



COLD ROLLING MILL ROLLS

ISO-9001:2000



SPALLING

Chipping off, flaking off, dismembering of a portion of roll from the Roll barrel is known as spalling. Spalling can occur both in work rolls as well as in back up rolls and is usually the end effect of crack generation and propagation.

Normally, factors responsible for crack generation are five fold.

A) Residual stresses

develop in roll manufacturing process such as heat treatment and roll grinding. Crack propagation could be rapid when rolling under stress and rapid premature failure takes place in case of extremely high residual stresses left in roll.

B) Thermal gradients

cracks develop in regions between top hardened surface and sub-surface below, during grinding stage. Gradually crack develops and propagates.

C) Contact fatigue

crack initiates due to compressive stresses experienced during contact between roll and strip while rolling. Mostly cracks grow under fatigue conditions.

D) Hydrogen embrittlement

under inadequate supply of coolant, hydrogen is released due to decomposition of coolant/lubricant, when temperature between roll surface and strip becomes high. This hydrogen is picked up by roll surface where structure is martensitic.

E) Local over stressing of roll surface

local over stressing of roll surface can be caused



due to several reasons such as :

- I) Stopping the roll under screw down / Hydraulic pressure.
- ii) By excessive roll face pressure during starting the mill.
- iii) Excessive body pressure caused by insufficient or uneven camber.
- iv) Skidding during rolling.
- v) Laps & Laminations lead to local overloading of the rolls.
- vi) Shifting & folding of strip during rolling.
- vii) Strip rupture / Pinching / Power failures.
- viii) Local over heating.
- ix) Rolling narrow width strip on one rolling path.
- x) Uneven cooling of roll.
- xi) Excessive work hardening.
- xii) Annealing residue / foreign bodies in roll gap.

Spalling is usually found in the area of highest contact pressure between the work and back up rolls. It is desirable, therefore, to provide a uniform contact pressure distribution across the faces of the rolls. However, due to such factors as mill design, roll wear, chamfers, mechanical crowns, thermal crowns, roll bending forces etc. the pressure is generally not uniform.

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Dee Tee stands for total quality movement



DEVELOPMENT OF SPALLING

- a) Roll body Small point damages or point cracks
- b) Roll body They develop inward as crack
- c) Roll body The cracks propagate
- d) Roll body They eventually meet
- e) Spalling The roll has spalled

Notes : (I) In case the cracks propagate towards each other (as shown in the sketches), they result in a big spalling.

(II) In case the cracks propagate in opposite direction to each other, they result in two small areas, chipping off.

It must always be remembered that the spalling originates in small incipient cracks or fractures on or just below the roll body surface. These discontinuities widen under rolling-pressure in a circumferential direction.

Fatigue fracture occurs and sooner or later the spall appears on the roll surface.

"Spalling" is the eventual major failure of a roll surface leading to the roll being rendered in most cases as useless; although its origin may be in an apparently small and insignificant surface flaw.

"Spalling" is not a spontaneous process, by taking precaution it could be minimised.

HOW TO AVOID SPALLING -

is a difficult advise to make, still one should take care of the following :

- Coolant should be sufficient and should be of good quality.
- Whenever strip breaks or skids, roll should be checked for damage with the help of magnifying glass / 3-5% HNO₃ solution.
- Stress relieving should be done for 4 hrs. at 160° C/ 180° C/ after 3 or 4 regrindings.
- Sufficient stock removal is recommended to remove work hardened layer. Hardness should be brought back to original level.
- Strict physical examination of every roll should be done after taking them out.
- Die penetration testing / ultrasonic testing / eddy current testing (very few mills have this facility) to be performed to ensure that the going into next campaigns is free from defects.
- Check hardness of every roll before and after use, work hardening should not be more than 2 HRC and work hardened layer should be removed completely in regrinding.
- For regrinding of skin pass mill rolls, resin or shellace bonded wheel is recommended to avoid chattering and micro-cracks.

Tools WHICH LAST LONGER - Slitting Line Tooling, Tube/Section Mill Rolls, Tube Cut Off Knives, Cold Rolling Mill Rolls, Leveller Rolls, Fins, Steel Centers, Chipper Knives, Friction Saws, Shear Blades, H.S.S. Saws & C.T. Saw Bodies.

