



# E-Multi™



## User Manual

version 5





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# Section 1 - Introduction

The purpose of this manual is to assist users in the integration, operation and maintenance of an E-Multi Auxiliary Injection Unit. This manual is designed to cover most system configurations. This manual should be used in conjunction with E-Multi Controller User Manual. If you need additional information specific to your system, or information in another language, please contact your representative or a *Mold-Masters* office.

## 1.1 Intended Use

*Mold-Masters'* E-Multi systems have been built to process thermoplastic material at the required temperature for injection molding and must not be used for any other purpose. The E-Multi injection unit is to be integrated with a host injection molding machine and not used as a standalone device. Any other uses would fall outside the engineered intent of this machine, which may be a safety hazard and will void any and all warranties.

## 1.2 Documentation

This manual is part of the documentation package for your order and should be referenced along with the following documents included in the package:

- The Bill of Materials (BOM). Together with the General Assembly drawing, the Bill of Materials should be referenced when ordering spare parts.
- General Assembly drawing
- Electrical drawings
- CE declaration of conformity and declaration of incorporation (EU only)

## 1.3 Release Details

Table 1-1 Release Details		
Document Number	Release Date	Version
AIU-UM-EN-00-05-7	May 2019	05-7

## 1.4 Warranty

For current warranty information please refer to the documents available from our website: <https://www.milacron.com/mold-masters-warranty/> or contact your *Mold-Masters* representative.

## 1.5 Returned Goods Policy

Please do not return any parts to *Mold-Masters* without pre-authorization and a return authorization number supplied by *Mold-Masters*.

Our policy is one of continuous improvement and we reserve the right to alter product specifications at any time without giving notice.

## **1.6 Movement or Resale of Mold-Masters Products or Systems**

This documentation is intended for use in the country of destination for which the product or system was purchased.

*Mold-Masters* takes no responsibility for documentation of products or systems if they are relocated or resold outside the intended country of destination, as stated on the accompanying invoice and/or waybill.

## **1.7 Copyright**

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## 1.8 Units of Measure and Conversion Factors



### NOTE

The dimensions given in this manual are from original manufacturing drawings.

All values in this manual are in S.I. units or subdivisions of these units. Imperial units are given in parenthesis immediately after the S.I. units.

Table 1-2 Units of Measure and Conversion Factors		
Abbreviation	Unit	Conversion Value
bar	Bar	14.5 psi
in.	Inch	25.4 mm
kg	Kilogram	2.205 lb
kPa	Kilopascal	0.145 psi
gal	Gallon	3.785 l
lb	Pound	0.4536 kg
lbf	Pound force	4.448 N
lbf.in.	Pound force inch	0.113 Nm
l	Litre	0.264 gallon
min	Minute	
mm	Millimeter	0.03937 in.
mΩ	Milli Ohm	
N	Newton	0.2248 lbf
Nm	Newton Meter	8.851 lbf.in.
psi	Pound per square inch	0.069 bar
psi	Pound per square inch	6.895 kPa
rpm	Revolutions per minute	
s	Second	
°	Degree	
°C	Degree Celsius	0.556 (°F -32)
°F	Degree Fahrenheit	1.8 °C +32

## 1.9 Trademarks and Patents

ACCU-VALVE, DURA, E-MULTI, FLEX-DURA FLEX-SERIES, FUSION-SERIES, HOT EDGE, MASTERPROBE, MASTER-SHOT, MOLD-MASTERS, MELT-DISK, MOLD-MASTERS ACADEMY, MASTER-SERIES, MASTERSOLUTION, MASTERSPEED, MERLIN, MOLD-MASTERS SYSTEM, MPET, STACK-LINK, are the registered trademarks of MOLD-MASTERS (2007) LIMITED.

