Note1: The General Mold Build Requirements contained herein are applicable to molds sourced by Pliant Plastics. Other requirements are applicable based on the class and size/machine prescribed on the tooling purchase order.

Note2: These build standards are intended to be used in conjunction with Pliant Plastics Injection Mold Design Standards, SD.7.5.1.5.1.01.

1. PLIANT MOLD CLASSIFICATION SYSTEM - Molds are identified in 3 classes:

   1.1. CLASS I - High quality quick change Master Unit Die (MUD) compatible or conventional (as directed) production molds intended for volume production or close tolerance capability. Pliant guarantees mold life for a minimum 500,000 cycles when used with non-abrasive materials or 250,000 cycles with abrasive materials.

   1.2. CLASS II - General use molds intended for short production runs with wide tolerance parts. Pliant guarantees mold life for a minimum 50,000 cycles when used with non-abrasive materials or 25,000 cycles with abrasive materials.

   1.3. CLASS III - Prototype or concept proving molds intended for very limited part production. Estimated life of 500 cycles with non-abrasive materials or 250 cycles with abrasive materials is provided but not guaranteed.

2. GENERAL MOLD BUILD REQUIREMENTS (where applicable based on the mold design and classification)

   2.1. Progress Timelines are required to be supplied on a weekly basis for each tool to be provided every Thursday by 4:00 pm. Timing to include adequate detail, milestones and major steps in the tool build with weekly progress towards them. Not supplying this information may result in being removed from our Approved Source list. Any potential delays in tool build need to be communicated to the Project Coordinator or Sales Engineer immediately to develop reaction plans.

   2.2. Mold Base & Construction:

   - The owner’s (normally Pliant's customer) name, part name, part number, Pliant’s mold number, the mold maker, date of construction, and the weight will be stamped on the operator side of the mold. Top of mold must also be identified.
   - Molds that have been hardened are to be marked with circled "H" on the outside of the mold.
   - Molds and tooling must conform to the base dimensions, clearances, mounting methods, sprue bushing orifice min/maxs, and accessory mounts per the designated injection molding machine size.
   - The mold body shall be free of all sharp edges and burrs.
   - Molds will have a minimum of two (2) leader pins. The leader pins must contact the bushing before any other component (e.g., slide horn pin). The leader pins must engage their bushings 1 ½ times the diameter of the pin.
   - Leader pins that extend past the back of the ejection half when the mold is closed must be within the ejection plate area.
   - Molds with ejection pins under a cam or slide should be avoided at all costs, if possible. If this condition cannot be avoided, the mold must have a thin switch installed on the back of the ejection plate.
   - Return pin ends and holes must be chamfered on the face of the mold.
   - Mold features associated with critical dimensions shall be inserted and removable from the mold unless otherwise authorized.
   - Cores, inserts, ejector pins, cams, heel blocks, horn pins, and other removable components shall be marked such that their location and orientation within the mold is identified to ensure ease and consistency of reassembly.
   - One full set of ejector pins are to be supplied with 3” x 3” and 5” x 6” insert molds.
   - Mold date inserts (when required) will be the DME screw in style that can be changed out without disassembling the mold base.
   - Pillar posts shall be located so they are fully supported by the frame back plate and do not overlap any holes/slots in the frame.
• The mold shall be constructed in such a manner that there is parting line shutoff around the entire perimeter of the mold or cavity inserts except at the orifice. It is not permissible to rely on an over molded component to block flow-through out the sides or the back end opposite the orifice.
• Guided ejection must be incorporated on all molds with stripper plates.
• Molds must have pry bar slots on a minimum of two sides (preferably four) to aid in splitting them when not in a machine.
• All mold plates must have tapped holes to allow the use of eye bolts to handle or move molds or components.
• All molds up to 6.5” x 8” MUD units will have one safety straps installed on them. Molds larger than 6.5” x 8” MUD units will incorporate two safety straps on opposite sides of the mold. All safety straps are to be painted safety yellow.
• In the case of molds where textured surfaces are present, Pliant Tooling or Sales Engineering will give direction on the approved texture source. No mold will be textured without approval from Pliant Plastics.

