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# Copper sulfate test for corrugator roll wear

## Scope

Singlefacer corrugator rolls are very important components in the corrugating process. They produce the fluted medium which is the foundation on which the quality of corrugated board is based. If the condition of the corrugator rolls is allowed to deteriorate, board quality and corrugator productivity will deteriorate with it.

Corrugator rolls are hollow steel cylinders, with gearlike teeth (or flutes) machined onto the surface. The entire surface is overlaid with a layer of chrome (or an alternate substance), which protects the underlying steel flutes from wear. During the running life of a corrugator roll, wear caused by friction from the corrugating medium gradually wears away the chrome overlay, thus exposing the machined steel teeth underneath to wear. If the base metal is allowed to wear without recovering it with fresh chrome, a noticeable drop in flute height (caliper) will occur, and high-lows (a condition whereby flutes are not of uniform height exiting the corrugator rolls) will become more pronounced. The corrugating roll will have to be recut, rebuilt to original specifications, or even scrapped.

A simple test, called the Copper Sulfate Test, can be run to determine the condition of corrugator rolls.

## Safety precautions

For best results, corrugating rolls should be cold. If applied to hot rolls, the solution will boil and may splatter onto the skin!

## Materials

- Cupric Sulfate Pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) or equivalent (such as Insta-Black)
- Beaker or cup of at least 100 mL capacity
- Water (tap is okay)

## Procedure

To prepare the test solution, mix cupric sulfate pentahydrate Powder ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) or equivalent (see Note 1) in water. About 5-10 gms cupric sulfate per 100 mL water is sufficient; about 200 mL of solution is adequate to test a corrugator roll.

**NOTE 1:** Copper sulfate comes in many forms. It is always recommended to purchase a powder rather than the flake or rock variety, as the powder will go into solution very readily. "Cupric" Sulfate and "Copper" Sulfate are essentially the same chemical, different terminology.

When the rolls are cold, clean the surface to be tested. Use of an electrical contact cleaner to remove any organic materials is suggested. Pour a small stream of the copper sulfate solution across the width of the corrugator roll. Make sure at least five or six flutes are coated with the solution. If the flutes' chrome overlay is intact, the area that the copper sulfate contacts will turn a silvery blue color. Wherever chrome has been worn away, the contacted area will appear brown to rust in color. Rotate the roll and repeat the test, observing for wear in each location. A

minimum of three tests around the circumference of a roll should be done. Once the test has been completed, clean the test site thoroughly and coat with oil to prevent medium wrap-up upon startup.

**Recommendations**

If there is a loss of chrome on the tips of the flutes, or if chrome loss is 1/3 or more up the flank of the flutes, the corrugating rolls should be considered for removal. By pulling them out before wear is severe, recuts can be avoided and the rolls can be rechromed. This practice should extend the life of corrugating rolls from three to five times (have rolls inspected for embrittlement of the steel after the third time) barring damage from some other source.

It is recommended that the copper sulfate test be conducted on new/rechromed corrugator rolls prior to installation, one week after installation, then approximately once every 4-6 weeks thereafter.

**Keywords**

Copper sulfate, Corrugating machines, Rolls, Maintenance

**Additional information**

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