# Safety

# Basic Principles

Milling machine – multi-point cutting (tool moves , work held still). Lead screw and slides position and move work with great deal of precision.

Flexible machine – fundamental part of workshop. Can do a lot of complex work given the right toolholding and workholding technique.

Number of adjustments – always leave it square, never assume its square.

Quill plunge vs Z-travel

## Dial Gauge

Flexible tool that is used to locate work and set up machine to run accurately. Dial gauge vs DTI – plunger vs lever. Mounting gauge – magnet stand, flexible arm. Stiffness.

## Edge finding

Tap off, read scale, zero, repeat. Remember to account for radius of edge finder.

# Toolholding

## Chucks and Arbors

Collet Chuck vs drill chuck. How tapers work. How to change chuck.

## ER Collet Chuck

Size -1 mm – can flex (unlike most other collet designs). Don’t use adjustable spanners – use proper wrenches. Less run-out – can be used for drills but can be fiddly for pilot holes.

## Drill Chuck

Quicker to change bits. No drawbar – not safe to use for milling.

## Slitting arbor / shell mill arbor

Holds saw blades and indexable ‘shells’ for facing and end milling. Slitting – clamp blocks.

# Workholding

## Milling vice

Precision and stiffness. Heavier construction than drill press vice – dampen vibrations, keeps jaws square. DON’T DRILL INTO THE VICE.

## ER40 Collet

For round / repetitive work. Just like ER20 but bigger. Can lock in vice, centre, and then drop workpiece in.

## Parallels, V Blocks

## Workholding on bed of machine

DON’T DRILL INTO THE BED. Use a spoil board.

Clamp using stepped wedges and clamp bars. Bar should run slightly downhill to work. Screw and nut closer to work than to wedge.

Use machinists jacks or stack of blocks / parallels to shim uneven work.