True Position Plastics

Scientific Molding Checklist Details

1. Establishing a Robust Process Window

- Scientific molding involves defining a "process window": the acceptable range of parameters where parts are dimensionally stable and cosmetically sound.
- This includes:
    - **Fill time** (to control shear and balance)
    - **Pack pressure and time**
    - **Cooling time**
    - **Mold and melt temperatures**
- This window is discovered through DOE (Design of Experiments) or systematic shot studies.

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2. Pressure Curve Analysis

- Using cavity pressure sensors (e.g., Kistler), you can create a signature curve that captures:
    - Initial filling pressure
    - V/P switchover point
    - Pack/hold performance
- These curves act like a fingerprint for each good shot; deviations can signal issues before defects show up.
- Not ALL molds / Molded products need this level of detail; this is a completely custom addition to any mold; cavity pressure sensors are uncommon in molds to be quite honest.

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3. Gate Freeze Study

- Helps determine exact pack time needed.
- You keep increasing the hold time until the part weight stops increasing; that's when the gate freezes and no more material can enter the part.
- Prevents overpacking or underpacking, which reduces warpage and sink.

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4. Dynamic Check Ring Evaluation

- Ensures the check ring is functioning consistently by analyzing screw recovery and shot-to-shot variation.
- Inconsistent check ring action = inconsistent shot size = dimensional issues.

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5. Velocity-to-Pressure (V/P) Switchover Optimization

- Set the switchover to occur just as the part is 95–98% full (or as identified by a pressure sensor near the gate).
- If too early → short shots.
- If too late → overpacked parts, excessive flash, warpage.

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6. DOE for Cooling Efficiency

- You can use thermal imaging or sensor data to evaluate core/cavity temperature variation.
- Good mold cooling = faster cycle time and reduced warpage.
- Some scientific molding teams even measure coolant ΔT and flow rate per circuit.

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7. Fill Studies

- Multiple short shots to visualize how the part fills, revealing:
  - Flow hesitations
  - Weld lines
  - Air traps
- Done at various fill % (e.g., 20%, 40%, 60%, etc.)

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8. Mold Deflection / Clamp Force Monitoring

- Too little clamp force = flash
- Too much = mold deflection, parting line wear
- Some shops use strain gauges or mold deflection sensors, or simple dial indicators to verify mold seating under load.
- Present day molding machines allow you to view track and trend clamp force vs. time (Clamp force screen).

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9. Real-Time Process Monitoring (RJG eDart, Kistler CoMo, etc.)

- Automated detection of "bad" shots using preset curves or in-window tolerance bands.
- Useful for real-time process control or auto-ejection rejection.
- Again, another very expensive addition and your product should warrant the need for this.

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10. Simulation Validation

- Run Moldex3D or Sigmasoft analysis results, then validate them empirically via:
  - Pressure traces
  - Fill time verification
  - Warpage measurement
  - Cooling curves
- Proves the simulation was accurate, or flags a difference due to mold shop practices/material changes.

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