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Total indicated runout and its impact on combined board quality

Scope

In the process of making corrugated board, there are several steps in the process that require precise applications of pressure between rolls, or consistent gaps between rolls in order to meter precise amounts of adhesive to the flutes. In order for these requirements to be met, rolls have to be parallel to each other and also must be as close to perfectly round as possible. Bearings or journals must also be operating in such a manner as to allow the rolls to turn as close to perfect circular motion as possible.

If a pressure roll is not rotating in a perfectly round manner, then as the roll turns against the corrugating roll there will be areas where the pressure applied to the singlefacer web at the rolls' nip point will be lessened. If the pressure is lessened enough, the singlefacer bond can be compromised and, thus, affect board quality. An adjustment to increase pressure to compensate for the problem could lead to another problem—pressure roll cutting of the medium and possibly box failure in compression and/or mullen (burst).

Similarly, if the adhesive applicator roll and/or metering roll are not perfectly round, then as the rolls turn against each other the gap between them will open and close in proportion to how much the rolls are out of round. Thus, for any one revolution, starch application can run heavy to light, leading to moisture and probable warp problems, as well as areas of possibly substandard bonding. To some degree the same effect can be seen between a rider roll and applicator roll at the doublebacker (DB) glue station. The heavy/light adhesive patterns and the potential fluttering of the singleface (SF) web through the nip point can lead to high-lows (or something that looks like them) on the doubleface side of the board. "High-lows" are often "corrected" then by narrowing the gap between the rider roll and applicator roll, crushing the flutes into the glue roll. This leads to lost caliper and possible losses in flat crush, edge crush or stacking strength.

Web defects often exhibit a repeated pattern when they are mechanical in nature. A glue roll that has excessive TIR in the center or on an end will result in a heavy to light starch application with each revolution of the roll as discussed in the first paragraph. This means that the bond strength may vary in the machine direction. In this case we can use the defect to help us pinpoint the problem roll by measuring the distance between the defects occurring on the combined board. For example, if the distance between "unbonded" or "weak bonded" areas is approximately 32 in. (812.8 mm), then that distance can be divided by π (approx. 3.14), or $32/3.14 = 10.19$ in. (258.83 mm). Therefore a roll with a 10-in. (254-mm) diameter would be the most likely candidate for excessive TIR. Note that the "green peel bond test" can be used to detect bond strength in the machine direction and this method is discussed in TIP 0304-27 (1).

In order to reduce the effects of out-of-round rolls or worn bearings, on the corrugating process, the roundness of the following rolls should be checked periodically: SF pressure roll, SF applicator roll and metering roll, DB applicator roll and metering roll, and DB rider roll. The method used to measure roll roundness is called Total Indicated Runout (T.I.R.) and is described below.

Safety precautions

CAUTION: This test requires close proximity to heated vessels and to moving rolls. Take care to avoid touching heated surfaces or to come too close to roll nip points. Thermal gloves for use around heated vessels are suggested.

Equipment

The equipment required to measure T.I.R. at the corrugator includes (Fig. 1):

- Dial indicator, analog, capable of measuring to 0.00254 cm (0.001 in.) or finer.
- Magnetic base indicator holder, with upright post minimum 0.9525 cm x 20.32 cm, (3/8 in. x 8 in.) long; swivel snug; gauge rod approximately 0.9525 x 24.13 cm (3/8 in. x 9 in.) long; indicator clamp.

NOTE 1: A flexible post may be substituted for the upright post for easier access to rolls. Further details on use of the flexible post are shown in TIP 0304-47 "Corrugator bearing clearance checks and their impact."

- Extra length contact points for dial indicator for reaching rolls where accessibility is poor. Recommend 2.54 cm (1 in.), 3.8 cm (1.5 in.), 5.08 cm (2 in.), 6.35 cm (2.5 in.), and 7.62 cm (3 in.) length contact points as a minimum.

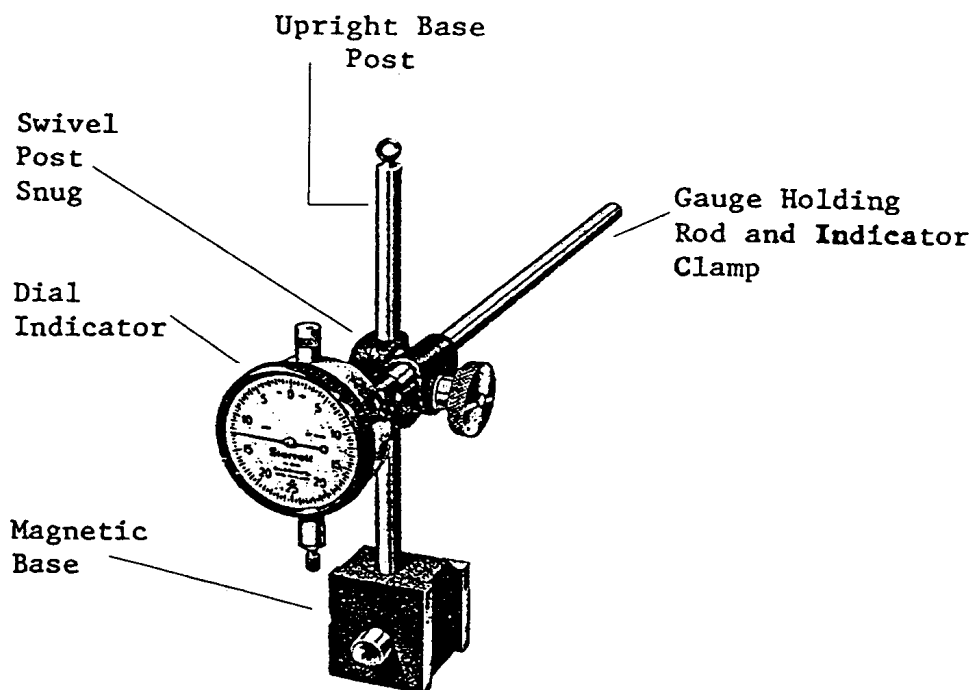


Fig. 1: T.I.R. Test equipment (may substitute flexible arm that can be locked into position).

Procedure

The single facer must be at normal operating temperature and the rolls turning for at least five to ten minutes so that the rolls are heated evenly and turning round if the machine was not running previously. Condensate