2012 Mold Masters Innovations
Mold-Masters I Product & Service Portfolio

- Injection Units
- Hot-Runners
- PET
- Controllers
# Products driving performances

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<td>E-Multi</td>
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Master Serie
Master-Series I The Flagship

✔ 12 standard gate options
✔ 6 standard nozzle sizes
✔ Precise temperature control with brazed heater technology and integrated T/C
Nozzle Design: Reliability versus Replaceability

- **THERMOCOUPLPE CONTROL NEAR TIP (BETTER GATE QUALITY)**
- **STANDARD MASTER-SERIES GATE SEALS**
- **PROFILED and FUSED HEATER ELEMENT (EVEN HEATING)**
- **CORE MADE FROM HEAT TREATED H13 – withstands 40,000 psi**
- **ENGINEERED TERMINAL ENDS**
- **BRAZED H13 ASSEMBLY**

Even heating results in more balanced filling and less degradation.

Large channel bores reduce pressure to fill.
<table>
<thead>
<tr>
<th>Master-Series I Nozzle range</th>
<th>Hecto</th>
<th>Deci</th>
<th>Centi</th>
<th>Pico</th>
<th>Femto</th>
<th>Femto Lite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Valved</td>
<td><img src="image1" alt="Hecto Non-Valved" /></td>
<td><img src="image2" alt="Deci Non-Valved" /></td>
<td><img src="image3" alt="Centi Non-Valved" /></td>
<td><img src="image4" alt="Pico Non-Valved" /></td>
<td><img src="image5" alt="Femto Non-Valved" /></td>
<td><img src="image6" alt="Femto Lite Non-Valved" /></td>
</tr>
<tr>
<td>12mm – 16mm</td>
<td>12mm</td>
<td>8mm</td>
<td>6mm</td>
<td>5mm</td>
<td>5mm</td>
<td>3.5mm</td>
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<tr>
<td>Valved</td>
<td><img src="image1" alt="Hecto Valved" /></td>
<td><img src="image2" alt="Deci Valved" /></td>
<td><img src="image3" alt="Centi Valved" /></td>
<td><img src="image4" alt="Pico Valved" /></td>
<td><img src="image5" alt="Femto Valved" /></td>
<td><img src="image6" alt="Femto Lite Valved" /></td>
</tr>
<tr>
<td>16mm – 18mm</td>
<td>16mm</td>
<td>11mm</td>
<td>8mm</td>
<td>7mm</td>
<td>6mm</td>
<td>n/a</td>
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</tbody>
</table>
Brazing for Longer life and better Thermal Profiles

- Wider operating windows
- Efficient brazed heater elements
  - 10% less power than conventional hot runner
- Minimal Maintenance, Maximum Uptime

**Brazed Nozzle – Temperature Profile**

**Non-Brazed Nozzle – Temperature Profile**
Accu-Valve I Premium valve gate solution

- Pristine cylindrical valve gating of commodity and engineering resins
- Continuous pin guiding
- 2 million cycle guarantee
- <150 shot color changes
Hot-Tip I Premium open gate solution

- Visco-Seal™: Additional leak-proof protection achieved with a thin plastic membrane that solidifies at edge of seal
- Seals and liners can be easily replaced in the press
- Liners are made from various materials depending on resin properties and requirements
  - Thermal cycling
  - Wear resistance
Master-Series I The Manifold Technology

- Patented 2-piece brazed Unique manifold technology in the industry

- Runners are carefully milled and polished, with no sharp corners or dead spots, promoting fast and precise color change

- Endless configurations of runner routes that drilling doesn’t allow for
Balanced Fill – Brazed Manifolds - IFlow

- 10% less fill pressure
- 1% imbalance at 95% fill
- Opportunity for faster fill rates
- 2 Piece Brazed Manifolds
  - Optimized flow paths to eliminate dead spots
  - Rapid color changes
- Minimized part weight variation for improved blow performance

Impact of Superior Balance
Less weight variation & faster fill ~ $US 60K Savings/yr on 96 Cavity
iFlow Manifolds: Lower Pressure Drop