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# Section 3 - Safety

## 3.1 Introduction

Please be aware that the safety information provided by *Mold-Masters* does not absolve the integrator and employer from understanding and following international and local standards for safety of machinery. It is the responsibility of the end integrator to integrate the final system, provide necessary e-stop connections, safety interlocks and guarding, to select the appropriate electrical cable for the region of use and to ensure compliance with all relevant standards.

It is the responsibility of the employer to:

- Properly train and instruct its personnel in the safe operation of equipment, including the use of all the safety devices.
- Provide its personnel with all necessary protective clothing, including such items as a face shield and heat resistant gloves.
- Ensure the original and continuing competence of personnel caring for, setting up, inspecting and maintaining injection molding equipment.
- Establish and follow a program of periodic and regular inspections of injection molding equipment to ensure it is in safe operating condition and proper adjustment.
- Ensure that no modifications, repairs, or rebuild of portions are made to the equipment that reduces the level of safety existing at time of manufacture or remanufacture.

### 3.2 Safety Hazards

The following safety hazards are most commonly associated with plastic injection molding equipment (see European Standard EN201 or American Standard ANSI/SPI B151.1).



**WARNING**

Also refer to all machine manuals and local regulations and codes for safety information.

Refer to the illustration of hazard areas below when reading the Safety Hazards Table 3-1 on page 3-3.

