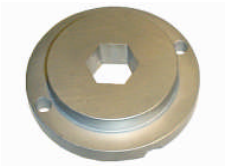
Watts Square and Hexagonal Hole Drilling



Equipment designed for producing Square and Hexagonal Holes consisting of a floating chuck to hold a drill with matching guide plate.

Drilling rather than broaching polygon holes has advantages in the manufacture of many items. Stronger and better components can be made, as well as smaller quantities. Broaching undercuts are not needed and the hole will have a flat unimpeded bottom.

These advantages show themselves in the manufacture of stamping dies, socket head screws, socket head wrenches, collets, etc. Another typical application is on outboard motor propellers. Square boring tools may be mounted in boring tool holders, hexagon head bolts may be countersunk and made captive, square sections may be joined as for stair rails, etc.

The DRILL is a special cutter with one less flute than the number of sides of the hole. The DRILL is rotated and also allowed sideways motion whilst held axially aligned. Its action is to lodge one cutting edge in a corner and to ‘sweep’ round with another edge until this one lodges in a corner. The drill must only be sharpened on the end so that the outside form continues to fit the GUIDE PLATE. In free cutting mild steels as many as several thousand holes may be made by one tool kept in good condition. On high carbon steels for dies several hundred may be expected.

The DRILL is clamped in the holder by a grub screw for which flats are provided. One cutting edge will tend to ‘lead out’ and from time to time the drill should be indexed to the other flat to ensure equal wear of the cutting edges.

The DRILL is held in a special FULLY FLOATING CHUCK. This Chuck positively drives the drill in rotation, holds the drill accurately aligned axially, but allows sideways float in order to follow the hole form. The chucks are available in several sizes to contain the full range of drilling.

The GUIDE PLATE is a bush of the form of the hole to be made. It is mounted in the same way as a drill bush, but does have to absorb radial thrust and should be held firmly. The drill has to enter the GUIDE PLATE while the spindle is stationary. A GUIDE PLATE will usually outlast 3 or 4 DRILLS. For drilling bar stock in a lathe, the GUIDE PLATE is held in a GUIDE HOLDER which is in turn clamped to the bar by a grub screw.

Predrilling is generally recommended. This reduces wear on the tooling and the amount of swarf to be cleared. It also relieves some of the drilling pressure. On some of the softer materials the cutting forces may become inadequate to hold the tool to the profile and a lump may appear on the hole face. This can usually be eliminated by reducing the size of the predrilled hole, or in the case of brass and some copper by not predrilling at all. This problem can also be eliminated by using a fully profiled tool which restricts the flute area. For predrilling a slip bush can be provided which drops into the guide plate. This also helps to align the spindle and guide plate so that the float of the chuck is symmetrical to the centre of the hole.

Square holes are produced with corner radii. The tools could be made to make the corners square but would have too short a life to justify their use.

Hexagon, octagon and other polygon holes have sharp corners. A short stubby push broach can be used to clean out the square corners, but would not normally be required. Holes follow the form in the GUIDE PLATE with a tendency to open out slightly, about .001 .003 at depth. As the tool wears the hole will become a few thousandths oversize. The maximum practical depth that can be drilled is twice the distance across flats. Over this depth swarf disposal is a problem and the hole can become spoiled. Also the form will open out. For best results flood coolant is recommended, particularly to help chip disposal. Light cutting oil is preferred. Also the chuck must be kept running free and requires lubricating from time to time with a light lubricating oil.