2.3. Venting:
• Gas vents shall be incorporated in all cavities and runner systems.
• Vents must be provided at point of last fill, weld lines and around the parting line and relieved to the atmosphere. Vent pins will be utilized in deep pockets were gas will be trapped and restrict fill or cause dieseling.
• Vent pins must be removable from parting line or back of mold without removing cavity blocks, whenever necessary to allow ease of cleaning.
• Unless otherwise specified, vents shall be 0.0010” - 0.0015” deep. Vents shall be added to the mold by the toolmaker before initial receipt unless directed otherwise due to mold/part design. As arranged with Pliant Tooling, final venting may be accomplished after initial sampling to determine optimal locations.

2.4. Cavity Markings:
• Multi-cavity tools will have unique and legible cavity identification on the cavity surface so it is molded into the part. The size and location of the identification will be specified by Pliant Plastics prior to tool build and will preferentially be relatively close to the gate area to ease identification during cavity fill studies.

2.5. Runner/Gate Systems:
• All molds should utilize sub-gates, unless specifically approved otherwise by Pliant Tooling.
• Runner systems shall be full-round (preferred) or trapezoidal, unless specifically approved otherwise by Pliant Tooling and incorporate cold slug wells at the sprue and before each gate.
• Runner systems shall have no sharp transitions (radius blend runner & gate corners for smooth flow).
• Sprues shall be as short as possible.
• Cold runner molds shall have the top of the runner system marked with a “T” to help determine orientation of runner in mold after ejection from the mold. Likewise, the runner system shall have the cavity identifications marked on the runner system also.
• Molds with diaphragm gates must have cavity identification marked on each diaphragm.
• Family tools must incorporate runner shutoffs to allow cavities to be run individually or together and should be accessible from the parting line of the mold.

2.6. Cams/Slides:
• Allcams/slides should be pulled with horn pins (positive retraction).
• Allcams/slides, regardless of the direction of movement, will be held in the open position by springs or have an appropriately sized lock back pin to prevent forward movement until engaged by the horn pin, unless specifically approved by Pliant Tooling. Detents for side to side or the bottom action feature for up/down movements may be acceptable, but must be approved by Pliant Tooling prior to tool build.
• Lamina wear plates should be used on all cams and slides.
• Materials with dissimilar hardness should be used to prevent galling of slides, gibbs, horn pins, and wear plates.

2.7. Waterlines:
• Waterline connectors shall be identified with “In”/“Out” and circuit number whenever the direction of flow would affect cooling effectiveness (e.g., when cooling cams/cores prior to the back-plate, when bubblers are employed, etc.).
• Water line connectors must not protrude past the bottom edge of the mold. If this not possible, standoffs must be incorporated onto the bottom of both mold halves to prevent possible damage to them when handling the mold. This must be approved as an exception at initial mold design.
2.8 Mold Steel Checks:
- Tool shops shall provide steel checks on each cavity for any critical dimensions called out on the customer print. This information is to be supplied to either the Process Engineer or Tooling Department before the mold is first delivered to Pliant. On tightly tolerated parts, laser scans of the mold cavities may be requested. Additional steel checks may be required and will be handled on an individual basis depending on the mold in question and necessary requirements.

2.9 Exceptions from Standard:
- There will be circumstances where this standard cannot be followed in its entirety, or that it would not be prudent to do so. The tool source is expected to inform Pliant Plastics Corporation when this is the case and obtain written authorization from Pliant Tooling or the responsible Sale-Engineer. In no case shall the toolmaker proceed with actions they feel are unwise for the situation without informing Pliant Plastics Corporation of the expected consequences and requesting exception or deviation. All communication of this sort shall be in an electronic e-mail format and shall be retained by the Pliant approving authority in the respective part engineering file. Any variance from the standards detailed in this document that are not approved by Pliant Tooling/Engineering, will be the responsibility of the tool shop to bring the tool to the current standards at their cost.

2.10 Hot Runner and Hot Sprue Systems
- Molds incorporating hot runner systems must be wired to the DME wiring format. Standard connector to be used is DME TPC-0001.
- Molds incorporating hot sprue systems must be wired to the DME wiring format, utilizing DME CKPTM-1 connectors, one for each zone.

