

Injection Mold Life Expectancy

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Background

The following information is to provide mold life expectancy guidance and help others to properly question their decisions when embarking on new mold purchases and/or developing preventative maintenance programs.

General Information:

Life expectancy of molds vary widely from mold to mold. To substantiate this statement, several reasons as to why follow.

Molds in general fall into many categories, but the three most common are:

1. General purpose molds
2. Precision crafted molds
3. High efficiencies/high precision molds.

1. General Purpose Molds (Mold life cycle is usually 500,000-1,000,000 cycles)

As to the first category, general-purpose molds are those molds without any tight dimensional steel tolerances and are made with common tool steel/hardness without any protective core and cavity coatings. Mold inserts are usually not exchangeable without extensive rework and the cavity and cores are usually constructed by EDM (Electrical Discharge Machining) without provision for inserts.

2. Precision Crafted Molds (Mold life cycle is usually 1,000,000-2,000,000 cycles)

The second category of molds takes different tool steel and thermal expansion in consideration. Mold bases are made from standardized components for better serviceability and the cavity and core inserts are detailed and exchangeable. Areas of wear and tear are inserted, coated and exchangeable. In addition, great detail is given to venting of cavity and core. Molds that fall within this range of products are subjected to periodic stress relieve.

3. High Effeciencies/High Precision Molds (Mold life cycle is usually 500,000-1,000,000 cycles)

The third category includes all of the above, additionally these molds have all sliding surfaces equipped with roller/needle bearings. All support platens are designed to maximum thickness. Usually stainless steel is used to prevent corrosion on cooling circuits and cavity/core seating areas. These molds run cycle times usually below 10 seconds.

To make things a bit easier, listed below are several factors influencing mold life expectancy by different categories and circumstances.

Type of Molds

Cold runner two-plate molds are the most commonly used molds and are the most simply constructed. It is followed in complexity by the three-plate cold runner mold, the hot runner mold, the hot manifold mold, and the most complex stack mold. Insulated hot runner molds are rarely used in today's molding environment.

Elements that effect the mold life expectancy

- Is the mold one cavity or multi cavity?
- Does the mold have moving slides, cams, locks, hydraulic or mechanical core pulls?
- Are part inserts introduced manually during mold open cycle?
- What type of gate is being used?
- Is the operation automatic or semi automatic?
- Is the mold subject to deflection (undersized platen thickness) during the molding process?
- What kind of mold steel was used?
- To what kind of tolerances was the mold build?
- To what hardness are the core and cavities treated?
- Was the mold subject to periodic stress relief?
- Is sufficient cavity venting guaranteed? If not, mold sections are in danger of burning due to entrapped air temperature.
- Is there any soft Beryllium inserts?
- What type of maintenance schedule exists, how often and to what extent is maintenance carried out?
- Is there a back up tool available to ensure proper mold maintenance?
- How often is the production interrupted due to part hang up and removal?
- Is mold/material plate-out present and to what extent has this problem been resolved?
- How corrosive is the cooling water?
- Are the cooling channels cleaned and lubricated at the end of each production run?
- Does the mold leak cooling water during production?

It is very difficult to determine life expectancy of a mold when all the above-mentioned considerations like mold type, mold functions and maintenance strategies are a puzzle of the total equation.

Elements that relate to injection molding machines and how they affect the mold life expectancy:

*Parallelism of clamping platen

Molding machines with hydromechanical/hydraulic clamp designs are superior to machines operating on a linkage or toggle design. Any play in linkage systems can affect clamping parallelism. It is recommended to check tie bar strain on a yearly cycle on all machine types.

*Platen deflection

It is very common to encounter machines with deflecting clamp platens during high-pressure build up. These deflections are transmitted into molds and weaken the mold structure.

*Mold safety adjustments

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Every molding machine manufacturer has its own mold safety system. Very often these systems are interconnected with the machine's hydraulic system, electrical timers and mechanical distance rods to trip a micro switch.

Type of plastic material

Plastic materials come with many different properties. Their main distinction is whether they are of amorphous or semi-crystalline types. Both can be molded easily but require a totally different approach when processing. Some materials have inherent abrasiveness and when a particular material is reinforced, such as with glass fibers, its abrasiveness only increases. Depending on the mold flow direction, wall thickness, flow lengths and processing influences, there will be more or less wear and tear on the mold cavities, cores and runner paths. In addition to the abrasiveness of materials, materials also can be corrosive and can react to moisture and excessive heat, attacking the mold and injection unit over time. Each material shall be discussed with the supplier to understand the effects of processing the specific resin.

Processing considerations

- What means are used when handling, transporting, and mounting the mold?
- What machine size is used?
- What clamping tonnage is the mold subjected to?
- Were mold protection safety requirements set at the beginning of production?
- Was the test procedure followed to evaluate proper mold safety settings?
- Is the mold slamming during its opening or closing movement?
- At what interval are liderpins greased?
- What force is needed to eject a finished part?
- Is the packing pressure optimal?
- Was the effectiveness of cooling water checked before production start up?
- Are all multiple cavity molds filling at the same rate?
- What melt and mold temperatures are being used for production?
- Are both mold halves at the same temperature? (Different steel expansion ratio)
- Is grinding of runner and parts done next to the machine/mold? (Glass particles are air borne and contaminate machine and mold)
- Is condensed water covering the mold?

Final Considerations

With all of the above issues related to "**Injection Mold Life Expectancy**," it can be very difficult to make an approximate prediction. Because these variables affect the end product, big differences can be expected from facility to facility. It is also a good reason to maintain a record of everything that happens to each mold during its lifetime. With this information, molders can establish a database for each mold. Today, one of the biggest hurdles is scheduling mold downtime to perform preventive mold maintenance service that is of optimum importance. This requires availability of adequate **back-up tooling** to allow enough time for mold tear down, cleaning and maintenance at least every **two months**, where applicable.

This document cannot begin to answer the many and complex questions that may arise in regard to mold life expectancy, but should provide a much needed insight to those who care for their investments. It is always recommended that before you begin to mold a new resin and/or build a mold for a specific resin that the supplier of the resin and the mold maker openly discuss the program.