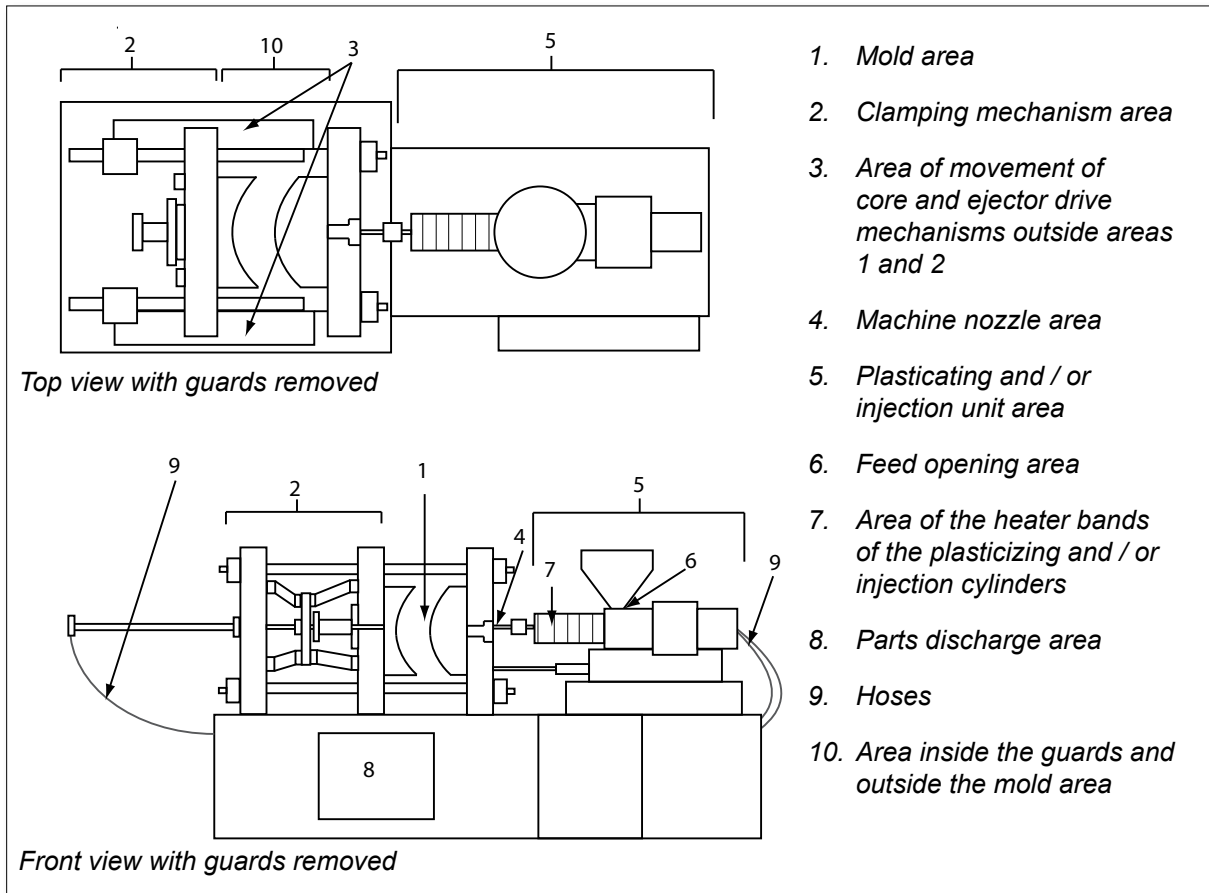


Figure 3-1 Injection molding machine hazard areas.

<b>Table 3-1 Safety Hazards</b>	
<b>Hazard Area</b>	<b>Potential Hazards</b>
<p><b>Mold Area</b> Area between the platens. See Figure 3-1 area 1</p>	<p><b>Mechanical Hazards</b> Crushing and / or shearing and / or impact hazards caused by: Movement of the platen. Movements of the injection barrel(s) into the mold area. Movements of cores and ejectors and their drive mechanisms. Tie bar motion.</p> <p><b>Thermal Hazards</b> Burns and / or scalds due to operating temperature of: The mold heating elements. Plasticized material released from / through the mold.</p>
<p><b>Clamping Mechanism Area</b> See Figure 3-1 area 2</p>	<p><b>Mechanical Hazards</b> Crushing and / or shearing and / or impact hazards caused by: Movement of the platen. Movement of the drive mechanism of the platen. Movement of the core and ejector drive mechanism.</p>
<p><b>Movement of Drive Mechanisms Outside the Mold Area and Outside the Clamping Mechanism Area.</b> See Figure 3-1 area 3</p>	<p><b>Mechanical Hazards</b> Mechanical hazards of crushing, shearing and / or impact caused by the movements of: Core and ejector drive mechanisms.</p>
<p><b>Nozzle Area</b> The nozzle area is the area between the barrel and the sprue bushing. See Figure 3-1 area 4</p>	<p><b>Mechanical Hazards</b> Crushing, shearing hazards, and / or impact hazards caused by: Forward movement of the plasticizing and / or injection unit including nozzle. Movements of parts-of-the power operated nozzle shutoff and their drives. Over pressurization in the nozzle.</p> <p><b>Thermal Hazards</b> Burns and / or scalds due to operating temperature of: The nozzle. Plasticized material discharging from the nozzle.</p>
<p><b>Plasticizing and / or Injection Unit Area</b> Area from the adapter / barrel head / end cap to the extruder motor above the sled including the carriage cylinders. See Figure 3-1 area 5</p>	<p><b>Mechanical Hazards</b> Crushing, shearing and / or drawn-into hazards caused by: Unintentional gravity movements e.g. for machines with plasticizing and / or injection unit positioned above the mold area. The movements of the screw and / or the injection plunger in the cylinder accessible through the feed opening. Movement of the carriage unit.</p> <p><b>Thermal Hazards</b> Burns and or scalds due to operating temperature of: The plasticizing and / or injection unit. The heating elements e.g. heater bands. The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper.</p> <p><b>Mechanical and / or Thermal Hazard</b> Hazards due to reduction in mechanical strength of the plasticizing and / or injection cylinder due to overheating.</p>
<p><b>Feed Opening</b> See Figure 3-1 area 6</p>	<p>Pinching and crushing between injection screw movement and housing.</p>

