

# Hot Stamp/Heat Transfer Decorating – Tooling Components

*A structure built on a shaky foundation will not withstand the test of time; neither will the quality of your decoration!* Tooling is the foundation of any Hot Stamp/Heat Transfer Decorating application.

Hot Stamping is “the combination of **Temperature, Pressure, & Dwell** to transfer an image from a carrier to a part”. These three components are interdependent; a change or variation in one may affect/impact another.

<b>Temperature</b>	The amount of heat required to soften the foil or heat transfer pigments <u>and</u> the part surface to insure thermal bonding of foil/transfer to part.
<b>Pressure</b>	The clamping force required to insure full contact of die to part. The size of machine is identified by the size & location of artwork as well as the size of the part being decorated.
<b>Dwell</b>	The time that the die or roller is in contact with the foil/transfer and the part.

The **Pressure** required for an application can be determined using the following guidelines:

**Foil & Silicone Rubber Dies** – approximately 350 pounds per square inch of die contact area (artwork size to be stamped).

**Heat Transfers & Silicone Rubber Dies** – approximately 500 pounds per square inch of die contact area (image size of transfer).

**Foil & Metal Dies** – approximately 1,000 pounds per square inch of die contact area (artwork size to be stamped).

*Example:* Artwork Size = 3” x 7” or 21 square inches  
21 sq. in. x 500 PSI (HT w/rubber die) = 10,500 pounds  
10,500 pounds / 2000 (pounds per ton) = 5.25 tons  
**5.25 tons** of Pressure required for a 3” x 7” Heat Transfer  
**3.6 tons** required for Hot Stamp application with rubber dies  
**10.5 tons** required for same application with metal dies

Hot Stamping & Heat Transfer Tooling must withstand these conditions. *A structure built on a shaky foundation will not withstand the test of time* under several tons of pressure.

**Nesting Fixtures** are required to secure/hold parts while being decorated, support the stamping area & locate/position part for repeatability. Nesting fixtures should be manufactured to be user friendly – easy for automation or an operator to load & unload parts.

Nesting Fixtures are manufactured of various materials as dictated by the part shape, substrate, size & support requirements.

<b>Aluminum</b>	Lighter than steel, easier to handle Easy to machine Will not rust Durable Heat Tolerant
<b>Cast Urethane</b>	Ideal for contoured applications Provides tighter fit than aluminum, PVC, nylon or Teflon Not as durable as aluminum Material begins to breakdown at temperatures of 120F
<b>PVC</b>	Machined to part configuration Won't scuff clear plastics or a high gloss finish Not as durable as aluminum
<b>Nylon or Teflon</b>	Ideal for automatic part discharge because of low friction. Won't scuff plastics Not as durable as aluminum
<b>Steel</b>	Offers the greatest amount of strength & durability Ideal for high tonnage applications

Additional features are often added to a Tooling Set to make set-up easier and provide consistent, quality parts more quickly on a tooling changeover. **Jackscrews** can be added to the base plate to facilitate proper alignment of the nest to the die. **Alignment Pins** will assist in aligning the part to die on contoured parts or flat parts where position of the graphics is critical. Fixtures can also be designed to be mounted one way preventing a mismatch from die to part or stamping the graphic out of orientation. **Part Sensors** interconnected with equipment controls detect part presence & identify proper positioning prior to stamping. These devices are ideal in automated systems greatly reducing scrap rates.

Consistent, repeatable part placement with proper support for the decorating process that is easy for the operator to use. These basic elements will provide very serviceable nesting fixtures. Keeping in mind these basic requirements are essential for a successful Hot Stamp/Heat Transfer application.

In the not-so-distant past, Hot Stamp & Heat Transfer Tooling was manufactured only from actual parts and delivered 2-3 weeks *after* receipt of injection molds often resulting in production delays. Prototype parts (which often did not match production parts) were sometimes used in an effort to have hot stamp tooling & molds delivered at the same time.

With the development of new software packages and advances of CNC-controlled equipment, Hot Stamp & Heat Transfer Tooling Sets can now be constructed simultaneously with Injection Molds. An electronic drawing file is all that is required to initiate the manufacture of required decorating tools – Nesting Fixtures, Die Mounting Blocks, & Dies. Completed tooling will be matched to the First-piece Run utilizing production molds. Any “tweaking” required will be made at this time avoiding previously long delays in new product launches. Electronic files are

kept indefinitely thus allowing for quick & easy duplication when artwork or part changes dictate.

Part Holding Fixtures make up only one half the requirements of a Tooling Set. The other half, the **Die**, is equally important. Hot Stamping/Heat Transfer Dies are produced to mate to the part while fixtured. These components should be manufactured together to guarantee a matched set.

**Silicone Rubber Dies** conform to surface variations inherent in plastic molded parts. Full graphic art & photographic capabilities assure accurate art reproduction. Rubber dies are available in flat, multi-level, and contoured configurations for diverse applications. Rubber Dies are manufactured from Machine-Engraved and/or Photo-etched Molds.

<b>Durometer</b>	Measure of rubber hardness as expressed on the Shore A Scale. Low durometers exhibit high-elongation properties and improve coverage on irregular surfaces. Rubber in higher durometers are more tear resistant and will withstand pressure with minimum distortion.
<b>Dual Durometer</b>	Two different rubber hardnesses molded together in levels. Usually a harder material is used in the face of the die and a softer rubber in the background. This construction provides a pliable belly beneath the stamping surface to help absorb variations in part, wall thickness, etc...
<b>Texture</b>	A texture in the rubber face helps redistribute trapped air. Ideal for vertical applications with large surface areas.
<b>Crown</b>	A convex crown (as little as .010") in the rubber face of a die will assist in eliminating air entrapment. Ideal for vertical applications with large surface areas.

