

Balancing and the Run-Out of Peripheral Bores

The tolerance of gun drills directly affects the mass distribution within the roll body and results in unbalance. This is especially true for long and slim rolls as used in today's modern multi-roll calendars. Because the run-out of the bores gets worse towards the roll center, the unbalance preferably should be corrected there. **SHW CT** offers Three-Plane-Balancing (3PB) for this task (Fig.1).

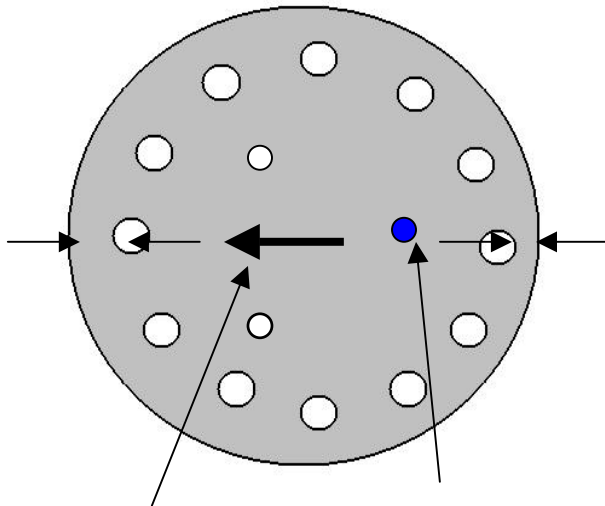


Fig.1: Direction of Run-Out and 3PB-Correction

Variations of the distance of the bores from the roll surface affect the temperature distribution, too. E.g. the surface temperature on the right side (Fig. 2) will be higher and vice versa. Considering the calculated temperature drop from the bore to the surface, which may reach 80°C for the design distance of approx. 50 mm to the surface, the temperature variation must be considerable for a scatter between 45 and 65 mm. Heat flow from hotter areas to cooler ones will partly compensate the differences, however, when more bores on one roll side are closer to the surface than on the other side, the roll will bend in operation

because of temperature non-uniformity on the circumference. This will result in vibrations of the stack comparable to those caused by unbalance.

Other than rolls bent by a permanent sag (to be corrected by straightening or re-grinding) or by metallurgical anisotropy at elevated temperatures (to be improved by hot-balancing), a thermal bend caused by variations of the peripheral bores is a function of the external heat load put on the roll. This prevents efforts to hot-balance such a roll effectively, as the heat transfer to the ambient air is not constant, but increasing with the rotational speed. The software of the balancing machines interprets the corresponding change of bend wrongly as an alteration of size and direction of the unbalance. In operation, the heat load and the bending are much more important.

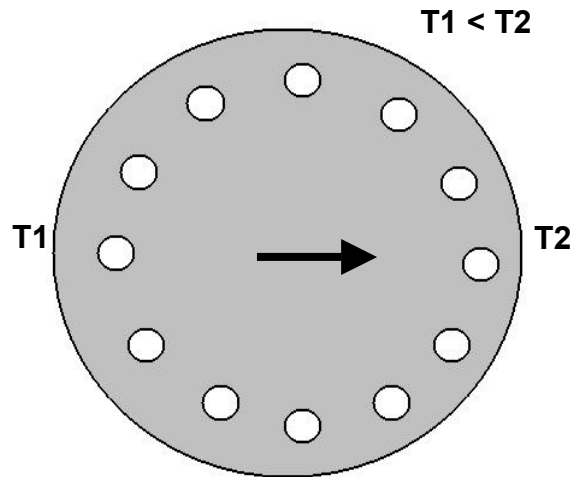


Fig.2: Direction of Run-Out because of Heat Load

A high uniformity of the peripheral boring - as achieved by **SHW CT's** patented gun drill method (see TNL No.4) - is of outmost importance for the smooth operation of modern multi-roll calendars.