<b>Table 3-1 Safety Hazards</b>	
<b>Hazard Area</b>	<b>Potential Hazards</b>
<b>Area of the Heater Bands of the Plasticizing and / or Injection Cylinders</b> See Figure 3-1 area 7	Burns and / or scalds due to operating temperature of: The plasticizing and/or injection unit. The heating elements e.g. heater bands. The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper.
<b>Parts Discharge Area</b> See Figure 3-1 area 8	<b>Mechanical Hazards</b> Accessible Through the Discharge Area Crushing, shearing and / or impact hazards caused by: Closing movement of the platen Movements of cores and ejectors and their drive mechanisms. <b>Thermal Hazards</b> Accessible Through the Discharge Area Burns and or scalds due to operating temperature of: The mold. Heating elements of the mold. Plasticized material released from / through the mold.
<b>Hoses</b> See Figure 3-1 area 9	Whipping action caused by hose assembly failure. Possible release of fluid under pressure that can cause injury. Thermal hazards associated with hot fluid.
<b>Area Inside the Guards and Outside the Mold Area</b> See Figure 3-1 area 10	Crushing and / or shearing and / or impact hazards caused by: Movement of the platen. Movement of the drive mechanism of the platen. Movement of the core and ejector drive mechanism. Clamp opening movement.
<b>Electrical Hazards</b>	Electrical or electromagnetic disturbance generated by the motor control unit. Electrical or electromagnetic disturbance that can cause failures in the machine control systems and adjacent machine controls. Electrical or electromagnetic disturbance generated by the motor control unit.
<b>Hydraulic Accumulators</b>	High pressure discharge.
<b>Power Operated Gate</b>	Crush or impact hazards caused by the movement of the power operated gates.
<b>Vapors and Gases</b>	Certain processing conditions and / or resins can cause hazardous fumes or vapors.



### 3.3 Operational Hazards

#### WARNINGS



- Refer to all machine manuals and local regulations and codes for safety information.
- The equipment supplied is subjected to high injection pressures and high temperatures. Ensure that extreme caution is observed in the operation and maintenance of the injection molding machines.
- Only fully trained personnel should operate or maintain equipment.
- Do not operate the equipment with unconfined long hair, loose clothing or jewelry, including name badges, neckties, etc. These may get caught in the equipment and can cause death or serious injury.
- Never disable or bypass a safety device.
- Ensure that the protective guards are placed around the nozzle to prevent the material from splashing or drooling.
- A burn hazard exists from material during routine purging. Wear heat-resistant personal protective equipment (PPE) to prevent burns from contact with hot surfaces or splatter of hot material and gases.
- Material purged from machine may be extremely hot. Ensure protective guards are in place around the nozzle to prevent material from splashing. Use proper personal protective equipment.
- All operators should wear personal protective equipment, such as face shields and use heat resistant gloves when working around the feed inlet, purging the machine or cleaning the gates of the mold.
- Remove purged material from the machine immediately.
- Decomposing or burning material could result in noxious gases being emitted from the purged material, feed inlet or mold.
- Ensure proper ventilation and exhaust systems are in place to help prevent inhalation of harmful gases and vapors.
- Consult manufacturer's Material Safety Data Sheets (MSDS).
- Hoses fitted to the mold will contain high or low temperature fluids or air under high pressure. The operator must shut down and lockout these systems as well as relieving any pressure before performing any work with these hoses. Regularly inspect and replace all flexible hoses and restraints.
- Water and / or hydraulics on the mold may be in close proximity to electrical connections and equipment. Water leakage may cause an electrical short circuit. Hydraulic fluid leakage may cause a fire hazard. Always keep water and / or hydraulic hoses and fittings in good condition to avoid leaks.
- Never perform any work on the mold machine unless the hydraulic pump has been stopped.
- Check frequently for possible oil leaks / water leaks. Stop the machine and make repairs.