<table>
<thead>
<tr>
<th></th>
<th>Pressure Drop (bar)</th>
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<tbody>
<tr>
<td><strong>1.5 MFI HDPE</strong></td>
<td></td>
</tr>
<tr>
<td>Gun Drill</td>
<td>36.1</td>
</tr>
<tr>
<td>2 Pc</td>
<td>32</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>-11.4%</td>
</tr>
</tbody>
</table>
iFLOW Manifolds: Better Color Change

Gun Drilled manifold channels can leave dead spots impeding color changes.

iFLOW
2 PC BRAZED MANIFOLD

CONVENTIONAL GUN DRILLED MANIFOLD
Cast-in heaters improve temperature uniformity versus pressed in heaters.

Multiple melt channels for different materials can be designed in the same manifold reducing the overall stack height by up to 22%.
Accu-Line
Long Nozzle improvements

- 98% of all long Femto nozzles are not pitch constrained but a small bore nozzle is used due to
  - Tight gate access
  - A side ejection or pins interference

- 75mm of nozzle length with small bore is needed to avoid needing to use a Femto nozzle
Compound Nozzle: Strength and small size gate

- For >150mm long Femto applications with tight gate access
- Larger stem provides 2x stiffness
- Single profiled heater covers entire nozzle
- Uses standard Pico Flange, terminal nut and sleeve with Femto gate cutout
- Lower pressure losses than current Femto nozzle due to larger bores at the flange end

**Diagram:**
- **PICO BODY**
  - Ø7.00mm BORE / Ø3.00mm PIN
- **FEMTO BODY**
  - Ø6.00mm BORE / Ø2.50mm PIN
- **STANDARD FEMTO GATE CUTOUT**

75 mm
Femto-Lite VG: commodity resins / high flow

Φ6.0mm
Φ5.0mm
Φ4.0mm
Φ2.5mm
Small Synchro-Plate

- Max. drops number per unit (pneumatic)
  - 3 drops for 3mm gate or less
  - 5 drops for 2.5mm gate or less).
- Stroke up to 9.75mm
- Either Pneumatic or Hydraulic can be applied.
Patented design eliminates traditional cold slug found on edge gated parts

For small or deep-draw parts

2 to 8 gates per drop with multiple angle configurations

Up to 192 cavities with a wide range of thermoplastic resins

Individual gate shut-off option with fool proof open/close position for temporary suspending individual cavities

Optimal heat control

Eliminates edge-gate’s cold slug
Markets

Pipettes

Tampon Applicator

Syringe Barrel

Syringe Barrel • with luer lock
Advantages

Melt-Disk uses STANDARD Hot Half Design
192 Cavity Melt Disk
Drops per Melt Disk

15 degree

30 degree

45 degree

60 degree
Typical mold application is similar to our standard melt disk except for access port and termnut cutout addition.

Termnut facing down allows easy serviceability of melt disk.
MPET I Next generation preform solutions

- Complete preform molds from 2 to 192 cavities
- Conversions & refurbishing
- Hot runners
- Spare parts
- Complete preform systems
- iCOOL and iFLOW Technology
- Quick change tooling for higher uptime & lower capital expenditure
Purpose engineered hot runner systems for ultra fast closure molding

Engineered for High Performance
Sprint I Engineered for Speed

- Industry standard gate bubble
- Cavitations up to 2 x 128
- Specifically engineered for applications running < 3 to 6 second cycles
- Hot tip / valve gate solution
- Robust seal-off with 250% more shut-off area
- Insulator withstands high melt pressures
Sprint Nozzle Designed for Closure Molding

- Individual thermocouple tip control for precise gate vestige tuning
- Brazed heaters for superior temperature control and long life
- Nozzle far away from part cavity for optimized cooling of cavity insert
- Robust, easily removable gate seals that are interchangeable with alternative systems
- Press fit Insulator Ring around torpedo – stays on torpedo during maintenance
- Fits industry standard gate bubble and size for easy retrofits
Hot Tip vs. Valve Gate

