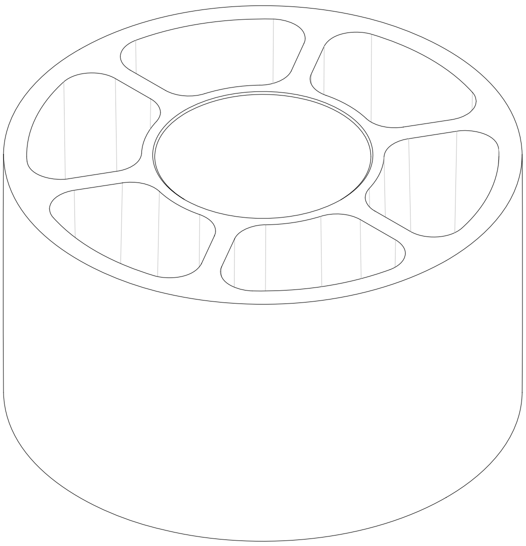
Conception and Design for Casting Parts

Design for Die Casting Parts

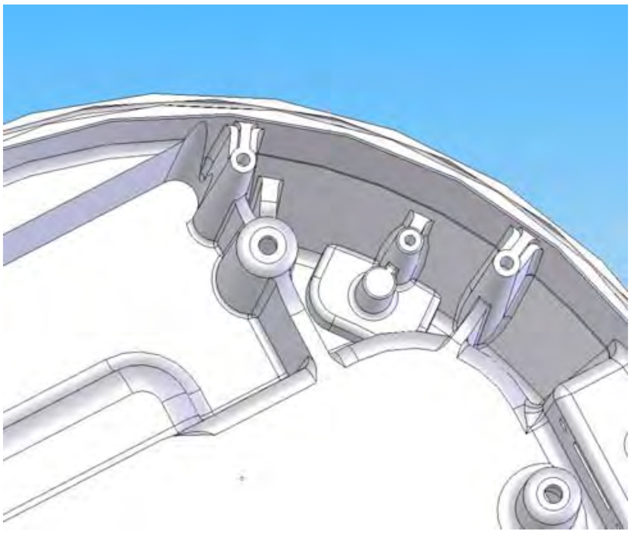
1. Weight Reduction to Save the costs and weights

The designer aim to reduce the volume of material for component to save both cost and weight. The more metal the component contains will need more time to fill the die cavity and more time to cool the metal prior to eject. He can design pockets or reduce the cross-section to be thinner sections if need with ribs to strengthen. The location and pockets need to be considered as they can sometimes cause no constant shrinkage which may affect components accuracy.



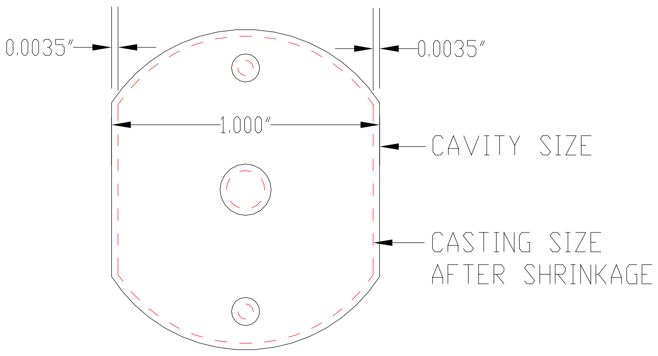
2. Add Ribs

The designer can add ribs on thin walls casting to increase component strength. Specially, he will locate the ribs on suitable location for ejector pins and assist in metal flow. If possible, the ribs should include fillets and radii as large as he can to reduce sharp corners and rapid changes in cross-section.



