Maintenance Requirements of Plastic Molds.

1.0 Purpose

To provide a systematic approach to the maintenance requirements of molds.

2.0 Scope

In order to maintain quality parts, they must be produced in quality molds. The best quality parts are produced from precision molds. Molds, quite like cars, begin to wear with use and maintaining a tool is an investment in precision.

Proper tool maintenance is a matter of attention to detail. As things begin to wear, they must be noted and attended to. This is a simple matter of keeping a molding log for maintenance as little things come up and performing periodic maintenance as the tool is run in production.

3.0 Responsibility

This maintenance procedure is a guideline provided to our customers for the proper maintenance of molds. It is the customer's responsibility to determine a maintenance schedule and follow it.

4.0 Definitions

5.0 Procedure

5.1 The degree and frequency of maintenance are determined by four factors.

5.1.1 Material: Aluminum or soft tools will suffer wear and tear in a shorter period of time than tools made of conventional tool steel. Molds made of hardened steel will last longer than those made of conventional mold steel.

5.1.2 Complexity: Molds with intricate mechanisms or parts requiring unreasonably high precision will require more maintenance than a simple two plate tool making a low precision part. Slides, lifters, internal cores, hydraulic and mechanical systems, hot runners, complex ejector systems or mechanisms with small, therefore weak, components all add to the maintenance schedule.

5.1.3 Molding material: Materials with high melt temperatures wear molds out quicker than those with low temperatures. Higher melt temperatures will expose the metals to more heat and enhance material wear. Filled materials are abrasive because the fillers are not liquid. Fiberglass, mineral fillers (Usually Mica), etc. are very abrasive to metal, they will tend to wash the mold steel away after thousands of cycles.

5.1.4 Abuse: Excessive clamp pressures, high injection pressures, jerking the mold open and closed, not lubricating the appropriate components, multiple ejection, crashing the mold closed or closing up on partially ejected parts are a sure road to increased maintenance.

Abuse can also be defined at the work place. A shop that is dirty, open to the outside dust and dirt, machines with grease and absorbent on the floor all create an atmosphere that will cause the molds to wear out quicker. Areas exposed to acid vapors, such as a molding area located near a plating operation will corrode the steel. Areas of high uncontrolled humidity or salt water will also enhance corrosion. Dry areas with constant wind and dust will cause premature wear on the mold.

Abuse can be incipient: Using untreated coolant in the tool can cause a scale build up in the water lines. Build up can be noticed by an increase in the differential of temperatures and pressures from the inlet and outlet of the cooling circuit. This scaling dramatically decreases the heat transfer ability of the tool and therefore affects the process capability and dimensional stability of the parts. While the tool steel may seem in perfect working order, clogged or constricted cooling circuits can seriously affect part quality. Solutions to environmental abuse:

5.1.4.1 Have a clean operation using well maintained tools and equipment.

5.1.4.2 Use soft or treated water in cooling systems.

5.1.4.3 Blow out or drain the tool when it is pulled from the machine.

5.1.4.4 Seal the work area and mold storage area from outside environment.

5.1.4.5 Have outside, filtered, positively pressurized air circulated in.

5.2 Maintenance Frequency.

5.2.1 Level 1: Every time the mold is pulled from production or put back into production, Routine Maintenance.

5.2.2 Level 2: 20,000 cycles or nine production shifts for Inspection Maintenance.

5.2.3 Level 3: 100,000 cycles or every 10 production runs for General Maintenance.

5.2.4 Level 4: 250,000 cycles or half the anticipated life time volume, whichever comes first for Major Maintenance.

5.3 Level 1 A, Simple Preventive Maintenance, to be done each time the mold is removed from production:

5.3.1 Before the mold is removed from the press, it is to be heated (if the mold is chilled) so that all surface condensation is evaporated. With the mold still warm, internal mold surfaces should be gently cleaned with shop safety solvent to remove any residual dirt and grime, the ejector system moved fully forward, then sprayed with approved rust preventive before the ejector system is retracted and the mold closed. Lenses and highly polished surfaces should be protected following specific instructions.

