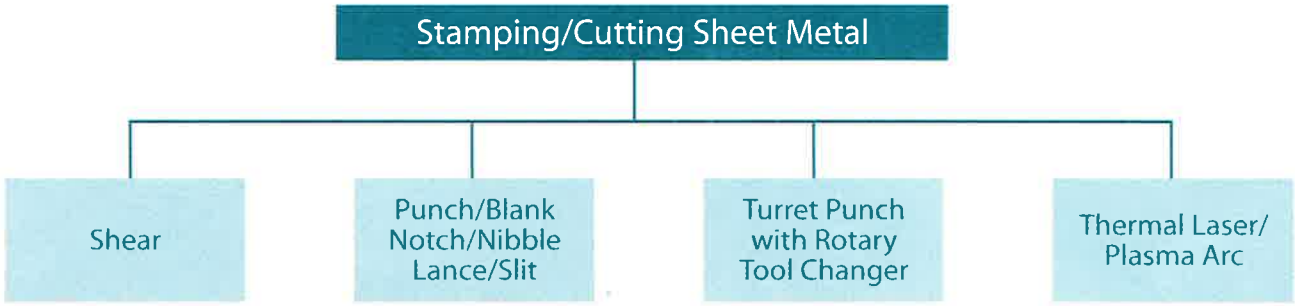

figure 5-4. stamping/cutting sheet metal chart

figure 5-3. punch and blank graphic

5.1 Sheet Punching and Shearing

Sheet metal punching or ***shearing*** is limited to sheet 0.25" thick (T) or less. Sheet metal is important in industrial design, especially in office products and equipment design, including computers, copiers, and a large array of industrial, medical, and research equipment. Short-run cabinets of any size, as well as almost all large enclosures, will most likely be sheet metal—usually aluminum or steel. Sheet metal is used in most large home appliances and enclosures in which high heat is generated, such as in gasoline engines, ovens, and lighting fixtures.

Computer numerical control (CNC) and programming advances have greatly improved accuracy, have dramatically reduced costs and tool changing time, and have expanded the potential for design innovation. In the past, a punch and die (tool) had to be designed and produced in order to punch a specially designed opening in sheet metal. The computer and laser/plasma arc cutting technology has almost eliminated that requirement, and turnaround time for parts is now normally a matter of days instead of weeks or months. These new technologies have improved quality and almost eliminated errors. Advances in decorative and protective coatings have also contributed to the design potential of sheet metal.

The old punch and die technology has not been entirely eliminated by the new technologies. There is a continuing need for the older sheet-punching technologies for long runs, where a specially designed tool is the most cost-effective strategy in manufacturing parts.

Sheet Metal Industry Terminology

In the ***sheet metal industry***, there is a tendency to be rather specific about each punching term that is used, even though there may be little difference among them. A good example is *punching* and *blanking*, which are almost identical except for the part that is discarded. A punch usually makes a hole in the sheet; in blanking, the part is usually a larger part or shape that may have holes punched in prior to being blanked out of the sheet stock.

Punching

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figure 5-6. punch detail

Punching

The ***turret punch*** contains a turret with a variety of punches that can execute various sized holes nonstop. The tool change is very rapid since same size cuts are made on a sheet that is moved back and forth below the punch.

Most sheet-metal punching is done on CNC sheet metal machining center with limited contouring and forming abilities. These machines are extremely accurate and very fast, and perform rapid tool changes. They have replaced the old method of designing a punch, called a ***blanking die***, for cutting a specific configuration. Most punches are of standard geometry, and many hits are required to produce holes of varying shapes. Specific tools such as vents and electronic connector openings are still created for applications in which the design is not likely to change and the volume is large enough to warrant the expense. A recent feature is the addition of thermal cutting using a laser or plasma arc described in Section 5.3. Newly developed are the automated sheet handling and punching centers.

