Dr. Die Cast

Tie Bars and Platens, Once More

In Western Michigan we are privileged to be home to some excellent die casting machine builders and supporting companies. Because they are convenient, some of the machine builder's employees get recruited as maintenance mechanics by some of the local die casting companies. That's the good news. The bad news is, some of them get recruited by the die casting companies. The "machine builder trained" mechanic knows the O.E.M. specifications by heart. What they often don't know is how the machine is used "in the field". That's when the fight starts. You see die casting dies can't read machine manuals. They don't know that the machine builders expected all dies to be perfectly centered on the platens or that they should be designed with slide locks or counter locks that are perfectly load balanced. (Or did they just leave out that part of the orientation.)

Tie Bar Load balance VS. Squaring VS. Parallelism:

First I need to clarify some terms. The above terms are often used interchangeably but are not necessarily synonymous. In addition, the assumption is that the linkage, platens and tie bars are in good physical condition. For the moment let's assume the above mechanical components are in good condition. Next the die "i.e. the load" should be equally parallel and centered in the platens. At this point the corner to corner parallelism of the platens should be within a few thousands say, 0.005 to 0.020 in. (0.127 to 0.508 mm). Measuring parallelism is accomplished by measuring between the 4 outside corners of the moving to fixed platens with an "inside" micrometer.

***Figure 1** – Inside micrometer example.*

The tie bar "load" is a measurement of the tie bar elongation. Continuing with the assumption that the "load" is balanced, the tie bar readings can generally be adjusted to within 2.5% of their full load. Tie bars that are significantly short of generating their rated tonnage are probably cracked. Two popular methods of measuring tie bar "strain" are shown in figures 2 and 3.

***Figure 2** – Magnetic base tie bar strain gage.*

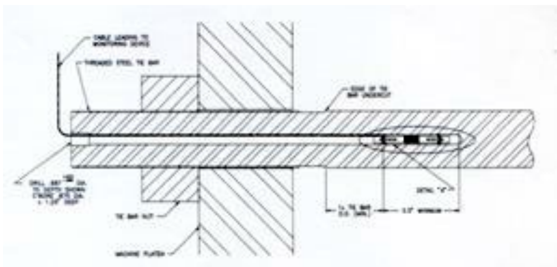

***Figure 3** – Integrated tie bar strain gage.*

At this point, no one is arguing so what's the point. Now reset the above die in its proper location and watch what happens to the tie bar loads. Let's assume for a moment that our die is in a typical 600 ton machine. There is 29 inches (736.6 mm) between the tie bars. The centerline of the die is setting 5.00 inches (127 mm) above the machine centerline. Because the die is now "above center" so also is the tie bar load. The total calculated "offset" is 16%. The total load on the tie bars remains the same, however the balance is now "offset". The load on the bottom two tie bars has dropped from 300 to 273 tons while the load on the top

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two tie bars has increased from 300 to 378 tons. So, here is the “fight”. The O.E.M. mechanic wants to adjust the tie bars to maintain an even 300 tons top to bottom. However, this will result in flash. Process and production just want to make parts. Actually leaving the tie bars alone will provide better lockup than trying to adjust with an offset die. This assumes that the tie bars were balanced with a die that was centered.[1]

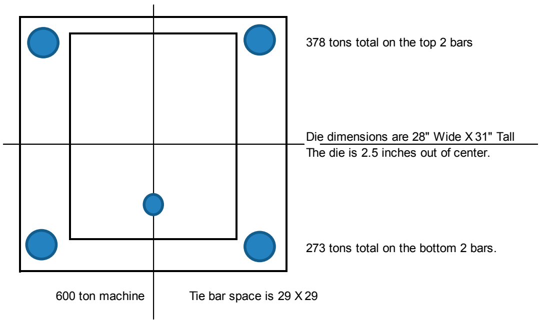

Figure 4 *– Example readings for an offset die.*

Naturally, carrying this concept to extremes could create tie bar and linkage damage but efforts should be made to try to center the dies on the platen within reason. If out of center, be prepared to engage in a debate with your machine maintenance mechanics. Hopefully, the above examples will help to explain why you might need to operate with the tie bars out of balance. Just don’t forget at the end of the day you need to sell parts. To borrow a quote from airplane pilots. “A good landing is one you can walk away from”, however “The best landing is one where you get to reuse the airplane”.

Tool and die designers are generally given a die space to work with but not much else. So steps should be taken to document platen, knock out patterns, tie bar spacing, tee slot locations and shot centerlines so that dies can be centered as much as feasibly possible.

Enjoy the reprieve from winter.

[1] *NADCA “Die Casting Process, Engineering and Control. Chapter 6: Clamping Force*