Trade of Metal Fabrication	
Module 3:	Plate Fabrication
Unit 8:	Square to Square Hopper
	Phase 2

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Document Release History

Date	Version	Comments
20/12/06	First draft	
13/12/13	SOLAS transfer	

Module 3 – Plate Fabrication

Unit 8 – Square to Square Hopper

Duration – 10 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- Read and interpret drawing
- Mark out material, flame cut, drill, assemble and weld a square to square hopper to standard of ± 2mm

Key Learning Points:

Sk Rk	Handling of materials – safety. *(Also see Module 3 Unit 7).*
Rk	Economic use of material. *(Also see Module 3 Unit 7).*
Rk	Application of square to square hoppers in industry. *(Instructor explains this in classroom).*
Sk Rk	Methods of development, radial line, triangulation. *(Instructor explains this in classroom).*
Rk	Bending – bend allowance inside and outside dimensions. *(Also see Module 3 Unit 1).*
Rk	True lengths – Pythagoras Theorem. *(Instructor explains this in classroom).*
Sk	Flame cutting.
Rk Sk	Use of jigs – assembly.
Sk	Manual arc welding.
Rk	Drilling – speeds and feed rate, types of drill bits.
M	Indices – rules of manipulation of indexed terms expression in standard form. *(Instructor explains this in classroom).*
P	Presentation and standard of work.

Training Resources:

- Fabrication workshop
- Shears
- Oxy/fuel cutting equipment
- M.M.A.
- Plant
- Equipment and consumables
- Apprentice tool kit
- Pillar drill
- Drill bits
- 5mm steel plate
- 50 x 6mm flat bar
- Safety clothing and equipment

Key Learning Points Code:

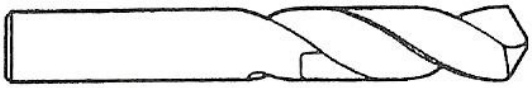
M = Maths D= Drawing RK = Related Knowledge Sc = Science

P = Personal Skills Sk = Skill H = Hazards

Twist Drill Cutting Speeds and Feeds

Jobber series (general use)

These are the PARALLEL SHANK drills normally found in the workshop.



Stub drill

These have the same parallel shank proportions as the drill above but shorter FLUTES. They are used where greater rigidity is required.

Long series

These again have the same parallel shank proportions as the jobber series but longer flutes. They are used for drilling deep holes.

Morse taper shank drill

These have the same FLUTE LENGTH as the jobber series, but have TAPER SHANKS made to the MORSE system of TAPERS.

Core drill

Figure 1 - Types of Twist Drill

For a drill to give satisfactory performance it must operate at the correct speed and correct rate of feed. For optimum results it is essential that:

1. The work is rigidly clamped.
2. The machine is in good condition.
3. A coolant is used if required.
4. The drill is correctly selected and ground to suit the material being cut.

A craftsman should be capable of grinding a twist drill by hand; however, one can never equal the twist drill point-grinding machine for consistent results. Whenever possible, the point should be ground on such a machine and checked on a point angle gauge.

TYPE	DIAMETER	STEPS	
Jobber series	0·20–1·00	0·02/0·03	
	1·05–3·00	0·05	
	3·10–14·00	0·10	
	14·25–15·00	0·25	
Stub drills	0·50–25·00	0·20/1·00	Steps increase rapidly with diameter
Long series	2·00–25·00	0·05/0·25	Steps increase similarly to the jobber series
Morse taper shank	3·00–100·00	0·02/1·00	Steps increase the same as for the jobber series up to 15 mm, then more rapidly

Table 1 - Metric Size Drills (mm)

