

BENCHTOP PNEUMATIC INJECTION MOLDING MACHINE



Benchtop Pneumatic Injection Molding Machine - ToronIMM™ P 20

ToronIMM™ P 20 benchtop pneumatic injection molding machine combines pneumatic injection actuation with a planetary servo screw drive to deliver an oil-free polymer specimen preparation platform on standard single-phase AC220V power. Running on $\geq 0.8\text{MPa}$ compressed air and a standard 220V wall outlet, it needs no industrial power connection. At 480kg net on a caster-mounted 1800×500×950mm frame, the machine repositions freely across laboratories and classrooms. For polymer researchers, materials educators, and R&D engineers who need a capable, self-contained molder without infrastructure demands, the ToronIMM™ P 20 is a practical system.

A 20mm screw with a 20:1 L/D ratio processes a broad range of common thermoplastics, with three independently controlled barrel zones reaching 360°C. Maximum injection capacity is 25cm³ at a standard injection pressure of 57MPa, with an optional force multiplier configuration raising this to 113MPa for lower-flowability resins and filled compounds. A 50kN dual-toggle clamping unit holds the mold through injection and hold phases. The machine supports a replaceable insert mold design that allows cavity inserts to be swapped in approximately 10 seconds, enabling rapid changeover between specimen types without replacing the complete mold assembly.

PLC control through a color touch screen provides centralized parameter entry and process monitoring in an easy one-touch operating format suitable for operators at any experience level. The single-phase 2.2kW power draw at 10A keeps electrical installation straightforward in facilities with limited panel capacity. Injection position resolution of 0.1mm supports precise shot volume repeatability across cycles. Dual mechanical and electronic safety protection covers all operating modes, making the machine appropriate for shared educational and research environments.

APPLICATIONS

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Applications

The ToronIMM™ P 20 benchtop pneumatic injection molding machine supports polymer specimen production, hands-on materials education, and small-batch R&D across a broad range of laboratory and institutional settings.

- Polymer Research and Development: preparing molded specimens from experimental formulations, compound modifications, and polymer blends to evaluate processability and physical properties under controlled conditions
- Test Specimen Fabrication: producing tensile bars, impact specimens, light transmittance plaques, electric breakdown discs, shrinkage samples, thermal deformation bars, and color calibration plates across multiple polymer grades
- Polymer Processing Education and Classroom Demonstration: illustrating injection molding principles, pneumatic actuation, and melt flow behavior in undergraduate and postgraduate materials science and plastics engineering programs
- Multi-Specimen Research Programs: using the replaceable insert mold system to switch between different specimen geometries mid-session, enabling comparison of multiple specimen types from a single polymer batch
- Melt Flow and Processability Screening: preparing small injection-molded samples to assess how formulation changes, additives, and processing temperature profiles influence flowability and part surface quality
- New Material Modification and Testing: molding representative specimens from modified polymer systems, blended compounds, and experimental additive packages for comparative mechanical property assessment
- Electrical Property Specimen Production: fabricating electric breakdown test specimens and dielectric discs for electrical insulation testing programs
- Scientific Research and Industrial Prototyping: supporting experimental injection molding programs at universities, research institutes, and manufacturing facilities with minimal space and utility infrastructure requirements



FEATURES

Benchtop Pneumatic Injection Molding Machine - ToronIMM™ P 20 Key Features

The ToronIMM™ P 20 delivers a self-contained pneumatic injection molding platform built for oil-free laboratory operation, standard civil power compatibility, and rapid multi-specimen workflows.

