Open Hearth Zebra Roof Experience Analyzed

by T. H. Harley

AN extensive survey to determine the extent, type, and results of the use of Zebra roofs covered 63 open hearth shops in the United States and Canada. Replies were received from 47 shops, or 75 pct of the plants contacted, employing 635 furnaces. These 635 furnaces, tapping heats ranging from 30 to 450 tons, represent 65 pct of the open hearth furnaces in this country and Canada. Of the 47 plants reporting, all but four, with a total of 29 furnaces, had experimented with or used the Zebra roof. Results of the survey are given in Table I.

The question that can probably be considered of most importance was that regarding the future use of Zebra roofs. An effort was made to further analyze the extent and results of the Zebra roof in classifying its use by furnace heat sizes, as shown in Table II. There were seven furnaces in plants with 450 ton furnaces which claimed no benefit from Zebra roofs.

As far as the survey determining what might be termed a standard Zebra design, 90 pct of the plants reported using a ratio of one silica to one basic ring. Approximately 80 pct of the plants use alternate long and short lengths of basic brick rings. Eight plants reported using basic brick rings of the same length. Four of these plants reported favorable Zebra success, three unfavorable, and one questioned the use of Zebra construction.

Numerous Zebra roofs of the same design, reported employed successfully in some shops, were found unsuccessful in other shops.

Plants using basic brick keys were 22 in number, compared to 11 plants using wedges. Four plants used both keys and wedges. Of all plants reporting, 85 pct used unburned basic brick in roofs, compared to 15 pct using the burned variety. All plants reported using the plated type of basic refractory.

Among the comments received from plants that have not realized benefits from the use of the Zebra roof were:

The Zebra slows down the installation of the roof; the Zebra slows down hot patching because of difficulty in knocking out the basic brick; Zebra roofs are unstable and must be braced early in the campaign—they are very sensitive to mechanical abuse, and buckling frequently causes the loss of a roof that could ordinarily be patched; seven Zebra roofs averaged 30 heats less than 26 regular roofs in the same period; Zebra roofs were eliminated in two shops with as good or better roof life since elimination—the shop now using Zebra has no better roof life than prior to using Zebra, but has increased fuel consumption and experienced tonnage decreases from tap to tap, and does not believe that the Zebra has shown any benefit, but with certain practices Zebra has possibilities.

Shops reporting favorably on the use of Zebra roof stated:

Zebra roofs reduce hot patching; Zebra construction used only in vulnerable areas and not in the entire length of the roof; Zebra roof a valuable asset to operation (several plants); wedges preferred for faster installation time; while some reduction in hot patching time and increased campaign life has been achieved, not entirely convinced the practice is economically sound (several plants).

It appears from the basis of the results of the survey, the use of Zebra roofs has been successful on two out of every seven furnaces, unsuccessful on four out of every seven furnaces, and questionable on one out of seven furnaces. An analysis of replies received from all plants indicates that there are no definite trends showing where Zebra design will perform satisfactorily, or where it will be unsuccessful. The answer probably lies in the old practice of cutting and trying in each individual application.

Appreciation is expressed to all who cooperated in helping to make this survey possible.

Table I. Summary of Results Obtained in Survey on Use of Zebra Roof

Question and Answer	Plants, No.	Furnaces, No.	Furnaces, Pct
Total plants to whom survey was sent	63		
Total replies received	47	635	65
Zebra roof experience	43	606	60
No Zebra roof experience	4	29	5
Have the number of heats to the first roof patch increased with Zebra construction? (43 plants, 606 furnaces)			
Yes	20	279	46
No	17	250	41
No reply	6	77	13
Has roof life increased with use of Zebra roof? (43 plants, 606 furnaces)			
Yes	15	158	26
No	21	365	60
No reply	7	83	14
Has furnace campaign life increased with use of Zebra roofs? (43 plants, 606 furnaces)			
Yes	12	131	22
No	23	383	63
No reply	8	92	15
Has furnace availability increased with use of Zebra roofs? (43 plants, 606 furnaces)			
Yes	10	121	20
No	23	387	64
No reply	10	98	16
Has tonnage increased with the use of Zebra roofs? (43 plants, 606 furnaces)			
Yes	12	130	21
No	21	366	61
No reply	10	110	18
Has use of Zebra roofs reduced furnace masonry? (43 plants, 606 furnaces)			
Yes	8	63	10
No	27	439	73
No reply	8	104	17
What are your intentions regarding the future use of Zebra roofs? (47 plants, 635 furnaces)			
Will discontinue and watch future developments	21	346	54
Will continue use of Zebra roofs	15	153	26
Use questionable, or will continue experimentally and watch further developments	7	97	15
Never used Zebra roof	4	29	5

Table II. Future Use of Zebra Roofs Classified by Furnace Size

	Furnace Size, Tons							
	30 to 99		100 to 149		150 to 199		200 to 290	
	No.	Pct	No.	Pct	No.	Pct	No.	Pct
Will discontinue and watch future developments	25	59	117	55	100	64	97	52
Will continue use of Zebra roofs	7	17	64	30	34	22	58	31
Use questionable, or will continue and watch further developments	10	24	33	15	22	14	32	17
Total	42	100	214	100	156	100	187	100

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