Selig Group
Technology Department

Innerseals and Closure Liners

Improving Punch and Die Set Performance

Selig Group (Selig) is a world leader in the manufacture of induction closure liners, seals, and other packaging components. Selig has a fundamental interest that its products are used as designed and intended. However, Selig has no control of the many and varied operations employed by its customers in the conversion of its products. Accordingly, the customer should understand their responsibilities in the conversion of Selig products in order to insure that they are consistent with product design and safety. The purpose of this document is to provide guidance to the customer in the design and maintenance of punch and die tooling employed to punch discs of lining material. It should be understood that this document is not all-inclusive.

Punch Tooling Manufacturer's Instructions & Guidelines

The following recommendations are intended to cover universal aspects and features of punch tooling that would apply to most all punch and die sets. However, the information in this document should not replace the information in your punch manufacturer's manuals. In any case where there is conflicting information, or the information is unclear, always defer to your punching machine manufacturers guidelines and instructions. Due to the differences of machine design from different machine manufacturers it is important that all aspects relating to safety, as outlined in manufacturers machine manuals, are adhered to.

1) **Thin Material ≤ .008" (0.20mm)** When punching thin material the punch and die should be ground to close tolerances. It is very important to have a tight and even clearance between punch & die of .0004" (0.010mm) - .0008" (0.020mm) on the diameter /overall (.0002" (0.005mm) - .0004" (0.010mm) per side). Roundness should be within .0001" (0.0025mm). Certain designs of punch and dies will include a back taper of .0003" (0.007mm) to .0005" (0.0125mm) per ½" (12.7mm) on both punch and die.

2) **Thick Material > .008" (0.20mm)** When cutting thicker material all the following recommendations apply, except the punch to die clearance may be slightly increased according to the material and thickness up to a clearance of .0008" (0.020mm) - .0012" (0.030m) on the diameter /overall.

3) **Die Ring ID Grinding** When grinding the ID of the die ring, care must be taken never to allow the internal grinding wheel to come out of the die ring more than ⅓ of its length while in contact with the surface of the bore. Otherwise, you will end up with "bell mouth" which is very difficult to detect but causes poor performance when cutting the material.

4) **Tabbed Material Recommendation** For ½ moon tabbed material (Top Tab™, Lift 'n' Peel™ etc.), consider as a thin material (see item #1 above).

5) **Push vs. Pull** Thinner materials like paper-backed foil and foam-backed foil will behave better being pulled through the lining machine. Depending on the machine design some foamed PE materials may behave better being pushed through the machine.

   If the liner material is advanced by driven nip rollers pulling on the punched skeleton after the punching area, as is normally the case, then it is important that there is no restriction or tension on the liner tape entering the punching area, as this could cause the skeleton to stretch and cause jams and other web feeding issues.

6) **Minimize Galling Recommendation** Punches made from A2 steel with 58 - 60 Rockwell Hardness. Dies made from D2 steel with 60 - 62 Rockwell Hardness , or equivalent.

7) **Shear Angles / Wave or Curved Grinding of Cutting Surfaces.** These are sometimes ground onto the bottom surface of punches for the punching of certain thicker materials. The object is to introduce a scissor cutting action to the punching process, thereby reducing the force required to cut through the material. Alternatively, this wave or curved surface configuration can be ground into the die ring. If used on the die ring, the default configuration is either 2 or 4 angles on the surface of the die ring (depends on the diameter of the liner being punched) using an angle of 1/8" (3.175mm) per 12" (305mm). When used, these shear angles are only applied to the cutting surface on the bottom of the punch or top of the die ring, but not both.

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8) **Sharpening Punches and Dies.** On certain punching tool assemblies that are relatively easy to remove from the machine as a complete unit, it may be possible to grind the punches without removing them from the punch holder plate, by putting the entire upper portion of the tool assembly inverted on the surface grinder on large magnetic parallels or other appropriate method of fixture. The die rings must be individually removed and ground on the surface grinder.

9) **Maintaining and Sharpening in Sets.** Where possible punch and dies should be kept as matched pairs and in sets by being marked with a means of identification. The identification marking should also indicate the radial orientation of the punch and dies so that on assembly they are always assembled in the same orientation to each other and in the same alignment. Where possible punch and dies should be ground as a set so that they are all of the same length, and theoretically will all need replacing at the same time at the end of their life.

10) **Height of Die Rings.** Sharpening of the die rings will reduce their height. Depending on the machine design / surface die mounting plate, any loss in height may result in the top surface of the die ring being below the top surface of the die mounting plate. In which case it is recommended that the die rings be shimmed up so that they are all level or slightly proud of the die mounting plate. This is so that the top surface of the die rings present a flat surface on which to support the liner tape when it is being punched or running through the machine. It also eliminates any protruding edges on which the liner skeleton can snag on.

    If some form of spring loaded stripper plate or individual bump rings are fitted to the punches when punching thin material or Lift 'n' Peel™ material, a level top surface of the die ring provides a uniform flat surface onto which the liner material can be trapped / held.

11) **Reassembly of Punches and Dies to Machine When New or After Sharpening.** It is important that individually the punches are located by hand within the die rings before they are tightened to their respective punch or die mounting plates, to ensure initial centralization of the punch to the die. The exact procedure for achieving the re-assembly will differ depending on the individual design of machines from different manufacturers. It is important that the exact re-assembly procedure as instructed in the machine manual is followed, such as sequential torqueing of bolts and checking that all mating surfaces are clean, free of debris, ding marks, and scratches. Failure to follow this can lead to the punch and die cutting edges colliding when the machine is started resulting in damage / blunting of the cutting edges, and a poor cut.

12) **Posts and Linear Bearings.** In order for the punch to correctly punch centrally to the die repeatedly on every stroke, it is important that the posts and linear bearings are maintained in good condition and replaced if worn.

13) **It's important, that new punch and die sets be manufactured and ground to close tolerances.** When new sets are received check the measurements to confirm they are within tolerance. The tight clearance between the punch and die is important and so is the grinding. Pay particular attention to the die ring to ensure that the cutting edge is not bell-shaped. When cutting thinner material, both punch & die sharpness and tight clearance are very important. Also very important is centralization / alignment between punch and die – this should either be checked in the tool room or when the die set is installed in the machine as detailed in section # 11 by advancing the machine over by the hand wheel and test cutting a single delaminated layer of a facial/hand tissue. Failure to cleanly cut or only partially cut around one side will indicate that the punch may not be correctly aligned, that the clearance may be excessive or that the cutting edges are blunt.

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