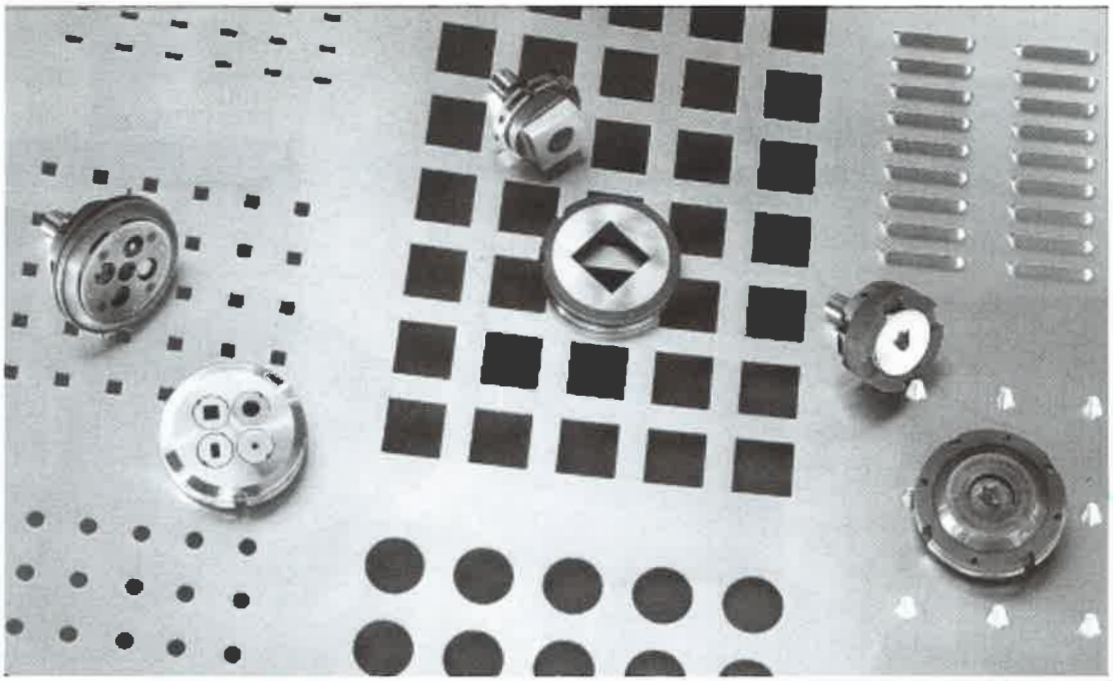

figure 5-5. usually hole patterns like vent slots (shown above) are produced by one specific punch. The designer should find out which stock punches are available before specifying a pattern that may have to be ordered at a higher cost and cause a delay. Below, a trap door allows the parts and scrap to be cleared from the turret punch work area (courtesy Trumpf, Inc.)

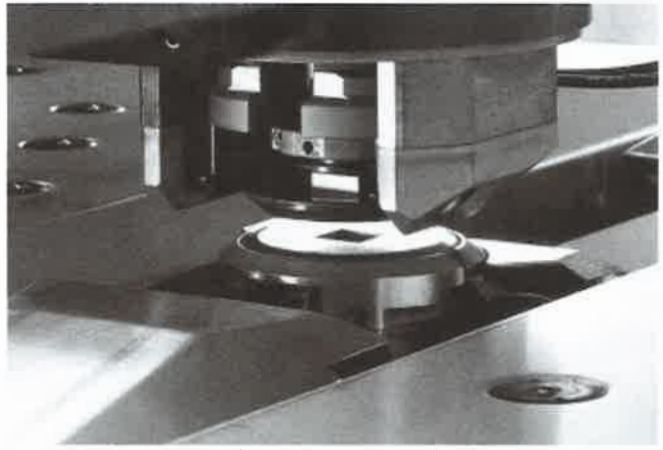

figure 5-6. punch detail (courtesy Trumpf, Inc.)

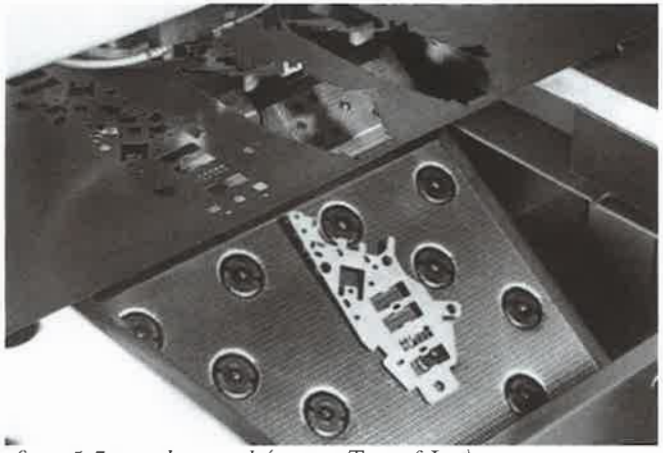

figure 5-7. trap door punch (courtesy Trumpf, Inc.)

figure 5-8. Trumat 500 punch machine (courtesy Trumpf, Inc.)