**WARNING**

- Make sure that the cables are connected to the correct motors. Cables and motors are clearly labeled. Reversing the cables can result in unexpected and uncontrolled motion causing a safety risk or damage to the machine.
- A crushing hazard exists between the nozzle and mold melt inlet during carriage forward motion.
- A possible shearing hazard exists between the edge of the injection guard and the injection housing during injection.
- The open feed port could present a hazard to a finger or a hand inserted during operation of the machine.
- The electric servo motors could overheat presenting a hot surface which could cause burns to someone touching it.
- The barrel, barrel head, nozzle, heater bands and mold components are hot surfaces which could result in burns.
- Keep flammable liquids or dust away from the hot surfaces as they could ignite.
- Follow good housekeeping procedures and keep floors clean to prevent slips, trips and falls due to spilled material on the work floor.
- Apply engineering controls or hearing conservation programs as necessary to control noise.
- When doing any work on the machine that requires moving and lifting the machine, ensure that lifting equipment (eyebolts, fork lift truck, cranes, etc.) will have sufficient capacity to handle mold, auxiliary injection unit or Hot Runner weight.
- Connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death.
- Mold cable from the controller to the mold must be removed before servicing the mold.

### 3.4 General Safety Symbols

Table 3-2 Typical Safety Symbols	
Symbol	General Description
	<b>General – Warning</b> Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death, and / or damage to equipment.
	<b>Warning – Barrel Cover Grounding Strap</b> Lockout/Tagout procedures must be followed before removing the barrel cover. Barrel cover can become energized upon removal of grounding straps and contact can result in death or serious injury. Grounding straps must be reconnected before reconnecting power to machine.
	<b>Warning – Crushing and / or Impact Points</b> Contact with moving parts can cause serious crushing injury. Always keep guards in place.
	<b>Warning – Crush Hazard Closing Mold</b>
	<b>Warning – Hazardous Voltage</b> Contact with hazardous voltages will cause death or serious injury. Turn off power and review electrical schematics before servicing equipment. May contain more than one live circuit. Test all circuits before handling to make sure circuits have been de-energized.
	<b>Warning – High Pressure</b> Overheated fluids may cause severe burns. Discharge pressure before disconnecting water lines.
	<b>Warning – High Pressure Accumulator</b> Sudden release of high pressure gas or oil can cause death or serious injury. Discharge all gas and hydraulic pressure before disconnecting or disassembling accumulator.
	<b>Warning – Hot Surfaces</b> Contact with exposed hot surfaces will cause serious burn injury. Wear protective gloves when working near these areas.
	<b>Mandatory – Lockout / Tagout</b> Ensure that all energies are properly locked out, and remain locked out until the service work is completed. Servicing equipment without disabling all internal and external power sources can cause death or serious injury. De-energize all internal and external power sources (electrical, hydraulic, pneumatic, kinetic, potential, and thermal).
	<b>Warning – Material Splashing Hazard</b> Molten material or high pressure gas can cause death or severe burns. Wear personal protective equipment while servicing the feed throat, nozzle, mold areas, and when purging the injection unit.
	<b>Warning – Read Manual Before Operation</b> Personnel should read and understand all instructions in the manuals before working on equipment. Only properly trained personnel should operate the equipment.
	<b>Warning – Slip, Trip or Fall Hazard</b> Do not climb on equipment surfaces. Serious slip, trip or fall injuries can result from personnel climbing on equipment surfaces.

Table 3-2 Typical Safety Symbols	
Symbol	General Description
	<b>Caution</b> Failure to follow instructions may damage equipment.
	<b>Important</b> Indicates additional information or used as a reminder.

### 3.5 Wiring Check



#### CAUTION

System Mains Supply Wiring:

- Before connecting the system to a power supply, it is important to check that the wiring between the system and the power supply has been done correctly.
- Particular attention must be given to the current rating of the power supply. For example, if a controller is rated at 63A, then the power supply must also be rated at 63A.
- Check that the phases of power supply are wired correctly.

Controller to Mold Wiring:

- For separate power and thermocouple connections, ensure that the power cables are never connected to the thermocouple connectors and vice-versa.
- For mixed power and thermocouple connections, ensure that the power and thermocouple connections have not been wired incorrectly.