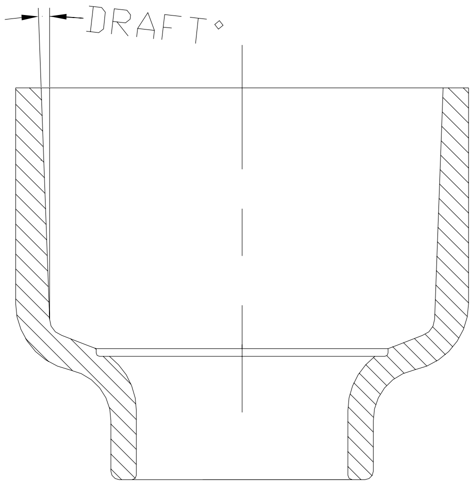
3. Shrinkage

All metals will shrink from casting temperature to room temperature. The theoretical shrinkage is about 0.006, always toward the nominal center as Figure shown. The shrinkage permits the casting escape from the tooling cavity, but tends to lock it onto any die section that projects into it. The designer can apply “draft” into the component to reduce.



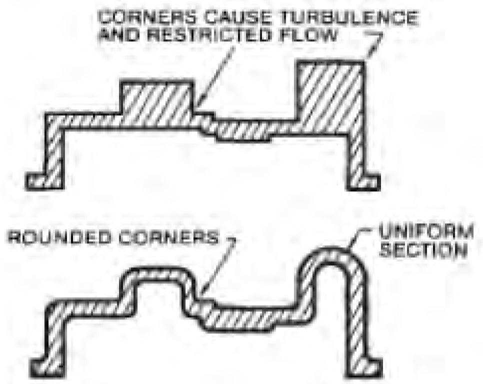
4. Draft

Draft is the small taper on the cavity sides to help the component easy to eject.



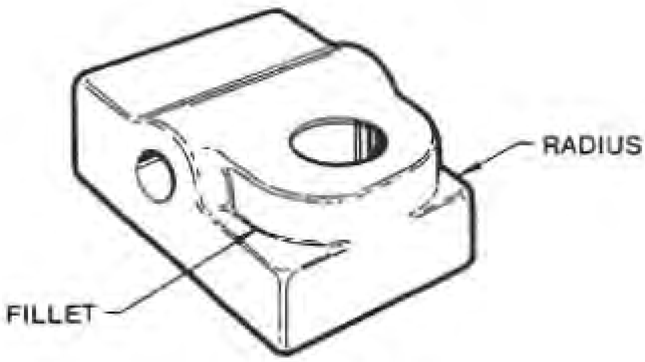
5. Uniform Cross Section

Designer can make the cross section to be uniform in order to speed up the metal flow through the die. Otherwise the suddenly wall thickness change will cause turbulence in die cast metal. The result is porosity happened. Think more is that casting with large difference in cross section will shrink irregularly.



6. Radii and Fillets

Designer has to avoid sharp corners and rapid change in cross section. In addition, an inside corner should be designed with a fillet- an outside corner with a radius as possible. Reducing sharp inside corners can give additional strength to components and can improve the filling. Radii and fillets as small as 0.127mm can make improvement to components.



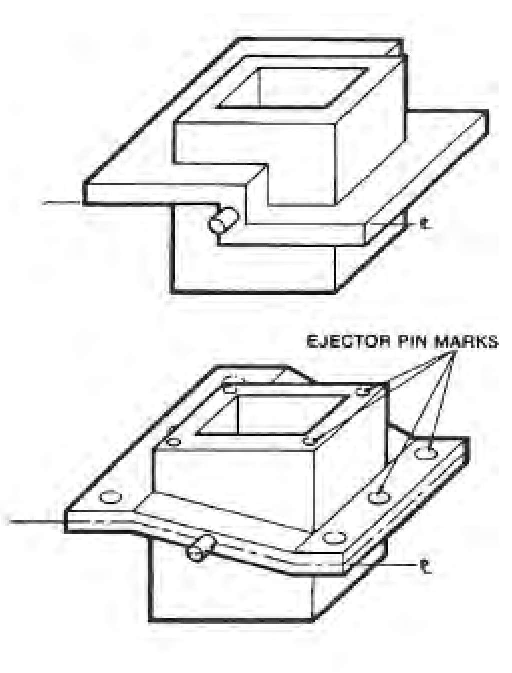
7. Surface Finish of Die Casting

Die Casting components surface finish depend on the finish of the tooling itself. Highly polished tooling surface can be expected to has a good surface casting component. The generally die casting parts surface roughness are from 16 to 64 mircoinches. The die caster can easy to produce the matte finishes, also to make a high logo and trademark.