5.3.2 All water lines should be drained and blown free of all residual water to avoid build up of rust due to standing water. It is imperative that no water be trapped inside mold.

5.3.3 Check and assure all bolts, plates, clamps etc. are in place and tight.

5.3.4 Bag the last shot as an example of the typical quality of this run. Store these parts with the

mold.

5.4 Level 1B, Simple Preventive Maintenance, to be done when removing a tool from storage:

5.4.1 Open the mold. Using properly approved safety shop solvent, remove the mold preservative with a lint free pad. It is bad practice to immediately run parts on the assumption that the first shots will scrape away the protective coating and will therefore be used to clean out the mold preservative.

5.5 Level 2, Inspection Maintenance:

5.5.1 This maintenance is performed by the lead operator or a tool maker at the end of a production run. Using the check list and visual inspection techniques, the mold is looked over and any minor repairs that are necessary are noted for the convenience of the General Maintenance procedure. If not, needed repairs or future required touchup notations are kept with the mold history log for future evaluation.

5.5.2 Any components missing or cavity blocked off should be noted and attended to. A sample from the blocked cavity should be retained for the mold maker to make repairs.

5.5.3 The mold should be washed with safety solvent to remove the varnish and build up from the molding process.

5.5.4 The vents should be checked for depth in a minimum of four clockface places around the cavity face.

5.5.5 Notations for work to be done during the General Maintenance procedure should be noted on the form for future work.

5.5.6 Bent, worn or broken ejector pins should be noted. The mold should be removed from production and the pins replaced.

5.6 Level 3, General Maintenance:

5.6.1 Only competently trained tool room technicians should perform this maintenance.

5.6.2 All plates are separated and their faces cleaned. Caution: Highly polished surfaces should not be cleaned with brushes or rags. Use only uncontaminated facial tissues or cotton balls. Loosen dirt by spraying cleaning fluid into cavity and wipe clean with clean cotton balls. Do not touch with fingers, dust on fingertips may scratch a polished surface. Be careful when blowing a cavity out, there may be dust or rust in the air lines which may damage the polished cavity.

5.6.3 All components are checked for wear. Any excessive wear is noted and a determination is made to repair, replace or continue to use.

5.6.4 All rough areas outside the cavity detail area are to be worked out. Any area inside the cavity detail area with dings, dents or other signs of wear or abuse should be considered critical and should be carefully analyzed before replacements or repairs are commenced.

5.6.5 All moving parts are to be lubricated if required. Use lubricant sparingly on all moving parts which make contact with plastic parts. 5.6.6 Vents should be checked for depth, width and land as

compared to the tool drawing specifications. This data should be recorded on the check list and a determination made to repair if required. They should also be checked for corrosion and vent burns (Better venting may be required).

5.6.7 "O" rings, seals and gaskets should be checked for integrity.

5.6.8 All water lines are to be pressure tested for leaks and recertified for flow capacity. Water lines that have built up scale and are restricted should be pressure cleaned with a descaling agent.

5.6.9 The ejector system is to be examined for proper alignment. If the ejector pin holes have become egg shaped it must be determined if they should be redrilled and bored to a larger size and the existing pins replaced with over size pins.

5.6.10 Broken return springs, replating or retexturing as a result of the material eroding the mold surface, replacement of gates or gate inserts, new runner blocks etc. must be analyzed and determined. Replace all springs after 50,000 cycles.

5.7 Level 4, Major Maintenance:

5.7.1 This maintenance should be performed by skilled tool and die personnel. It should be done when triggered either by the mld fulfilling the required number of cycles for maintenance, excessive wear or damage to the tool. Record keeping here is quite important. Before maintenance begins, there should be four complete shots (Parts, sprues and runners) delivered with the tooling for study. Two shots should be from the initial mold qualification. This gives a visual record of what was acceptable when the mold was new and fully functioning. The second two shots should be the most recent parts produced before the tool was pulled for maintenance. Comparison of the before and after shots will give an excellent indication of wear and abuse the tool has suffered.

