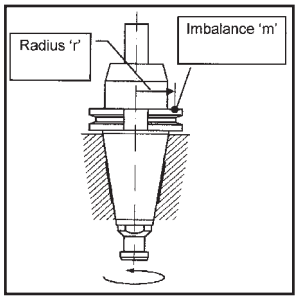
Balancing of Toolholders

Modern machine tools are now capable of utilising very high spindle speeds for many machining applications. As these speeds increase, particularly over 8,000 r.p.m., the balancing of the toolholder and cutter becomes critical to optimising cutting tool performance.

Advantages of Balancing:

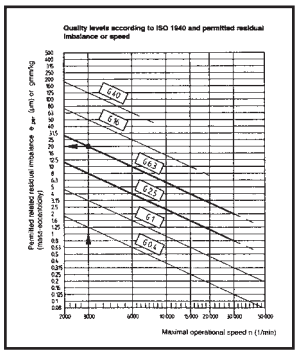
- Increased cutter R.P.M.
- Improved Cutting Tool Life
- Improved Life of Machine Tool Spindle
- Improved Surface Finish
- Reduced Vibration

Definition of Balance



To reduce imbalance 'm' to a required grade is achieved by rotating the toolholder using a balancing machine. The resulting imbalance 'm' is measured in gram mm, and is independent of speed.

The degree of balancing depends on the machining process. Bearing in mind the effect of cutting forces at the tool tip a high degree of balancing is often unnecessary. To achieve optimum machining performance against cost usually requires experimentation to determine improvement gains in the machining process against the cost of balancing each toolholder and cutter assembly.



The next stage is to choose the required grade of balance. The chart opposite, ISO 1940-1 is commonly used to calculate the maximum allowable imbalance at a specified rpm and grade.
Some commonly used grades are: G0.4 Precision Grinding Spindles, G2.5 Machine Tool Drives, G6.3 Machine Tool Components

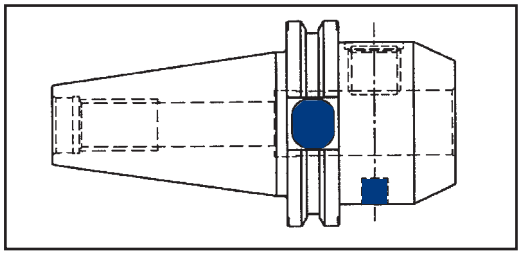
Once the allowable imbalance is known, then the toolholder can be balanced, usually by the removal of metal from the flange area. This is often by trial and error requiring several checks for out of balance to be made.

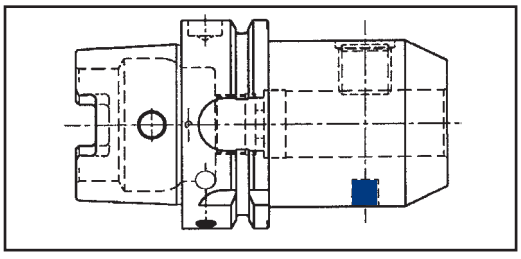
Ideally toolholders should be balanced with the cutting tool clamped into position to achieve the optimum result. Also for long toolholder / cutter assemblies then two plane balancing should be utilised.

Coventry Toolholders offer two stages of balance

1 Balance by Design

In this case, out of balance features such as unequal drive slots, end mill lock screws, are counteracted by removing metal (shown in blue) to theoretically counter the out of balance effect of the above.





When used with an inherently balanced cutting tool this provides adequate balance for many higher speed machining applications.

2 Dynamically Balanced

This is recommended for higher speed applications, from around 12,000 rpm upwards. The toolholder is dynamically balanced on a balancing machine using a standard shank or test bar in place of the cutting tool.

A toolholder balanced to the grade g2.5 can be supplied using this technique.