8. Parting Line and Ejector Pins

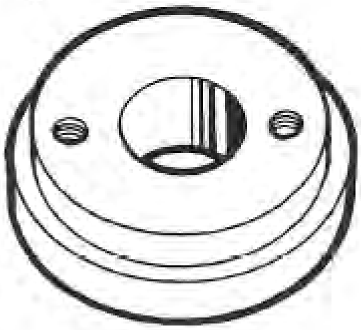
The parting line is the plane where the two halves die meet. The designer must think through each part carefully, much of success or lack of success will depend on the construction of parting surfaces. The parting line should be kept as straight or flat as possible in general.

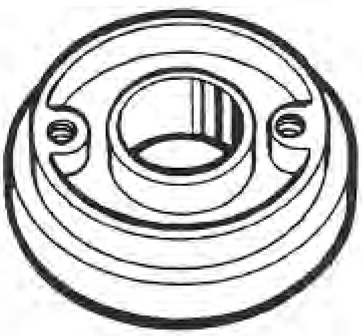
The ejector pins are the steel bars to remove the casting component from the tooling. Good tooling maker will reduce the “visible” marks as possible. Designer may give the suggestion on where the ejector can be located or not.



3.1 Weight Reduction

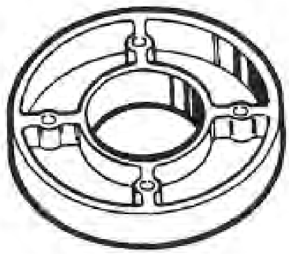
Reducing the volume of material needed to produce a part will reduce material cost. The more metal the part contains the longer the time required to fill the die cavity and cool the metal prior to ejection, thus adversely affecting run rates. Weight reduction can be achieved by reducing the cross-section or by designing pockets. These thinner sections can be strengthened if needed with ribs which can also improve metal flow. The size and location of weight reduction pockets need to be carefully considered as they can sometimes cause irregular shrinkage which may affect accuracy.





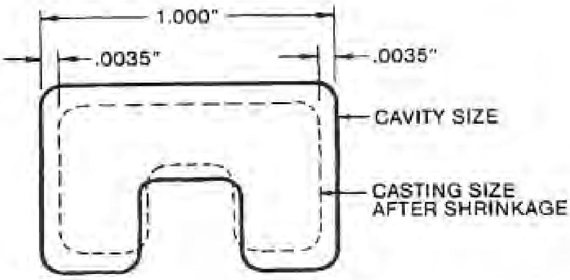
3.2 Ribs

Ribs can be added to thin walled castings to increase part strength. In addition, these ribs provide an ideal location for ejector pins and assist in metal flow. Where possible, ribs should be blended with fillets and radii to eliminate sharp corners and rapid changes in cross section.



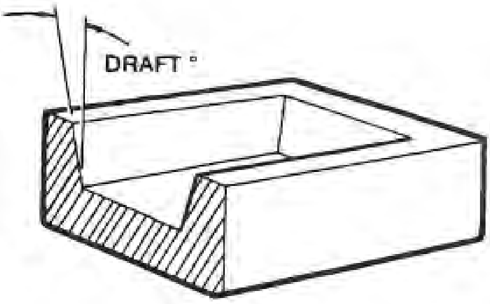
3.3 Shrinkage

Virtually all metals shrink as they cool to room temperature. With the two most commonly used zinc alloys, #3 and #5, this shrinkage is approximately .007 in. per in. This shrinkage, which is always towards the theoretical center, permits the casting to be released from the outside walls of the cavity but tends to lock it onto any die section that projects into it. This tendency can be reduced by designing "draft" into the part.



