CATEGORY: ROLL INSPECTION

TYPE: EDDY CURRENT TESTING

Eddy current testing is today a universally adopted method of non destructive inspection carried out in roll shops across the globe. Eddy current testing with automated systems fitted to roll grinders is a fast and efficient method of inspecting the barrel surface of a roll for the presence of flaws after mill service. The equipment currently in use has the capability to detect flaws such as cracks, bruising, hardness variation, grinding wheel burns and some structural anomalies of the roll material.

Eddy current testing uses the principle of electromagnetic induction to detect flaws. In a standard eddy current testing set up a circular coil carrying a current is placed at a fixed distance from the roll surface. The alternating current in the coil generates a changing magnetic field which interacts with the roll and generates an eddy current. Variations in the phase and magnitude of these eddy currents can be monitored using a second 'search' coil, or by measuring changes to the current flowing in the primary 'excitation' coil. Variations in the electrical conductivity or magnetic permeability of the test object, or the presence of any flaws, will cause a change in eddy current flow and a corresponding change in the phase and amplitude of the measured current. These changes in eddy current flow are then processed and output to a display with two channels showing crack and bruise values. These channels will typically have a threshold limit set at which the flaw magnitude must not exceed. Typically rolls will be ground until all flaws are below the set threshold limits.

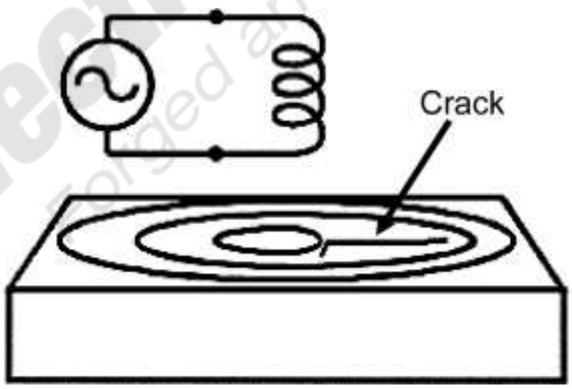

Figure 1
Diagram showing the basic principle of eddy current testing.

Eddy-current testing can only detect surface breaking flaws. The typical minimum flaw size able to be detected and quoted by the equipment manufacturers are in the range of 3 to 10 mm in length with a maximum measurable depth of 3 mm. The magnitude of the values output onto the crack and bruise displays give an indication of the severity of each flaw. These values, especially on the crack channel should not however be assumed to give an accurate depth for the flaw. For example a crack which is greater than 3 mm in depth cannot be fully measured by the eddy current system. Crack orientation within the surface of a roll can also greatly influence the indicated value output on the crack channel. Cracks that are oriented parallel or tangential to the roll surface may give a smaller response than cracks of the same size oriented perpendicular to the roll surface. Likewise crack orientation upon the roll surface will affect the size of the response. Flaws of the same size that are aligned circumferentially may give a lower response than those aligned axially.

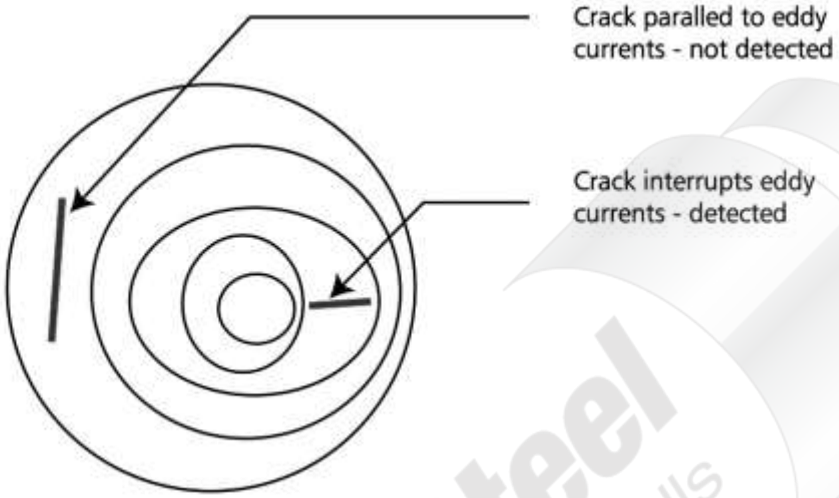

Figure 2
The effect of crack orientation on crack detection

Advantages

- ✓ Fast and efficient inspection of barrel surface breaking flaws. Such as cracks, bruises and material anomalies.
- ✓ Allows for optimization of stock removals during grinding that can improve overall roll performance.
- ✓ Greatly reduces the risk of in-service roll failures initiating at barrel surface flaws.
- ✓ Reduces the likelihood of strip surface defects due to the presence of material anomalies and or hardness variations at the roll surface.

Disadvantages

- ✗ Flaws must be surface breaking. Sub surface flaws will not be detected.
- ✗ Flaws smaller than the minimum specified size may not be detected. These flaws will typically propagate inward with a corresponding increase in size but at a radial depth below the detection limits of the eddy current system and may result ultimately in failures.
- ✗ Flaw orientation can reduce the indicated size below that of the threshold limit and result in an unacceptable flaw not being removed before mill service.