3. CLASS-SPECIFIC REQUIREMENTS:
3.1. CLASS I molds will also have the following features:
- Quick-change unit based platform or conventional style (if so directed).
- All cavities, cores, & inserts constructed of S-7 tool steel hardened to 52-54 Rockwell. The mold shall be hardened by the toolmaker before initial receipt unless otherwise approved by an authorized Pliant representative.
- Four (4) return pins, minimum .375” OD with four die springs for ejector plate return. Return pin ends or return pin guides must be chamfered at the parting line.
- A minimum of two (2) pillar posts required, also used to retain the EJ plate. Support pillars will support a minimum of 10% of the surface area within the inside edges of the support rails.
- Internal water cooling channels incorporated within both halves of the mold.
- Water connections with quick snap connectors. Location to be approved by Pliant Tooling before build.
- Hardened sprue bushing with a ½” radius and 5/32” orifice diameter fastened in place (to prevent rotating). [removed requirement to be flush with back of mold - rev02]
- EJ plate travel stops, minimum of one required on center.
- Leader pins and bushings to be .375” minimum diameter.
- Positive locating ear plates.
- Laminated plates on all cam slide wear surfaces
- Contoured parting lines will be EDM’ed & blued/spotted using a suitable spotting press.
- Utilize removable cores where possible on details and critical dimensions of molded part.
- Must have eye bolt holes on top of both mold halves to aid in handling and setting of mold.

3.2. CLASS II molds will have the following features:
- Cavity inserts sized to fit Pliant owned unit frames or Master Unit Die (MUD) style. Customer owns cavity inserts only.
- Inserts shall be constructed of S-7 tool steel hardened to 52-54 Rockwell. Tool shall be hardened before initial receipt unless otherwise approved by an authorized Pliant representative.
- Mold design drawings provided only by prior agreement.
- Ejector pins smaller than .125” OD will have a step-shoulder no longer than .500”.
- Molds must incorporate hardened leader pins and bushing on opposite corners to ensure proper alignment.
3.3. **CLASS III** molds will have the following features:
- Cavity inserts sized to fit Pliant-owned unit frames, plate mounts or conventional mount (sized at 3" x 3" or 5" x 6" or Plate style).
- Construction may be of soft steel, aluminum, brass or other materials.
- Ejector pins that are smaller than .125" OD will have a step-shoulder no longer than .500".
- Water cooling circuits are not incorporated in the mold, unless specified by Pliant Tooling.
- Mold design drawings are normally not provided, unless specified on the tooling purchase order.
- Molds must incorporate hardened leader pins and bushing on opposite corners to ensure proper alignment.

4. **MOLD SIZE/MACHINE-SPECIFIC REQUIREMENTS:**

4.1. **MOLD BUILD REQUIREMENTS for 10"x 21", 8"x 19" and 8"x 15" CLASS I MOLDS**
- All molds must have a Quick Change Master Unit Die (MUD) companion insert.
- Molds will have internal water cooling system in both halves, with ¼ -18 NPT quick connect fittings (Parker 300 series).
- Single cavity molds will have the cores and cavities positioned above the sprue (to avoid any damage from nozzle drool), unless otherwise approved by Pliant Tooling.
- 5/8" – 11UNC tapped holes in the top of each half for an eye bolt.
- Centerlines of cooling passages must be a minimum of .500" from the parting line.
- Centerlines of cooling passages must be a minimum of 1.500" from the back of the mold when any quick connect fittings are located on the side or bottom of the mold.

4.2. **MOLD BUILD REQUIREMENTS for 6 ½" x 8" CLASS I MOLDS**
- All molds must have a Quick Change Master Unit Die (MUD) companion insert.
- Molds must have internal water cooling system in both halves, with 1/8-27 or ¼-18 NPT quick connect fittings (Parker 200 or 300 series).
- Single cavity molds will have the cores and cavities positioned above the sprue (to avoid any damage from nozzle drool), unless otherwise approved by Pliant Tooling.
- 3/8-16 tapped holes in the top of each half for eye bolts.
- Centerlines of cooling passages must be a minimum of .400" from the mold parting line for 1/8" lines and .500" for 1/4" lines.
- Centerlines of cooling passages must be a minimum of 1.150" (for 1/8" lines) or 1.1250" (for ¼" lines) from the back of the mold when any quick connect fittings are located on the side or bottom of the mold.