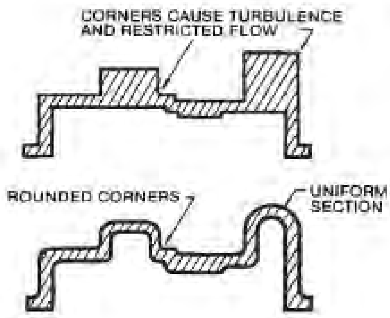
3.4 Draft

Draft is the slight taper on the sides of cavity inserts which form any internal features of a die casting. Draft is needed to make it easier for the ejector pins to push the casting out of the cavity. Surfaces of the cavity that have draft are usually highly polished for improved ejection. If no draft is provided the die caster may be forced to use some of the dimensional tolerance for draft.



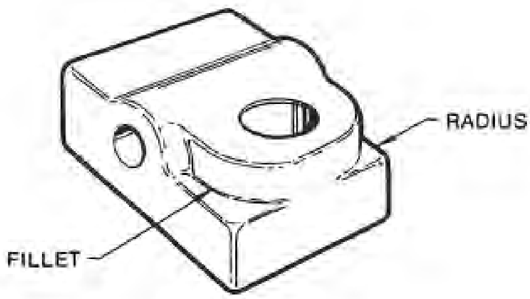
3.5 Uniform Cross Section

By improving metal flow through the die, uniform cross sections can speed up the casting cycle. On the other hand excessive changes in cross section can cause turbulence in the die cast metal. This tends to trap air resulting in porosity. A further consideration is that castings with large differences in cross sections tend to shrink irregularly.



3.6 Fillets & Radii

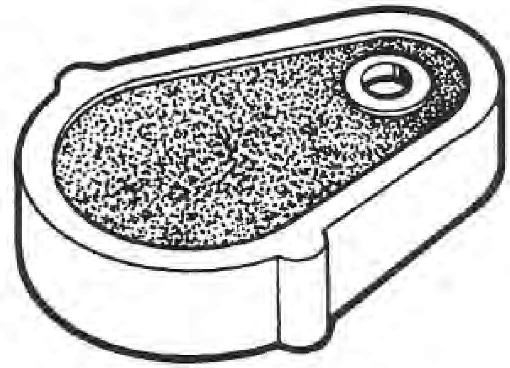
It is very important to avoid sharp corners, especially when they are associated with a rapid change in cross section. Whenever possible, an inside corner should be designed with a fillet - an outside corner with a radius. This is necessary to ensure good results when plating operations are a requirement. Eliminating sharp inside corners also gives added strength to the casting and can improve fill by reducing turbulence. Rads & fillets as small as .005" can make noticeable improvements to a casting.



3.7 Surface Finish

The surface finish of die castings are directly related to the finish on the tool itself. As a result, highly polished tooling can be expected to give good surface finishes on the castings. Miniature die cast parts are generally cast with surface finishes between 16 and 64 microinches.

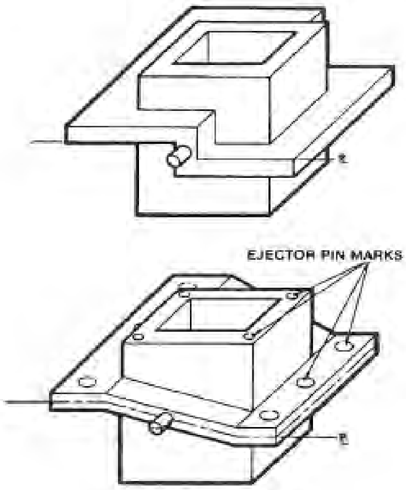
Of the many textured finishes that your die caster can produce, a matte finish is usually the easiest. Matte finishes are usually specified to improve the appearance of a casting or to highlight a logo or trademark.



