It was found that failures did not occur below the bath level in the furnace; consequently, the brick work in the lower 6 ft of the furnace was reduced in thickness from 27 in. to 22.5 in., and subsequently to 18 in. without any detrimental effects. This reduced the working lining by 12.5 tons and proved to be economical.

In March 1958, heat-size was changed from 54 to 81 tons, and attempts were made to reduce refining time by increasing the oxygen flow rates. Rates of 6500 cfm and above increased refining rates from 2.5 to 4 tons per min, but resulted in greater wear in the cone section. To alleviate this problem, the working lining of the cone section was increased from 13 to 16 in.

Changing over to tar-bonded dolomite-magnesite brick, lining life averaged 190 and 159 heats with brick consumption at 19.65 and 24.10 lb per ingot ton, respectively, for two investigating periods. Further improvement in lining life was obtained through the use of 100 pct tar-bonded magnesite brick. The initial six linings had an average life of 233 heats with brick consumption 12.28 lb per ingot ton, and a campaign time of 7½ days. To further increase the lining life with the magnesite

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refractory, 21- and 24-in. bricks were installed in the barrel section of the furnace to replace the 18 in. brick. As a result, the following 21 linings averaged 259 heats with a brick consumption of 16.77 lb per ingot ton. However, full utility of the 24 in. brick was not realized because of consistent lining failures in the 16-in. cone section. For this reason, the use of 24-in. brick has been temporarily discontinued, and 21-in. bricks are being used exclusively in the barrel section. As a result of these changes, lining failures are again confined to the cone section, and evaluations are underway with the use of 18-in. brick in that area.

The method of operation also influences lining life. In the fourth quarter of 1960, production varied from 13 to 18 turns per week with an 8 hr down time between turns. This method of operating seriously affected lining life. In the third quarter, we operated at 20 turns per week in producing 30.88 heats per day in 11 campaigns which averaged 258 heats per lining and used 17.17 lb of brick per ingot ton. In the fourth quarter, we averaged 20.31 heats per day in eight campaigns which averaged 218 heats per lining and used 20.40 lb of brick per ingot ton.

The working lining contour is currently 18-in. thick in the inverted bottom, 21-in. in the barrel, and 18 in. in the cone section. The weight of this working lining is approximately 168 tons. The permanent tank lining of burned magnesite brick remains the same as originally installed. At present, the lining in service contains 60 to 62 pct MgO, 32 to 34 pct CaO, and the balance auxiliary oxides of silica, alumina, and iron oxide.

This type of brick had an average lining life of 240 heats for 1960, and three linings in January provided lining lives of 240, 247, and 251 heats, for an average lining life of 246 heats.

We currently have three sources capable of supplying 100-pct magnesite tar-bonded brick and will receive a trial supply of tar dolomite brick from a fourth producer. Since we are very much interested in cost, we are hopeful of obtaining a tar dolomite brick which will provide satisfactory service for an 8 to 10 day run at maximum tonnage output.