Communications Interface and Control Sequence:

- It is the customer's responsibility to verify functionality of any custom machine interface at safe speeds, prior to operating equipment in the production environment at full speed in automatic mode.
- It is the customer's responsibility to verify all required motion sequences are correct, prior to operating equipment in the production environment at full speed in automatic mode.
- Switching the machinery into Auto mode without having verified the control interlocks and motion sequence are correct, may cause damage to machinery and / or equipment.

Failure to do wiring or connections properly will result in equipment failure.





## 3.6 Lockout Safety

### WARNING

DO NOT enter the cabinet without first ISOLATING the supplies.

Voltage and amperage cables are connected to the controller and the mold. Electric power must be shut off and lockout / tagout procedures followed prior to installing or removing any cables.

Use lockout / tagout to prevent operation during maintenance.

All maintenance should be performed by properly trained personnel based on local laws and regulation. Electrical products may not be grounded when removed from the assembled or normal operating condition.

Ensure proper grounding of all electrical components before performing any maintenance to avoid potential risk of electrical shock.

Often power sources are inadvertently turned on or valves are opened mistakenly before maintenance work is completed, resulting in serious injuries and fatalities. Therefore, it is important to ensure that all energies are properly locked out and that they remain locked out until the work is completed.

If a lockout is not performed, uncontrolled energies could cause:

- Electrocution from contact with live circuits
- Cuts, bruises, crushing, amputations or death, resulting from entanglement with belts, chains, conveyors, rollers, shafts, impellers
- Burns from contact with hot parts, materials or equipment such as furnaces
- Fires and explosions
- Chemical exposures from gases or liquids released from pipelines

### 3.6.1 Electrical Lockout

Employers must provide an effective lockout / tagout program.



#### **WARNING - READ MANUAL**

Refer to all machine manuals and local regulations and codes.



#### **NOTE**

In some instances, there may be more than one power source feeding equipment and steps must be taken to ensure that all sources are effectively locked out.

1. Shut down machine using normal operational shutdown procedure and controls. This should be done by, or in consultation with the machine operator.
2. After ensuring that the machinery has been completely shut down, and all controls in the “off” position, open the main disconnect switch located in the field.
3. Using your own personal padlock, or one assigned by your supervisor, lock the disconnect switch in the off position. Do not lock only the box. Remove the key and retain. Complete a lockout tag and affix to the disconnect switch. Each person working on the equipment must follow this step. The lock of the person doing the work or in charge must be installed first, remain throughout and be removed last. Test the main disconnect switch and make sure it cannot be moved to the “on” position.
4. Try to start the machine using the normal operation controls and point of operation switches to make sure that the power has been disconnected.
5. Other sources of energy that could create a hazard while working on the equipment must also be de-energized and appropriately “locked-out”. This can include gravity, compressed air, hydraulics, steam and other pressurized or hazardous liquids and gases (see table below).
6. When the work is completed, prior to removing the last lock, make sure the operational controls are in the “off” position so that the main disconnect switching is done under “no load”. Ensure all blocks, tools and other foreign materials are removed from machine. Also ensure that all personnel that may be affected are informed that the lock(s) will be removed.
7. Remove lock and tag, and close the main disconnect switch if permission has been given.
8. When the work has not been completed on the first shift, the next operator should install a personal lock and tag before the first operator removes the original lock and tag. If the next operator is delayed, a lock and tag could be installed by the next supervisor. Lockout procedures should indicate how the transfer is to be conducted.
9. It is important that, for their personal protection, each worker and/or fore person working in or on a machine places his/her own safety lock on the disconnect switch. Use tags to spotlight work in progress and give details of work being done. Only when the work is completed and the work permit signed off, may each worker remove his/her lock. The last lock to be removed should be that of the person supervising the lockout and this responsibility should not be delegated.