3.8 Parting Lines & Ejector Pins

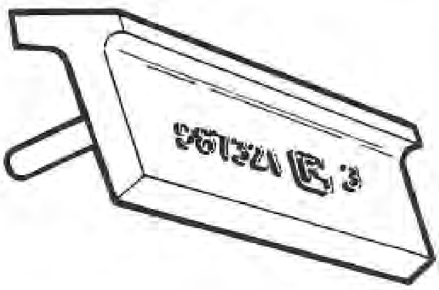
The plane where the two halves of the die meet, is called the parting line. The outside shape of the part determines where the parting line must go. As a general rule the parting line should be kept as flat or straight as possible. If this cannot be done, changes from one level to another should be as gradual as possible.

Castings are removed from the die by ejector pins. Good toolmaking practices can reduce the "witness" marks, but you will still be able to see where they are located. A designer may specify certain surfaces which must be free of parting lines and ejector pins but you should give your die caster as much leeway as possible.



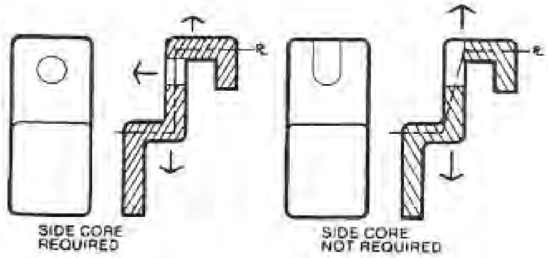
3.9 Part Identification

The designer should consider what identification marks are to be cast into the part and where they can be permitted. All too often the die caster is asked to add a part number or other identification to the casting after the die has been built and sampled. This can be very costly to do at this stage. Many die casters like to identify their castings with their logo and the cavity number in which the part was cast. Die casters usually find it easier to produce raised letter as these require less work in the die.



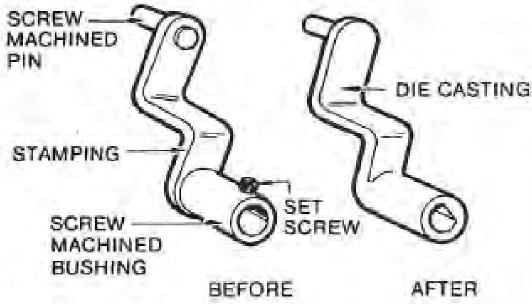
3.10 Side Cores

Side cores are required to produce holes or undercuts that are parallel with the major parting line of the die. As they add substantially to the tool cost, side cores should be designed out wherever possible. The line drawing shows one of the ways die casters have developed to simplify the design of castings and avoid side cores.



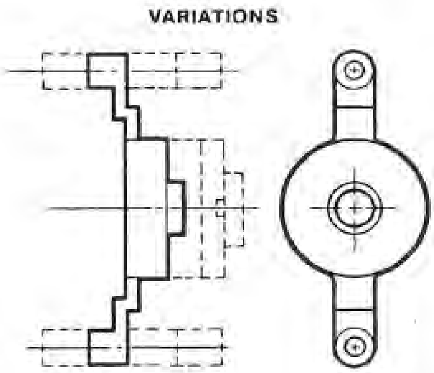
3.11 Combining Functions

Probably the most effective way to reduce costs is to combine several parts into one die casting. There are many benefits from this, including reduced production costs, as well as less handling, storage and assembly costs. Often this results in a superior product as the design is usually simpler. The part illustrated was originally produced in steel from two screw machined parts and a stamping. Die casting eliminates the need to manufacture the parts separately, drill and tap the cross hole, as well as pressing the parts together. The "D" shaped hole eliminated the set screw and tightening operation when the part was used in the final assembly.



3.12 Variations

Savings can also be realized when there are a number of different, but similar parts to be made. For instance, an appliance manufacturer may use the same electric motor to power several different appliances. To accommodate this, several variations of bearing brackets having slightly different configurations, may be required. In these instances, a die can be designed with multiple inserts so that one basic tool is capable of producing the different variations. If variations of the part being considered will be required in the future you should give your die caster all the details before he begins designing the tool. The line drawing illustrates some of the different parts that could be produced from one basic die which is designed with replaceable inserts.



Why Magnesium, Why Aluminium and Why Zinc?