**Hot Tip**

**Used when**
- Some stringing is acceptable
- Small vestige is acceptable
- Cycle times are less than 6 seconds
- Costs is less than VG solution providing faster returns

**Valve Gate**

**Used when**
- Flat gate surface is required with no pin hole or vestige
- No strings are acceptable
- Cycle time is 4.6 seconds or more
- Permits larger gates resulting in lower shear rate in gate area which increases top panel strength
SPRINT - Valve Gate

- New Liner – NAK55, Large Exit holes
  - Colder Gate
- Uses DECI CX style gate cutout
  - TSM108-1C-- for 3mm Pin
    - (TSLM098 +TSM108-1)
  - Valve Disk – VD0113B
- Minimum cycle time: 4.6 sec
- Minimum cooling time: 1.6 seconds
Taking Valve Gating to the next level
Taking Valve Gating to the next level

- Advancements
  - Electrification
  - On the fly pin adjustment
  - Automatic stopping and starting of a pin
  - Adjustable Speed and Power of movement
  - Valve pin sensing
E-VG I Electric valve gate solution

- High energy savings
- High closing force
- Fast cycle times
- Sequential Valve Gate Control
- Simple, Easy to Use Controller
- Great flexibility

75 mm

55 mm

2 cavity Accu-Valve CX hot half with 75mm and 55mm EVG
Electric Solenoid Actuation

- 110V to 220V power source
- Solenoids are class 10,000 capable
- Flexibility: Individual cavities can be remotely turned off without temperature changes in the nozzles
- Consistency
  - No dependency on shop air pressure
- Serviceability
  - 2 bolt removal of piston with no need to remove valve pins
Electric Solenoid Actuation

- Very fast cycle times are possible
  - Down to ~ 0.9 seconds
- Low maintenance
  - Life span of 10 to 20 million cycles
  - No wear components (no o-rings)
- Pin motion sensor to detect whether the pin has moved
- Extremely high forces possible at the end of the closing stroke
Syncro plate valve pin actuation with servo motor control

Fully enclosed valve gating system with electro-mechanical actuation

Applicable for 2 up to 128 cavities

Oil-free actuation, all electrical (no oil/air power)

Suitable for clean room applications

High performance system for absolute stable production processes

Sustainable production/part quality

Cost-effective solution based on TCO

60% less energy consumption compared to hydraulic valve gate systems

>50 % reduced maintenance costs due to extended maintenance cycles

Magnetic Pin Option
New E-drive System Features

- Fully enclosed and all electrical--no oil or air power required
  - Suitable for clean room applications
- 60% energy savings compared to hydraulic valve gates
- Applicable for 16 to 128 cavities
- Ball screws eliminate friction, lubrication or loss of energy versus sliding movement systems
Components View

- Valve pin (synchro) plate
- Idlers (2)
- Tensioning idler
- Ball Screws (2)
- Servo and gear box
Section View

- Ball Screw (2)
- Inlet
- Valve pins
E-Drive Controller

- Touch Screen & Stand Alone: allows for use on multiple machines
- Small Foot Print: 35 x 28 x 21 cm
- Stores up to 10 different setups
Fusion G2

Large Part Molding - Fusion G2
Fusion-Series G2 I Medium to Large Part

- Drop-in, connect, go!
- Single point connection design
- Faster start-ups, reliable operation and user-friendly maintenance
- Completely pre-assembled and pre-wired
- Quick access to spare parts due to modular standard components
- Rapid 2D and 3D designs resulting in expedited system delivery
- Geared for medium and large part applications
Typical Applications

50g to 750g per nozzle

Commodity and engineering grade resins

Two to eight nozzles ideal (Based on tooling size)

Contoured parting line requiring independent length nozzles

Long nozzle applications, up to 550mm (22")
Offer a Complete Pellet to Gate Solution!