- **Pneumatic Injection Drive (Oil-Free):** compressed air drives the injection cylinder without hydraulic fluid, eliminating oil contamination risk and allowing installation wherever a $\geq 0.8\text{MPa}$ compressed air line is available
- **Standard Single-Phase AC220V Operation (2.2kW / 10A):** runs on civil residential or standard office power without requiring an industrial three-phase power circuit, simplifying installation in any laboratory, classroom, or office environment
- **Replaceable Insert Mold System (10-Second Changeover):** the inner cavity insert separates from the outer mold carrier frame, allowing specimen geometry to be changed in approximately 10 seconds without disassembling the full mold or resetting the clamping setup
- **Planetary Servo Screw Drive (105N·m):** independent planetary servo motor controls feed speed (0.1–60RPM) and feed torque separately from the injection system, enabling material-specific plasticization settings for each experiment
- **Optional Pneumatic Force Multiplier System:** mechanical advantage device raises injection pressure from 57MPa to 113MPa, accommodating lower-MFI resins, filled compounds, and more complex mold geometries without changing the air supply
- **50kN Dual-Toggle Clamping Mechanism:** robust double-toggle clamp holds molds securely throughout injection and hold phases without pressure variation
- **Three-Zone Barrel Temperature Control (360°C max):** independently controlled barrel zones allow precise thermal profiling for each resin type, with $\pm 0.5^\circ\text{C}$ steady-state accuracy maintaining consistent melt conditions across repeated cycles
- **0.1mm Injection Position Resolution:** precise shot volume control across the full stroke reduces material waste during process setup and supports repeatable specimen dimensions cycle to cycle

- PLC Color Touch Screen with One-Touch Operation: intelligent, centralized interface simplifies parameter entry, process monitoring, and recipe selection for operators at any experience level
- Dual Mechanical and Electronic Safety Protection: combined hardware interlocks and electronic monitoring protect operators and equipment across all operating modes
- Compact, Caster-Mounted Frame (480kg net): 1800×500×950mm footprint repositions freely across labs, classrooms, and demonstration spaces without specialized handling equipment or floor reinforcement

THEORY & METHOD

Theory and Method

Injection molding processes solid polymer pellets into shaped parts through sequential plasticization and injection operations. During plasticization, the servo-driven screw rotates within the three-zone heated barrel, conveying pellets forward and melting them through barrel heat and the mechanical shear generated between the rotating flights and barrel wall. Molten polymer accumulates ahead of the screw tip, pushing the screw rearward until the programmed injection position is reached.

When the screw reaches its set-back position, rotation stops and the pneumatic injection cylinder drives the screw forward as a plunger. Compressed air at $\geq 0.8\text{MPa}$ entering the cylinder pushes the melt through the nozzle into the clamped mold cavity at the programmed rate. Hold pressure follows immediately to compensate for volumetric shrinkage as the part cools and solidifies. The 50kN toggle clamp then opens and the ejector removes the finished part.

The optional force multiplier system uses mechanical advantage to amplify the pneumatic cylinder's output, raising injection pressure from 57MPa to 113MPa without requiring higher air supply pressure. This extends the material range to lower-MFI and filled compounds beyond standard pneumatic capability. The machine supports a replaceable insert mold design where the inner cavity insert separates from the outer carrier frame. Swapping inserts changes the specimen geometry while the carrier and clamping setup remain in place, reducing tooling cost and allowing rapid changeover between specimen types mid-session.

TECHNICAL SPECIFICATIONS

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Technical Specifications

Parameter	Specification
Screw Diameter	Ø20 mm
L/D Ratio	20:1
Feed Torque	105 N·m (servo motor + planetary gearbox)
Feed Speed	0.1-60 RPM
Injection Stroke Range	0-80 mm
Injection Resolution	0.1 mm
Maximum Injection Capacity	25 cm³
Injection Pressure (standard)	57 MPa
Injection Pressure (with force multiplier)	113 MPa (optional)
Clamping Force	50 kN (dual-toggle mechanism)
Mold Opening Stroke	~70 mm (excl. mold)
Tie Bar Spacing	280 × 186 mm
Mold Size (max, excl. mold plates)	360 × 90 × 72 mm (L×W×H)
Mold Thickness	0-25 mm (freely adjustable)
Fixed Platen Ring OD	Ø50 mm

Parameter	Specification
Hopper Capacity	0.2 L
Temperature Zones	3 (Zone 1/2/3)
Max Temperature	360°C
Temperature Control Accuracy	±0.5°C (steady state)
Air Pressure Required	≥0.8 MPa
Voltage	Single phase AC220V±10%, 50Hz, 2.2kW, 10A (110V is also available)
Overall Dimensions (L×W×H)	1800 × 500 × 950 mm
Gross Weight	540 kg
Net Weight	480 kg



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