5.7.2 All components determined and authorized to be replaced should be removed and new components constructed and installed in accordance to the original designs if previously certified spare components are not available.

5.7.3 Worn leader pins, bushings and all bearing moving surfaces should be checked for wear and replaced/repaired as required.

5.7.4 Plates and mold cavity surfaces should be checked for parallelness and ground flat if required.

5.7.5 Mold cavity surface should be cleaned and polished as required to the original surface requirements. Galling, dings and dents should be worked out until the surface is fully in compliance to the original print specifications.

5.7.6 All components not meeting the part print's original specifications should be repaired, replaced and requalified as required.

5.7.7 All components that have been plated should be stripped and replated where required. All components that have had special surface treatments for corrosion resistance, lubricity, hardness and the like should be retreated to insure the original intent of the tool.

5.7.8 All moving components should be checked for ease of movement. Adjustments should be made as required. All return springs in the ejector plate should be replaced with new springs to avoid fatigue.
5.7.9 All water lines should be flushed with descaling agent to remove scale build up. All "O" rings, internal plugs, seals and gaskets should be replaced.

5.7.10 For tools requiring high production, the cavities should be removed and stress relieved to remove work hardening and material embrittlement. The entire mold/cavity set must be reinspected and requalified as though it was a new cavity.

5.7.11 The mold base is to be inspected for cracks, work hardening, corrosion, etc. If the mold base was plated or painted for corrosion resistance, the coating is to be stripped, the base cleaned and the coating reapplied. The mold's ID is to be redone indicating the tool was rebuilt.

5.7.12 The cavity surface is to be inspected for wear or erosion of plating or texturing. When determined necessary, the cavity surfaces are to be stripped and replated, or the texture is to be polished off and then new texture applied.

5.8 Suggested tools available for proper tool maintenance:

5.8.1 Assembly table: 3' x 3' x 6' (90cm x 90cm x 180cm) should be able to handle a minimum of 1 ton or 1000kg.

5.8.2 Good lighting: A high density portable lamp with a magnetic base is desirable.

5.8.3 (2) Heattreated rails: 36" x 1" x 1" (90cm x 2.5 cm x 2.5 cm) for molds to slide on.

5.8.4 (2) Pry bars: 7075 Aluminum.

5.8.5 (3) Hammers: Heavyduty plastic head, light duty plastic head, light weight (13 oz) machinists hammer (Ball Peen).

5.8.6 (2) Hex wrenches: (1) Set metric, (1) set inch and extension pipe.

5.8.7 (1) Ruby polishing stone (fine): To remove burrs or scratches on mold inserts.

5.8.8 (1) Medium bench stone: To remove burrs or scratches on mold plates.

5.8.9 (1) File: To remover burrs or hobbed corners and edges on mold base.

5.8.10 (1) Cleaning tank: With clean cleaning solvent.

5.8.11 Towels: Clean shop rags or paper towels.

5.8.12 Air hose: With standard shop air pressure.

5.8.13 Flashlight.

5.8.14 Grease: All purpose type, minimum temperature 500 degree F.

5.8.15 Cleaning brushes.

5.8.16 (1) Set knock out pins: For removing pins in ejector housing (Do not use these knock out pins in cavity or core area).

5.8.17 Soft brass pins: For removing plastic material left in sprue bushing.

5.8.18 (1) Ratchet wrench: With 7/16 and 9/16 deep sockets for removing water line fittings.

5.8.19 Containers: For storing all loose parts.

5.8.20 Masking tape: To protect all critical corners on ejector pins, ejector sleeves and lift cores. To protect cavity and core and wherever there is a sensitive area on tool which can be easily damaged.

5.9 Always protect exposed cavity and core areas by covering with a rigid impact resistant material, such as a sheet of plywood or rigid plastic. Tools or parts may be accidentally dropped and can end up on top of a cavity or core insert causing extensive damage.