

CHAPTER 6 Tools and techniques

Test your knowledge 6.1

The wedge angle will be 68°

Test your knowledge 6.2

Vice jaws are hardened and often serrated to grip and prevent a workpiece from slipping. When the vice jaws are tightened, the serrations will often cause surface marks when soft materials are held in the vice. Vice shoes have smooth (but still relatively hard) fibre surfaces. These still provide plenty of grip but help to avoid damage to soft materials.

Test your knowledge 6.3

Wedge angle increases as the material gets harder. Metals are usually much harder than woods and so tools for cutting metal tend to have a larger wedge angle than those used for cutting wood.

Test your knowledge 6.6

With the machine tools that are used for turning, relatively large amounts of metal are removed in a short interval of time. This requires a considerable amount of energy and a significant proportion of this is converted into heat in the cutting zone and the cutting tool gets hot resulting in wear and inaccuracy. To help minimise this rise in temperature a cutting fluid is applied to the cutting zone. The cutting fluid acts as a coolant. Filing, on the other hand, is an operation carried out using a hand tool and only relatively small amounts of material are removed during cutting. This does not generate much heat in the cutting zone and so there is no need for cutting fluid to be applied.

Test your knowledge 6.7

The safe edge of a file is a smooth or uncut edge. Many flat hand files and flat crosscut files are designed for safe filing of internal corners. One edge of the file is uncut or "safe" for filing one surface without damaging an adjoining one. They are double cut on both sides and one edge, and parallel in width.

A useful reference on filing can be found at:

<http://www.nicholsontool.com/MagentoShare/media/documents/nicholson-guide-to-filing-2014.pdf>

Test your knowledge 6.11

- (a) 7.5 mm
- (b) 10.2 mm
- (c) 3 mm.

Test your knowledge 6.17

Proof strength is the maximum amount of tensile strength that a part can withstand before it begins to exhibit a permanent deformation (this is the point beyond which the part will not return to its original shape when the load is eventually removed).

Test your knowledge 6.18

The marking indicates the 'bolt grade' or 'relative strength' of the bolt. A marking of '12.9' indicates that the bolt can sustain a load of 120 kgf before it breaks and the point at which the bolt is likely to stretch will be when a load of 90% of this value is applied (i.e. 108 kgf). To express the ultimate tensile strength in MPa we can multiply the value expressed in kgf by 9.81 so the bolt will have an ultimate tensile strength of 1177.2 MPa.

Activity 6.1

- (a) Around 50 to 52 nm
- (b) Around 70 to 75 nm.

A useful reference source is:

http://mint.hu/files/MINT_10-1-bevezetes-NORBAR-oldal9-10.pdf

Test your knowledge 6.19

The structural joints in an oil rig will be subject to a variety of environmental factors that cause them to suffer degradation. They include:

- Ingress of sea water and deposition of salt cause corrosion
- Wide (and sometimes rapid) variations in temperature causing expansion and contraction of structural components.
- High (and sometimes excessive) values of wind loading resulting in repeated mechanical stress.
- Vibration and mechanical stresses resulting from drilling operations
- Spills of chemicals and other fluids (some of which can be corrosive).

Protection measures might include:

1. Surface preparation followed by the application of high-quality paint coatings can be effective in protecting the surface of the structural components so that they are no longer exposed to agents that might cause or assist corrosion. Prefabrication primers are used on structural steelwork, immediately after blast cleaning, to maintain the reactive blast cleaned surface in a rust-free condition through the fabrication process until final painting can be undertaken.

2. Hot-dip galvanizing involving the immersions of steel components in a bath of molten zinc. The resulting coating is durable, tough, abrasion resistant, and provides cathodic (sacrificial) protection to any small damaged areas where the steel substrate is exposed. The typical minimum average coating thickness for structural steelwork is 85µm.

Test your knowledge 6.25

Any three from: soldering, clamping, wire wrapping, and crimping.

Test your knowledge 6.26

Check the DC voltage at each output and use this information to identify the outputs that are not within the expected tolerance range.