**Metal Dies – Magnesium, Copper, Brass, & Steel** offer excellent heat recovery properties ideal for high speed, vertical applications. Metal dies offer an embossed appearance to your finished part. Recommended for “soft” substrates such as fabrics, paper, polyurethane, etc... When selecting a die material for your Tooling Set, use the following guideline:

***“Rigid substrate – Flexible, Rubber Die”***

***“Flexible Substrate – Rigid, Metal Die”***

## SILICONE RUBBER DIES vs. METAL DIES

	<b>Rubber Dies</b>	<b>Metal Dies</b>
<b>Materials Available</b>	Various for specific applications – high temperatures, quick heat recovery, & high strength	Magnesium Copper Brass Steel
<b>Average Die Life</b>	Contoured – X Flat – 2X	Magnesium – Y Copper – 4Y Brass – 18Y Steel – 20Y+
<b>Surface Variations (sinks)</b>	Will Compensate	No Compensation for Sinks
<b>Variation in Material Thickness</b>	Will Compensate	No Compensation
<b>Set-up Time</b>	Quick Process	Lengthy Process
<b>Pressure Requirements</b>	350 lbs. Per sq. inch (HS) 500 lbs. Per sq. inch (HT)	1000 lbs. Per sq. inch
<b>Temperature Requirements</b>	100F > Metal (approximately 300-400F)	100F < Rubber (approximately 250-300F)
<b>Dwell Time</b>	50% > Metal	30% < Rubber
<b>Decorative Finish</b>	Foil/Transfer lays on top of substrate	Imbeds foil/transfer into surface
<b>Price</b>	Initial Set-up/Mold Charge Die Cost < Metal	No Set-up/Mold Charge Magnesium - \$ Copper – 2X \$ Brass – 8X \$ Steel – 10X \$
<b>Substrates</b> <b>*indicates preferred material</b>	ABS Acetal Acrylic Polyamide (Nylon) Polycarbonate Polyethylene Polystyrene PVC – Plasticized PVC – Rigid* SAN* UV Coating Epoxy / Epoxy Coating Polyurethane Wood	ABS Acetal* Acrylic Leather* Paper* Polyamide (Nylon)* Polycarbonate* Polyethylene* Polystyrene PVC – Plasticized PVC – Rigid SAN UV Coating* Epoxy / Epoxy Coating Polyurethane*

**Die Mounting Blocks** act as a “connector” in the Tooling Set mating the decorating equipment to the stamping die. Mounting Blocks provide the support behind the die. Without this support, a die may deflect under the force of the machine causing a lack of pressure in this area. Traditional Die Blocks are drilled with mounting holes to match your equipment & tooling set. Variations of the Standard Die Block offer alternatives for mounting dies – Dovetail, Type Holders, & Magnetic.

“Quick-Change” die technology vastly reduces time related to die changeover and set-up. A Magnetic Die Block mounts to your machine allowing dies to be easily affixed eliminating the need for screws to secure the hot stamp die. Using pin registration, Quick-Change dies improve repeatability from die-to-die offering increased production and less down time.

When venturing into a new Hot Stamp/Heat Transfer project, remember that **Tooling** is the foundation of all decorating applications. Many factors impact a decorating project. Too often critical tooling required for quality, finished parts is overlooked. *A structure built on a shaky foundation will not withstand the test of time; neither will the quality of your stamp!*

## Troubleshooting Hot Stamp/Heat Transfer Decoration

Symptom	Cause	Remedy
<b>Incomplete Image</b>	Uneven Die-to-Part Contact	Reposition fixture so decorating surface is parallel to a flat die or conforms to a cont'd die
	Part Contamination	Discontinue use of flow agents, anti-stat solutions and/or silicone-based mold releases
	Foreign Particles on Part Surface	Clean surface with white cotton cloth or glove
	Insufficient fixture support permits part to flex under pressure	Redesign fixture to provide rigid support under stamping surface and/or ensure that mandrel-type designs do not deflect
	Air entrapment between foil & part	Redesign die face to include convex crown
<b>Rollover in Image</b>	Uneven Die-to-Part Contact	Reposition fixture so decorating surface is parallel to a flat die or conforms to a contoured die
	Excessive Pressure	Decrease stroke length and/or reduce machine output
	Lengthy Dwell Time	Reduce dwell time setting
	Sinks in Part	Introduce make-ready beneath part in the areas that are hitting light then reduce force as indicated above
	Variations in wall thickness from part-to-part	Switch to dual durometer silicone rubber die

## Troubleshooting Hot Stamp/Heat Transfer Decoration (con't)

Symptom	Cause	Remedy
<b>Edges of Decoration are not Sharp</b>	Insufficient Pressure	Provide adequate stroke length and/or increase machine output
	Part Contamination	Discontinue use of flow agents and/or silicone-based mold releases
	Die face temperature not hot enough	Increase thermostat setting on machine
	Short Dwell Time	Increase dwell time setting
	Foil Stripping Conditions	Slow head retraction and/or introduce head-up delay
	Foil coatings are effected by lengthy heat exposure prior to the cycle	Use before/after foil selector to advance foil just prior to head descending
<b>Poor Foil-to-Part Adhesion</b>	Insufficient Heat at Die Face	Increase thermostat setting on machine and/or move the thermocouple closer to die face
	Short Dwell Time	Increase dwell time setting
	Part Contamination	Discontinue use of flow agents, anti-stat solutions and/or silicone based mold releases
	Foreign particles on part surface	Clean surface with white cotton cloth or glove
	Foil-to-Part Incompatibility	Switch to different foil formulation