Hydraulic

Integrated control

Electric
E-Multi I All-Electric Injection Units

- All-electric mold-mounted injection unit
- Compact footprint
- Simple to setup and operate
- Fast, precise injection
- Low maintenance
- Energy efficient

<table>
<thead>
<tr>
<th></th>
<th>E60 (Standard)</th>
<th>E60X</th>
<th>E490 (Standard)</th>
<th>E490X</th>
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<tbody>
<tr>
<td>Schneckendurchmesser (mm)</td>
<td>14</td>
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<tr>
<td>Einsatzdruck (bar)</td>
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<td>1530</td>
<td>1530</td>
<td>1210</td>
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<td>Einsatzhub (mm)</td>
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<td>100</td>
<td>100</td>
<td>130</td>
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<td>Schussgewicht (cc)</td>
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<td>Schneckengeschw. (rpm)</td>
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<td>Max. Einspritzgeschw. (mm/s)</td>
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<td>Max. Einspritzrate (cc/s)</td>
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<td>Düsenkraft (kN)</td>
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<td>Düsen-Präzision (mm)</td>
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<td>Länge (mm)</td>
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<tr>
<td>Breite (mm)</td>
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<td>480</td>
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<tr>
<td>Höhe (mm)</td>
<td>400</td>
<td>400</td>
<td>510</td>
<td>510</td>
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<tr>
<td>Gewicht (kg)</td>
<td>190</td>
<td>205</td>
<td>500</td>
<td>525</td>
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</table>
Adaptor kit

The mold adaptor plate will be unique per each project. It requires hot runner locating ring dimension, mounting location. This plate has two standard thickness.

EXI 60 & 130, the thickness will be 30 mm
EXI 240 & 490, the thickness will be 40 mm

If needed!

The mold support beam is another unique part per project. The injection machine information is required. Location, width, height and length will require engineering.
Hot Runners for Single Stage
Axiom Hot Runner Technology
Intensive development effort optimized performance & reliability

- iFLOW manifold for balance, color change
- Master Series Nozzles (Centi & Deci)
- Valve disk & hydraulic driver with special sealing device
- Synchro Plates for tight pitches
Technology to drive your business growth

Confidential Information: Please do not copy or distribute
IRIS I Co-Injection Technology

- Unique **barrier molding solution for i.e. food and beverage containers**
- Barriers to protect the product and ensure a long shelf life
- Such barriers are typically created using glass, metal or plastic, with liners or multiple layers
- **IRIS co-injection technology** is a **revolutionary alternative** to these traditional packaging methods
- IRIS co-injection is achieved via the combination and integration of Mold-Masters’ key technology elements
- **Single source supply** of the melt distribution and control system with global service and support
- **Lower capital investment** with the ability to use existing tooling and machinery
- Production flexibility as the IRIS system can easily be moved to other machines and locations
Co-injection: Multiple materials through 1 nozzle

- Skin Barrel A
- BARRIER Barrel B
- HR Nozzle 1
- Cavity 1
- HR Nozzle 2
- Cavity 2
Potential Barrier Applications

- Beverage containers and lids
  - Beer, juice, carbonation, teas, milk, coffee
- Closures – single piece
- Food containers and lids
  - Tomato based, diced fruit, puddings
- Wet pet food
- Medical
- Chemical
Hardware Technologies

- iFlow
- Brazed in heat
- Brazing
- Nozzle design
- E-Drive
- E-Multi
Importance of Balance

- First shot balance is critical as it determines the position and balance of the barrier
- Molding surfaces must be held to tighter than normal tolerances
  - 0.02 total on parts >0.7mm thick
  - Less on parts <0.5mm thick

Fill balance within 10% at 50% fill
Barrier Control: Thickness

- Nominal barrier thickness was 0.05mm on 0.73 mm wall (7% of wall)
  - Barrier thickness can be increased up to ~20% of the wall section with this approach
  - Barrier thickness variation across 16 closures was 0.03mm
Melt-CUBE I Next Generation Hot Edge Gating

- 20% higher pitch density than circular systems
- Retains benefits of patented Melt-Disk
- Easy tip removal in the press
- Simultaneous gating of 2 to 16 cavities
- Able to run engineering grade resins
Melt-CUBE I Next Generation Hot Edge Gating

