

LABORATORY POLYMER INJECTION MOLDING MACHINE



Laboratory Polymer Injection Molding Machine - ToronIMM™ PI 20

ToronIMM™ PI 20 laboratory polymer injection molding machine is a desktop-class system for mixing and injection molding of new polymer formulations, blends, and modified compounds on standard AC220V power. At 165kg on a 950×470×600mm footprint, it is the most compact molder in the ToronIMM series. A servo motor controls both screw rotation and mold clamping, with 30kN of servo-regulated locking force and screw speeds of 1–150RPM. This suits polymer research groups, material development labs, and teaching facilities where benchtop footprint and operating simplicity matter.

The three-zone heated barrel reaches 400°C with $\pm 0.5^{\circ}\text{C}$ steady-state accuracy, the highest temperature rating in the ToronIMM lineup and sufficient for processing commodity plastics through high-temperature engineering resins. A 20mm screw with a 9:1 L/D ratio operates at 22N·m torque, delivering screw-driven plasticization in a compact barrel geometry suited to small-volume shot preparation. Manual feeding simplifies material loading for research use where batch sizes are small and changeovers are frequent. PLC touch screen control provides access to all process parameters from a single interface.

Servo motor speed regulation controls the 30kN clamping unit, eliminating hydraulic oil circuits and pneumatic supply requirements and keeping mold closing fully programmable through the PLC. This all-servo, all-electric architecture runs on a single 220V outlet, making the machine straightforward to install and relocate between workstations. Maintenance is simplified with no hydraulic circuits or pneumatic components to service. The combination of mini size, low entry cost, and easy upkeep makes the ToronIMM™ PI 20 a practical starting point for screw-type injection molding in research and teaching environments.

APPLICATIONS

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Applications

The ToronIMM™ PI 20 laboratory polymer injection molding machine serves polymer research, formulation development, and educational polymer processing across a wide range of new material programs.

- New Polymer Material Development: processing experimental formulations, modified compounds, and polymer blends into injection-molded trial specimens to evaluate processability and part properties at laboratory scale
- Polymer Blend and Compound Screening: evaluating how different mixing ratios, compatibilizers, and additive loading levels affect the processability and mechanical output of new compound formulations
- Micro-Volume Specimen Fabrication: producing small injection-molded test pieces from limited quantities of experimental material where minimizing sample consumption is a research requirement
- High-Temperature Engineering Resin Processing: molding specialty engineering plastics and high-temperature polymer systems requiring up to 400°C barrel temperatures, using the machine's full three-zone thermal range
- Polymer Additive and Filler Evaluation: injection molding trial specimens from additive-modified or filler-loaded compounds to assess dispersion quality, surface appearance, and initial mechanical behavior
- Color and Pigment Compounding Trials: processing and evaluating the mixing and distribution of color masterbatches and pigment additions in small injection-molded plaque and bar specimens
- Polymer Processing Education: demonstrating screw-type injection molding principles, melt behavior, and cycle parameter effects in undergraduate and postgraduate materials science and polymer engineering programs
- Feasibility Testing of New Formulations: producing first injection-molded specimens from novel polymer systems to assess processability, shrinkage, and surface quality before scaling to larger laboratory equipment



FEATURES

Laboratory Polymer Injection Molding Machine - ToronIMM™ PI 20 Key Features

The ToronIMM™ PI 20 delivers a self-contained all-servo injection molding platform in the smallest footprint available in the ToronIMM series, prioritizing bench space, entry cost, and ease of upkeep.

- Ultra-Compact Desktop Form Factor (165kg): at 950×470×600mm and 165kg, the machine fits a standard laboratory bench without floor anchoring or structural reinforcement, and relocates between workstations without specialized handling
- All-Servo, Oil-Free Drive Architecture: servo motors control both screw rotation and mold clamping, eliminating hydraulic oil circuits and pneumatic supply lines and keeping the machine self-contained on a single AC220V outlet
- Servo-Regulated Mold Clamping (30kN): locking force is delivered and maintained through servo motor speed regulation, providing programmable, repeatable clamping without hydraulic pressure circuits or pneumatic toggles
- Wide Screw Speed Range (1–150RPM): servo-driven screw rotation is adjustable across a broad range for precise control of plasticization rate and shear for different polymer types and formulations
- 400°C Maximum Barrel Temperature: three independently controlled zones reach 400°C, the highest rated barrel temperature in the ToronIMM product line, accommodating specialty engineering resins and high-temperature polymer systems
- ±0.5°C Temperature Control Accuracy: steady-state thermal accuracy maintains consistent melt conditions for repeated injection cycles, supporting reproducible specimen properties across experimental batches
- Three Independent Barrel Temperature Zones: zone-by-zone thermal profiling enables targeted temperature gradients along the barrel to optimize melt quality for each resin type
- PLC Touch Screen Control: centralized interface provides programmable control over screw speed, temperature zones, clamping sequence, and cycle timing in a straightforward touch-screen format
- Manual Feeding System: simple top-feed material loading suits the small, controlled batch inputs typical of research-scale processing where material is metered manually between shots

- **Cost-Effective Entry-Level Platform:** screw-type injection molding capability at lower capital investment than hydraulic or full-scale electric laboratory machines, making it accessible to programs with limited equipment budgets
- **Easy Maintenance:** all-servo drive architecture eliminates hydraulic circuit servicing, oil changes, and pneumatic component maintenance, reducing the ongoing upkeep burden for laboratory operators

THEORY & METHOD

Theory and Method

Screw-type injection molding processes solid polymer material into shaped parts by combining screw-driven plasticization with servo-controlled injection and mold clamping. During plasticization, the servo motor rotates the 20mm screw within the three-zone heated barrel, conveying material forward while barrel heat and screw shear melt it progressively. Molten material accumulates ahead of the screw tip as the screw retracts to the programmed shot position.

When the shot position is reached, screw rotation stops and the servo drive advances the screw as a plunger, forcing the melt through the nozzle into the clamped mold cavity. The 30kN servo clamping unit holds the mold closed through fill and hold phases, with clamp force regulated through servo motor speed control. Hold pressure maintains cavity fill as the polymer solidifies. The servo mechanism then opens the clamp for part removal.

The 9:1 L/D screw ratio is shorter than the 20:1–30:1 ratios typical of production injection machines, a trade-off that reduces the barrel length and overall footprint to desktop dimensions while retaining screw-driven plasticization. The shorter barrel works with small, manually fed material batches, matching the research workflow where operators process limited quantities of experimental compound. Three independently controlled temperature zones compensate for the shorter melt path, allowing targeted thermal profiling for each resin type processed in the machine.

TECHNICAL SPECIFICATIONS

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Technical Specifications

Parameter	Specification
Screw Diameter	Ø20 mm
L/D Ratio	9:1
Feeding Method	Manual
Screw Torque	22 N·m
Screw Speed	1-150 RPM (servo motor control)
Locking Force	30 kN (servo motor speed regulated)
Temperature Zones	3
Max. Temperature	400°C
Temperature Control Accuracy	±0.5°C
Control Mode	PLC touch screen
Voltage	AC220V±10% (110V is also available)
Overall Dimensions (L×W×H)	950 × 470 × 600 mm
Weight	165 kg



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