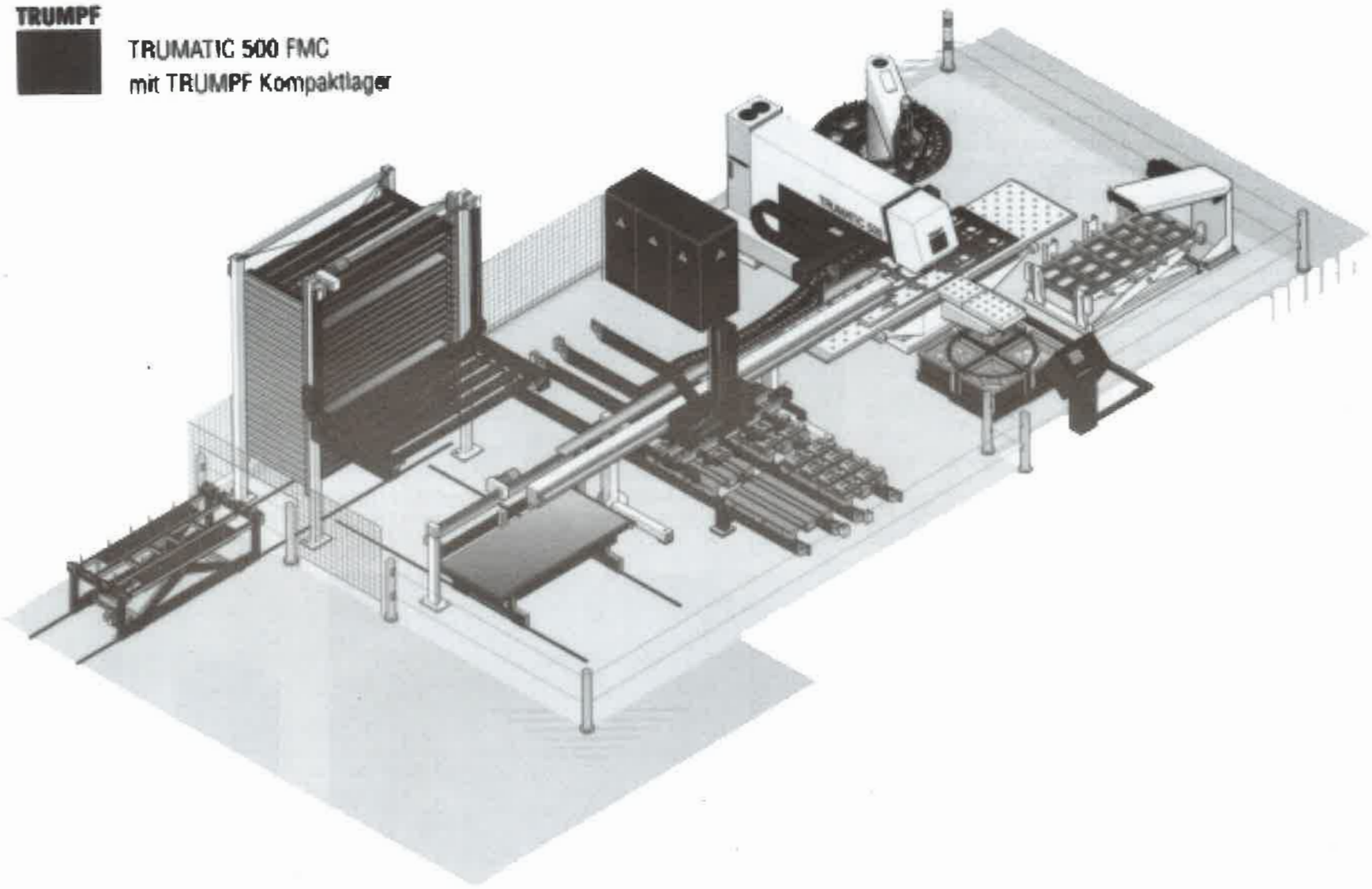

figure 5-9. totally automated sheet handling and punching system (courtesy Trumpf, Inc.)

Sheet Punching

The ***shearing proc***
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to use for norm

Sheet Punching and Shearing

The ***shearing process*** is a scissor-like action between a punch and a die. The punch or blade breaks the surface to initiate the shearing action. The quality of the cut depends on the "c" clearance. The process is a tearing action, and the edge has a residue, or burr, that is very sharp and must be removed or deburred. If the clearance is too large, the sheet will be distorted, will have a large burr, and will be difficult to use for normal purposes.

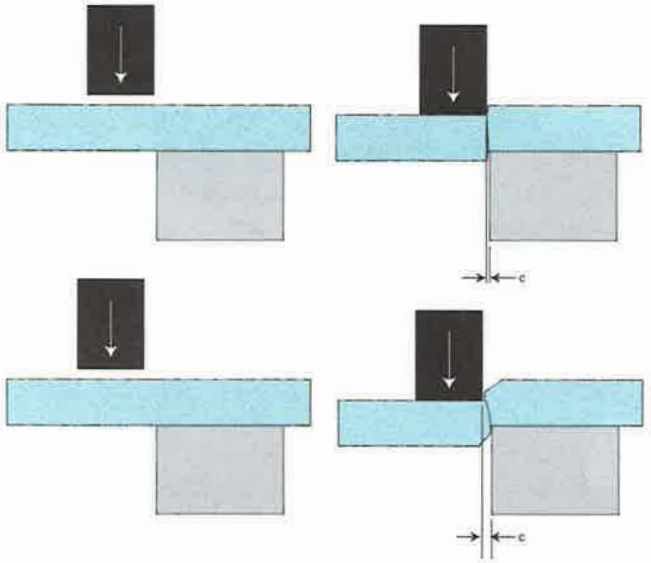

figure 5-10. the proper clearance c at the deformation zone in shearing

figure 5-11. effect of improper clearance c at the deformation zone in shearing

figure 5-12. shear (courtesy Amalco)