- Retains benefits of patented Melt-Disk
  - Precise tip location due to Melt-link
  - Separate heat control of tips from nozzle
  - No cold slug
- Easy tip removal in the press
- Simultaneous gating of 2 to 16 cavities
- Able to run engineering grade resins
- 20% higher pitch density than circular systems
Advantages of the New Design

- Individual shut-offs
- Less number of zones for temperature controller
- Minimized gate to parting-line distance
- Can use present in-house mold design practices
- Supports are away from gating area (less worried about heat loss) close to gate
Plan View of Melt-Cube & Cavities
Angled Nozzle Options

- 15, 30, 45 and 60 degree options will be available
- Center Wedge Loads Both Tips Together

15 Degree

30 Degree
Fusion Lite
Introducing the new Fusion Lite system

- Specially engineered angled step
- Drop-in functionality with quick disconnects
- Pre-assembled and pre-wired
- Field replaceable components including heaters
- Quick actuator disassembly to release valve pin
- Optional dual thermocouples
- Optional water cooling nozzle jacket
Fusion Lite – Key Features

- **Manifold – Key Features**
  - Standard sub manifolds
  - Semi-engineered custom angles

- **Transfer Seal Design**
  - Larger channels for increased flow
  - Improved gate steel condition
  - Tapered shutoff
    - Eliminates flow lines
    - Pristine gate

- **Improved piston design**
  - Integrated cooling
  - Standard anti rotation feature
# Fusion Lite – System Features and Customer Benefits

<table>
<thead>
<tr>
<th>System Features:</th>
<th>Customer Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Specially designed for the Automotive Lens/Housing Industry</td>
<td>• Minimized business risk</td>
</tr>
<tr>
<td>• Specially engineered angled step</td>
<td>• Able to meet a variety of angles for optimal gate locations</td>
</tr>
<tr>
<td>• ‘Drop-in’ functionality with quick disconnects and field replaceable components</td>
<td>• More uptime. Supports quick, easy maintenance and minimal precision machining required</td>
</tr>
<tr>
<td>• Dual Thermocouples</td>
<td>• Increased uptime and quick easy maintenance</td>
</tr>
<tr>
<td>• Replaceable heaters</td>
<td>• Quick, easy maintenance</td>
</tr>
<tr>
<td>• Extended Bi-Metallic C-Valve</td>
<td>• Improved steel condition at the gate</td>
</tr>
<tr>
<td>• Water Jacket design</td>
<td>• Simplified cooling circuit design gives consistent gate thermal profile</td>
</tr>
<tr>
<td>• Quick Valve Pin release</td>
<td>• Quick and easy maintenance</td>
</tr>
<tr>
<td>• Pneumatic actuator</td>
<td>• Quick and easy maintenance</td>
</tr>
</tbody>
</table>
Key Technical Features

- Optional Solenoid Valves
- Wire Armor
- Nozzle
- Gate Seal Package
- Bridge
- Inlet
- Heater Plate
- Pneumatic Actuator
- Angled Step (Wedge)
- System Mounting
- Optional Water Cooling Nozzle Jacket
- Integrated Electrical Panel
- Manifold
Fusion Lite - Typical Applications

- Auxiliary Lights
- Rally & Off-road Lamps
- Headlights
- Dipped Beam
- Main Beam
- Tail Lights
- Marker Lights
- Signal Lights
MasterSOLUTION I Offerings

- Custom engineered solutions
- Technical training and consulting
- Mentoring program (co-development program)
- Large program management incl. risk assessments
- Trouble shooting
- SAMP > Solution Assessment Management Program
- CAMP > Cause Assessment Management Program
Femto Nano valve gate

For 11mm cutout, 220V nozzle, up to 200mm long
Advanced Applications: multi valve gate nozzle

Gate pitch up to 5mm
Slim Stack Mold

Up to 1/3 saving in stack height
Accuvalve hypermorphing to higher quality: M-EX

- Improved gate quality
- Improved balancing
- Reduced pressure drop
- Improved components longevity
Advanced Applications: large cavitation
Unique solutions

128+128 stack mold