

Parting Shots

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Taking Care of Basics, the Clamp Mechanism

The die casting clamping mechanism is a mechanical marvel that multiplies force by approximately 33:1 while providing a die stroke roughly equal to that of the closing cylinder. Despite the demands on the system, most clamping mechanisms make millions of cycles without failure.

Success is not an accident. In order to produce die castings with quality consistent enough to approach PPM levels, it is necessary to have a method to maintain the entire clamp system. It is a key component of process control.

Components of a clamp mechanism:

- Foundation and levelers
- Tie bars
- Tie bar adjusting nuts
- Die height mechanism
- Platens
- Moving platen shoes or guides, also known as traveling plate and rails.
- Toggle linkage
- Cross head
- Closing cylinder
- Hydraulic system

What are some of the common causes of failure?

- A level machine begins with a solid floor/machine pad:
 - An un-level or weak floor that does not support the machine at all points will create stress points in the machine frame and clamp system.
 - This will accelerate machine wear and can cause operating problems in the die.
 - Frequent hydraulic leaks from cracked hydraulic lines are common.
- Leveling pads may compress over a period of time.
 - Recheck machine level annually to insure that the machine is not stressed and remains within tolerance of 0.002 in/foot. (0.0508 mm/0.305 meters)¹
- Tie bar has end play.
 - Cover end: The tie bar should be secure and have no end play. If end play is allowed the tie bar nut will "coin" both the nut and the platen each cycle. If this is only occurring on one tie bar, eventually the reduction of pre-load on this tie bar will result in an uneven stress on all the tie bars. This can cause flashing dies, and failure of the other tie bars. As the tie bar nut becomes coined it will be difficult or impossible to remove or adjust. In addition, coining the hole through the platen can reduce the hole diameter making the tie bar difficult to remove. Damage to the platen is permanent and requires extensive welding and/or machining to repair.
 - An "end bell" is used on some cover end tie bars. A pre-load is essential to prevent end play. Machining or welding may be required to eliminate end play and prevent future wear.
 - Adjustable end: The tie bar adjusting nut covers should be secure and proper operating clearance maintained.
 - Loose covers:
 - This is often the sign of a more serious problem. It is a common practice to loosen the covers in order to free a locked up die height system. The cause of the bind is overlooked and the covers remain loose further accelerating the wear.
 - The most frequent reason covers are allowed to operate loose is an out of square machine caused by worn linkage.
 - The failure mode is similar to the cover end. If allowed to operate loose for extended periods, the gears, nuts and platen will become coined and require machining or replacement of the tie bar and nuts and welding and machining to repair the damaged platen.
- Die Height mechanism:
 - See above

- Tie bar bushings:
 - Tie bar bushings provide both lateral and vertical alignment. They are not, however intended to support the weight of either the platen or the ejector die. That is the function of platen shoes/guides.
 - Regular lubrication is essential.
 - See platen shoe/guides below for additional information.
- Moving platen shoes/guides:
 - The platen shoes and wear plates must support the platen and ejector half of the die. Die carriers are recommended for larger dies 600 ton and above. This will reduce the wear on the tie bar bushings and guide pins in the die.
 - Adjust the shoes as required to maintain platen support.
 - Replace rail or wear strip if necessary.
 - Regular lubrication is essential.
- Platens:
 - Platens should provide a smooth parallel surface to support the die.
 - Surfaces that are coined or not structurally sound can allow the die to flex during the fast shot, impact and intensification.
 - Short term solutions include welding and hand grinding the surface (if small enough area) to create a flat supporting area. For larger surfaces see below.
 - Machine the platen to re-qualify the surface using portable milling equipment. (For more on portable machining see next months issue.)
 - Longer term solutions include tear down, removal, welding and Blanchard grinding.
- Toggle linkage:
 - The toggle linkage uses mechanical advantage to develop the lock up force by placing the linkage, platens and die in compression while elongating the tie bars.
 - Worn pins and bushings result in excess clearance and uneven lock up. Wear accelerates as the clearance increases, further coining them with each cycle.
 - Problems with uneven lock up/out of parallel:
 - Flash (wasted metal)
 - Inconsistent casting thickness
 - Slide blow (flash) and stuck slides.
 - Safety issues from flash
 - Die damage from above.
 - Damaged die guide or leader pins.
 - Frequent interruptions to clean up flash.
 - In addition to placing a relatively equal force on the entire surface of the die, it also must maintain parallelism while opening the dies.
 - Problems from out of parallel opening.
 - Broken or shearing link bolts on Harvill machines
 - Drags on castings
 - Broken or damaged core pins
 - Castings sticking to the cover half of the die.
 - Galled die guide or leader pins
 - Cracked castings from out of parallel ejection.
- Toggle systems live on lubrication. A constant supply of clean lubricant is essential for reliable service.
 - Maintenance keys:
 - Routine check and maintain the level in the automatic toggle lubrication system.
 - Daily, weekly and monthly checks of the lubrication hoses, lines and metering blocks.
- Cross head:
 - The cross head and bushings maintain the linkage alignment. Depending on the manufacturer of your machine, the cross head bearing surfaces could

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Memory Joggers...

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example, you may need to speak with a technical person after the show. "Get some kind of idea about commitment: What does the exhibitor expect in terms of more dialog, and what do you want? Additional information mailed to you? A phone call? A visit?"

Know Your Note-Taking Style

This article has covered some important ways to improve your usage of brochures, business cards, notebooks and tape recorders. But the question remains: Which medium is best for you? The answer will only come through experimentation.

Whatever your decision, you must make a deliberate one to manage the flood of information. "There's so much going on at a trade show that it's impossible to remember it all," says consultant Friedman. "You need to take the right notes and work with them when you get back to your business. By doing so you'll achieve a return on the time and money you have invested in attending a show."

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- vary greatly in design. Regardless of design, the cross head must maintain its center throughout the lock up in order to develop force on all four corners of the platens.
 - Four corner lock up designs such as B&T, Prince and Quantum have a center bearing.
 - Other linkage systems use stationery guide bars attached to the bumper or knock out plate on one end and the adjustable platen on the other. Examples include Birch, Cleveland, Ajay/Dejay, National/Avnet and Kux.
 - Moving cross head guide bars are attached to the moving platen and move through bushings in the adjustable platens. Examples include Harvell, HPM and UBE.
- Worn cross head components also create excess side loads on closing cylinder rod bushings and seals. This results in frequent blown seals, lost fluid and more down time.
 - Other problems created by worn cross head components include "over-locking". In this situation, the main linkage is pushed past center and must tighten during the opening or "un-lock" portion of the cycle. In extreme cases, the cylinder may not have enough force to open the die and is stuck with a casting in the closed position.
- Cross head maintenance and lubrication requirements are similar to the toggle linkage.
- Closing cylinder and hydraulic system:
 - The closing cylinder and hydraulic system do not affect balance, but they do affect force and cycle time. Examples include:
 - Closing cylinder piston rings/seals must be maintained to prevent blow-by. A defective piston seal can reduce the lock-up force by as much as 50%.
 - An improperly adjusted hydraulic system can also reduce the locking force. An example would be a regenerative circuit that remains active also reduces the lock-up capability of the machine by 50%.
 - Improperly adjusted pressure controls can drop off early resulting in reduced lock up force or excessive lock up time.

In summary, the maintenance of the mechanical system of the machine is essential to producing quality casting consistently year after year. While it does require effort and investment, the cost is minimal in comparison to the cost of neglect.

Notes:

¹ Alofs, W., Carstens, J., "Mechanical Maintenance and Evaluation of Die Cast Machines," NADCA, 1987

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