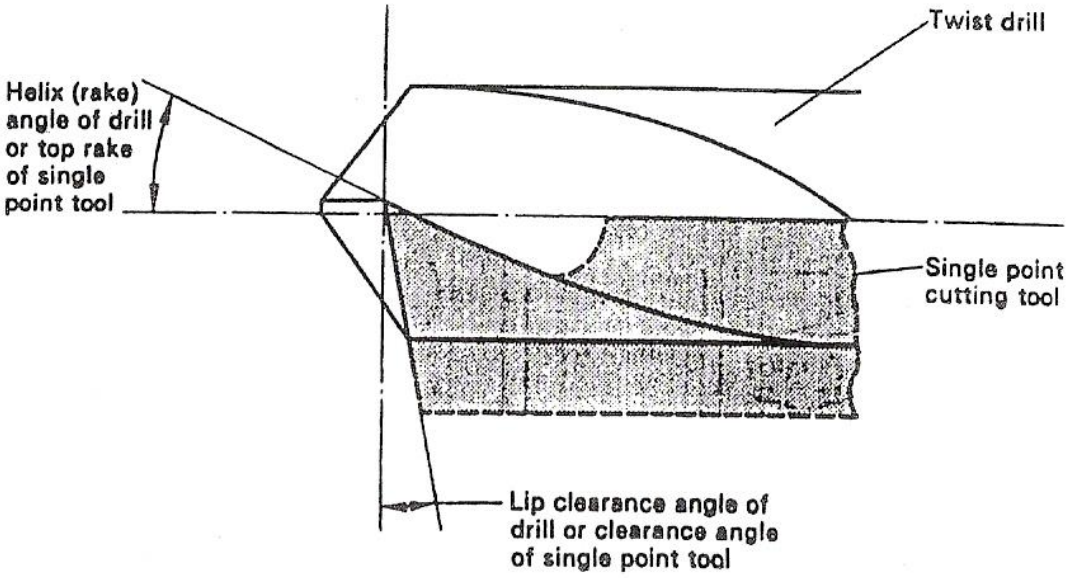


Figure 2 - Twist Drill Cutting Angles

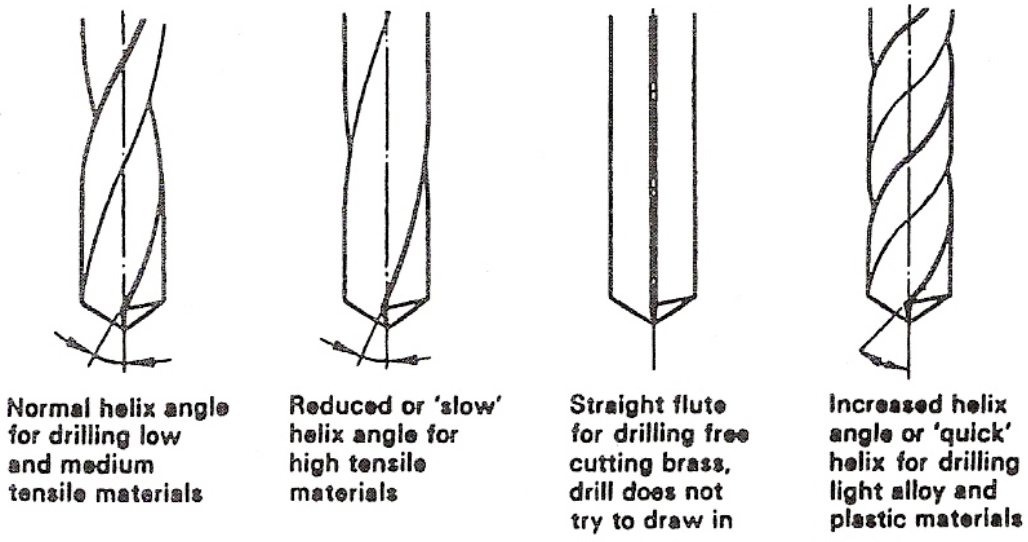


Figure 3 - Helix Angles

Table 2 gives a range of cutting speeds suitable for jobbing work. The rates of feed and cutting speeds for twist drills are lower than for most other machining operations. This is because:

1. The drill is relatively weak compared with other cutting tools – the cutting forces are only resisted by the slender web.

2. In deep holes it is relatively difficult for the drill to eject the chips.

3. It is difficult to keep the point and cutting edge cool when they are enclosed in a hole.

MATERIAL BEING DRILLED	CUTTING SPEED m/min
Aluminium	70–100
Brass	35–50
Bronze (phosphor)	20–35
Cast iron (grey)	25–40
Copper	35–45
Steel (mild)	30–40
Steel (medium carbon)	20–30
Steel (alloy-high tensile)	5–8
Thermo-setting plastic	20–30 (Low speed due to abrasive properties)

Table 2 - Cutting Speeds for HSS Twist Drills

DRILL DIAMETER (mm)	RATE OF FEED (mm/rev)
1·0– 2·5	0·040–0·060
2·6– 4·5	0·050–0·100
4·6– 6·0	0·075–0·150
6·1– 9·0	0·100–0·200
9·1–12·0	0·150–0·250
12·1–15·0	0·200–0·300
15·1–18·0	0·230–0·330
18·1–21·0	0·260–0·360
21·1–25·0	0·280–0·380

Table 3 - Feeds for HSS Twist Drills

Self Assessment

Questions on Background Notes – Module 3.Unit 8

No Suggested Questions and Answers.

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