4.3. **MOLD BUILD REQUIREMENTS for 5" X 6" CAVITY INSERT MOLDS**
- Molds must have S-7 steel for cores and cavities on class II molds.
- Molds can be aluminum or mild steel construction for class III molds.
- Ejector pins smaller than .125" OD will have a stepped shoulder no longer than .500".
- Return pins should be incorporated, unless otherwise specifically approved by Pliant Tooling.
- Minimum of 2 leader pins required. Leader pins shall be different sizes with the smaller a minimum of ¼" diameter.
- Cores and cavities shall be above the sprue to avoid any nozzle drool damage unless otherwise specifically approved by Pliant Tooling.
- Sprue orifice must be a .160" minimum ID.
- After the mold has been hardened it must be identified with a circled “H” on the outside of the mold.
4.4. **MOLD BUILD REQUIREMENTS** for 5” x 6” CAVITY INSERT MOLDS w/ INTERNAL WATER LINES

- Center of water line must be a minimum of 1.600” from back of mold.
- Water line connectors must be on the zero side whenever possible.
- Water line connectors must not be on either top or bottom of the mold.
- Centerlines of cooling passages must be a minimum of .400” from the mold parting line for 1/8” lines and .500” for 1/4” lines.
- Water line quick connect fittings must be Parker 200 series.
- Minimum mold thickness is 2.000” for each half containing water lines.
- Molds must have leader pins and hardened bushings to ensure positive alignment of mold halves.

4.5. **MOLD BUILD REQUIREMENTS** 3” x 3” CAVITY INSERT MOLDS

- Leader pins shall be different sizes with the smaller a minimum of \( \frac{1}{4} \)” diameter.
- Contact Pliant Tooling for specific mold requirements for 3” x 3” molds.

4.6. **MILACRON / AUTOEJECTOR ROTARY STYLE VERTICAL IMM MOLDS** for production of over-molded parts will have the following features:

- For 40 ton rotary IMM, mold must be 6.5” x 8” MUD unit. For 150 ton rotary IMM, mold must either be 9” x 12” bolster or 6.5” x 8” MUD unit.
- Nozzle interface must be on parting line of mold and be hardened.

4.7. **MILACRON / AUTOEJECTOR SHUTTLE STYLE VERTICAL IMM MOLDS** for production of over-molded parts will have the following features:

- For 150 ton shuttle IMM, mold must be either 16” x 21” bolster plate.
- Nozzle interface must be on parting line of mold and be hardened.

4.8. **NISSEI ROTARY STYLE VERTICAL IMM MOLDS** for production of over-molded parts will have the following features:

- Mold must be 6.5” x 8” MUD unit.
- Standard ejector half height of 5.500” thickness to minimize adjustment of the injection unit.
- Nozzle interface must be on parting line of mold and be hardened.
# Table 1 - IMM Specifications

| Machine # | Clamp Tonnage (kN) | No. of Cams | Max Carriage Length (mm) | Model | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | Max Shot Size (g) | Specified Mold Frame Size (mm) | 
|-----------|-------------------|-------------|--------------------------|-------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|------------------|-------------------------------|
33 Ton Nissei Platen Drawings

170 ton Milacron Platen Drawing
<table>
<thead>
<tr>
<th>INJECTION MOLD BUILD STANDARDS</th>
<th>SD.7.5.1.5.1.02</th>
<th>REV: 07</th>
</tr>
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<tbody>
<tr>
<td>CREATED BY: G. Ferris</td>
<td>APPROVED BY: P. Frens</td>
<td></td>
</tr>
<tr>
<td>4 March 2013</td>
<td></td>
<td></td>
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</tbody>
</table>

**120 ton Milacron Platen Drawing**

![Diagram of 120 ton Milacron Platen Drawing]

**55 ton Milacron Hydraulic Platen Drawing**

![Diagram of 55 ton Milacron Hydraulic Platen Drawing]

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INJECTION MOLD BUILD STANDARDS
SD.7.5.1.5.1.02
REV: 07
CREATED BY: G. Ferris
APPROVED BY: P. Frens
4 March 2013

17 ton Milacron ROBOSHOT
Platen Drawings

Stationary Platen
Moving Platen

Nissei 250 Ton Two Shot Platen Drawing
Nissei 50 Ton Vertical Rotary Platen Drawing

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CH 40-R Rotary Table

1/2-13 TAP
FRONT
UPPER PLATEN

PROFILE

1/2-13 TAP
ROTARY TABLE

Autojector 40 Ton Rotary IMM Platen Drawings
Autojector 150 Ton Vertical Shuttle IMM Platen Drawings

Autojector 150 Ton Vertical Rotary IMM Platen Drawings

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