Pressing Matters -- Key Considerations for Your Pressing Application

"It's simple. All you gotta do is press this bearing into this housing… " When we hear these words, we cringe. Not because we can't successfully press a bearing; we can. We cringe because processes involving press-fit components are often among the most underestimated, yet critical functions in the manufacturing process. In this article, we'll discuss some key considerations that apply to all pressing applications.

Press It Until…?

The first part of the process that must be defined is whether we are pressing the object to a hard stop or to a distance. A hard stop may be a step or shoulder on the part, the bottom of a bore, or a mechanical hard stop in the press itself. The second method entails pressing the object to a distance, or depth. Assuming that the press has adequate tonnage, the press stroke will continue until a signal indicates that the distance or depth falls within a given parameter and that the press may now return. This signal may come from an external proximity switch, mechanical switch, optical switch, or LVDT.

But Force Is Important, Too…

The next major consideration is force. Outside dimension minus inside dimension yields the level of interference fit and, subsequently, the amount of force required to press the two parts together. The reasons why interference and force are so important are pressed part retention and structural integrity. Too little force and the pressed part (bearing, gear, etc.) may simply fall free of its mate. Too much force and one or both parts may suffer irreparable, and maybe even undetected, structural integrity damage (cracked housings, collapsed dimensions, etc.).

Closing the Loop: Force over Distance…

Since distance and force are both important to the process, we may need to set parameters for each factor. Whereas a switch or LVDT confirms the distance, a load cell will provide feedback on the amount of force encountered during the cycle. Correlating these two parameters together to create a Pass or Fail condition closes the loop. Force-over-distance logic holds that the part was pressed to the right depth, encountered forces that were within spec, and that these two events occurred at the right time relative to one another.

This graph illustrates possible outcomes of a force-over-distance application:

Dist.	Force	Result
OK	OK	PASS
OK	NOT OK	FAIL
NOT OK	OK	FAIL
NOT OK	NOT OK	FAIL

What Source for Force…?

The three most common sources of force in a press are pneumatic, hydraulic, and ball screw. Pneumatics are most commonly used in applications with lower forces where the part is pressed to a hard stop and the position confirmed by a switch. In higher force applications, it is not uncommon to get erratic or jerky motion due to the compressibility of air. An air-over-oil reservoir can smooth out this motion but force will still be limited.

Hydraulic cylinders are more often used in medium to high force applications. Hydraulics can provide high pressing forces (100,000 lbs. plus), extremely smooth operation, high speed, and when combined with a servo positioning valve and integral LVDT, surprising positional accuracy.

For the ultimate in positional accuracy, try a ball screw press driven by a servomotor with encoder. The downsides of the ball screw are that it usually gives up tonnage to the hydraulic cylinder, often gives up speed as well, and will be more expensive to purchase. But you can't argue with the accuracy!

Last, there is a hybrid system commonly referred to as an air-over-oil intensified cylinder. This hybrid technology combines the cleanliness of pneumatics with the force of hydraulics. There is a catch, however: while the overall stroke may be considerable (10" plus), the actual power stroke wherein the intensified forces are generated may only be 1" or so. These systems require only compressed air and conventional pneumatic valves and plumbing to operate. When combined with an integral LVDT and precision pressure switch, these cylinders can deliver incredibly accurate results.

Pulling it All Together…

In summary, if you're going to press-fit two parts together, then you must first decide if you are pressing to a hard stop or to a depth, and to what level of accuracy. The second consideration is the amount of force that will be required under maximum tolerance buildup conditions and whether this force should be a condition for passing or failing the finished assembly. The third consideration is the method by which you will press these parts—pneumatic, hydraulic, or ball screw.

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