

Reclamation of Forming Rolls of Hot Strip Mill of Bokaro Steel Plant

—A Case History

R. S. Chaudhury
 Manager
 Reclamation & Special Repair

1. BACKGROUND

In the year 1981-82, there was a crisis due to non-availability of spare Forming rolls for the coilers of Hot Strip Mill of Bokaro Steel Plant. Excessively worn out Forming rolls in the coilers were causing frequent cobbing of the hot rolled strips and causing loss of production almost every day. Due to improper coiling action of coilers, surface finish of the rolled sheets were also getting affected. It was causing a great concern. Management took the decision to reclaim the worn out Forming rolls and then recondition to make it fit for reuse.

1.1 Number of test pads were prepared using different welding alloys under similar & dissimilar conditions. Dye penetrant test on every layer of welding, Metallography and Ultrasonic tests etc. were carried out. Finally the repair welding technology, best suited to our working condition, was developed and the same was followed for reconditioning the rolls.

1.2 Forming rolls were reconditioned and installed in coilers of Hot Strip Mill and the performance was found quite satisfactory. Till now 23 such rolls have been successfully reclaimed in BSL.

2. Particulars of the original Roll

Material : 9-X Steel (Russian standard)
 Diameter : 350 mm
 Barrel length : 2000 mm
 Depth of hardness : 5 mm
 Hardness : Rc 47 to 50

3. Particulars of worn out roll

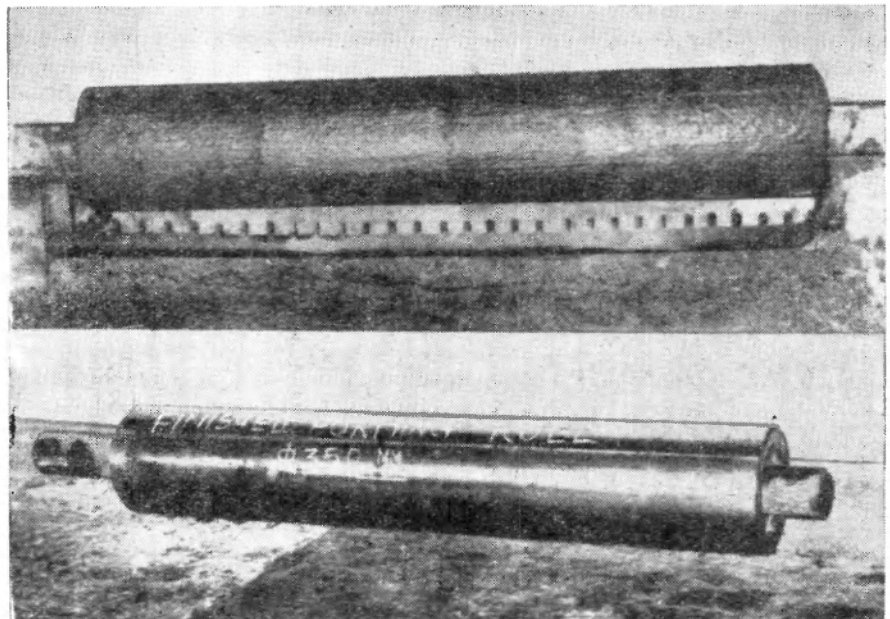
Wear—10 to 12 mm in radius. These have been used beyond the

permissible recommended wear of 5 mm in radius. The wear was on total length of the barrel.

4. Procedure for roll reconditioning

4.1 Technique roll surfacing

Worn out rolls have been tested ultrasonically to detect the internal defects, if any, developed during the normal course of operation. The worn out roll was mounted on two



Top : Reclaimed forming roll after surfacing by manual metal arc welding process.

Bottom : Reclaimed forming roll after finishing by machine grinding.

fabricated pedestals with a manual rotating arrangement. The roll was preheated up to 350°C to 400°C with the help of specially designed coke oven gas burners. The total length of the roll was divided into three equal parts for the purpose of continuous welding. Buffer layer was deposited using an austenitic stainless steel type electrode generally used for welding of Armour Steels. Composition of the weld metal is characterised by C-0.06%, Mn-1.6%, Si-0.7, Cr-23%, Ni-12%, Mo-3%. The weld deposit was hot peened to reduce residual stress.

The hardfacing layer was deposited with the electrode having 5 Ni, 5 Mo type of weld deposit. Hardness achieved was in the range of Rc-47 to Rc-50 in as-deposited condition.

Number of layers were deposited to attain a depth of hardness between 8 and 10 mm. Welding once started, it was continued till completion. Post heat-treatment was done by heating in the brick wall enclosure upto 500°C and then slow cooling at site, to remove the locked up stresses due to weld surfacing.

4.2 Machining & testing of reclaimed rolls

Reclaimed rolls were finished by machine-grinding as per drawing.

Ultrasonic test was carried out on the reclaimed rolls and found to have no defects. The trueness of the bearing journal portions were also checked and no distortion was observed.

5. Techno-economics

1. Cost of new Forming roll : Rs. 2 Lakhs
2. Total cost of reclamation of one roll : Rs. 0.6 Lakhs.
3. Cost of reclamation : 33%.
4. Gain in working life : 275%

The comparative statement between original and reconditioned rolls is given in Table 1.

6. Future Work

We are still keeping our efforts to bring down the reclamation cost and also to improve the quality of the reclaimed roll by changing over from manual welding to automatic welding process. For surfacing, continuous flux coated electrode has been developed in coil form for automatic welding using gas shielding. The first roll will be completed very shortly. ●

Table 1. Comparative statement of original roll and reconditioned roll

Parameters	Original roll	Reconditioned roll
Depth of hardness	5 mm (induction hardening)	8 to 10 mm (with alloyed deposit weld metal)
Hardness	Rc 47 to Rc 50	Rc 47 to Rc 50 (Work hardening type)
Hardness at elevated temp. during coiling.	Comes down considerably.	Retains the hardness at elevated temperature
Cost	2.0 Lakhs	0.6 Lakh
Life	0.32 MT steel rolling.	1.2 MT steel rolling
Procurement time.	24 months.	1 month

Course Curriculum for CWE Examination

Welding Education Sub-committee informed that those interested in having the particulars regarding the Rules for the Certified Welding Engineer Examination of the Indian Institute of Welding may write to The Hony. Secretary, Indian Institute of Welding 3A, Loudon Street, Calcutta-700 017.

Cost of the booklet including the postal charges is Rs. 15/- and will be available on remittance of Rs. 15/- by M.O./Crossed Postal Order/Bank Draft in favour of The Indian Institute of Welding.

—Editor.