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### 3.6.2 Energy Forms and Lockout Guidelines

Table 3-3 Energy Forms, Energy Sources and General Lockout Guidelines		
Energy Form	Energy Source	Lockout Guidelines
<b>Electrical Energy</b>	<ul style="list-style-type: none"> <li>• Power transmission lines</li> <li>• Machine power cords</li> <li>• Motors</li> <li>• Solenoids</li> <li>• Capacitors (stored electrical energy)</li> </ul>	<ul style="list-style-type: none"> <li>• Turn off power at machine first (i.e., at point of operation switch), and then at the main disconnect switch for the machine.</li> <li>• Lock and tag the main disconnect switch.</li> <li>• Fully discharge all capacitive systems (e.g., cycle machine to drain power from capacitors) according to the manufacturer's instructions.</li> </ul>
<b>Hydraulic Energy</b>	<ul style="list-style-type: none"> <li>• Hydraulic systems (e.g., hydraulic presses, rams, cylinders, hammers)</li> </ul>	<ul style="list-style-type: none"> <li>• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>• Bleed off and blank lines as necessary.</li> </ul>
<b>Pneumatic Energy</b>	<ul style="list-style-type: none"> <li>• Pneumatic systems (e.g., lines, pressure reservoirs, accumulators, air surge tanks, rams, cylinders)</li> </ul>	<ul style="list-style-type: none"> <li>• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>• Bleed off excess air.</li> <li>• If pressure cannot be relieved, block any possible movement of machinery.</li> </ul>
<b>Kinetic Energy (Energy of a moving object or materials. Moving object may be powered or coasting)</b>	<ul style="list-style-type: none"> <li>• Blades</li> <li>• Flywheels</li> <li>• Materials in supply lines</li> </ul>	<ul style="list-style-type: none"> <li>• Stop and block machine parts (e.g. stop flywheels and ensure that they do not recycle).</li> <li>• Review entire cycle of mechanical motion, ensure that all motions are stopped.</li> <li>• Block material from moving into area of work.</li> <li>• Blank as necessary.</li> </ul>
<b>Potential Energy (Stored energy that an object has the potential to release due to its position)</b>	<ul style="list-style-type: none"> <li>• Springs (e.g., in air brake cylinders)</li> <li>• Actuators</li> <li>• Counterweights</li> <li>• Raised loads</li> <li>• Top or movable part of a press or lifting device</li> </ul>	<ul style="list-style-type: none"> <li>• If possible, lower all suspended parts and loads to the lowest (rest) position.</li> <li>• Block parts that might be moved by gravity.</li> <li>• Release or block spring energy.</li> </ul>
<b>Thermal Energy</b>	<ul style="list-style-type: none"> <li>• Supply lines</li> <li>• Storage tanks and vessels</li> </ul>	<ul style="list-style-type: none"> <li>• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>• Bleed off excess liquids or gases.</li> <li>• Blank lines as necessary.</li> </ul>

## 3.7 Disposal



### WARNING

Milacron *Mold-Masters* declines any responsibility for personal injury or personal damage arising from reuse of the individual components, if these parts are used other than for the original and proper intended purpose.

Recycling of the materials occupies a forefront position during the disposal process.

1. Hot runner and system components must be disconnected from the power supply fully and properly before disposal, including electricity, hydraulics, pneumatics and cooling.
2. Ensure that the system to be disposed of is free from fluids. In the case of hydraulic needle valve systems, drain the oil from the lines and cylinders and dispose it in an environmentally responsible manner.
3. The electrical components are to be dismantled, separating them accordingly as environmentally friendly waste or disposed as hazardous waste if necessary.
4. Remove the wiring. The electronic components are to be disposed in accordance with the national electric scrap ordinance.
5. The metal parts are to be returned for metal recycling (waste metal and scrap trade). The instructions of the corresponding waste disposal company are to be observed in this case.

Recycling of the materials occupies a forefront position during the disposal process.

### 3.8 E-Multi Injection Unit Safety Hazards

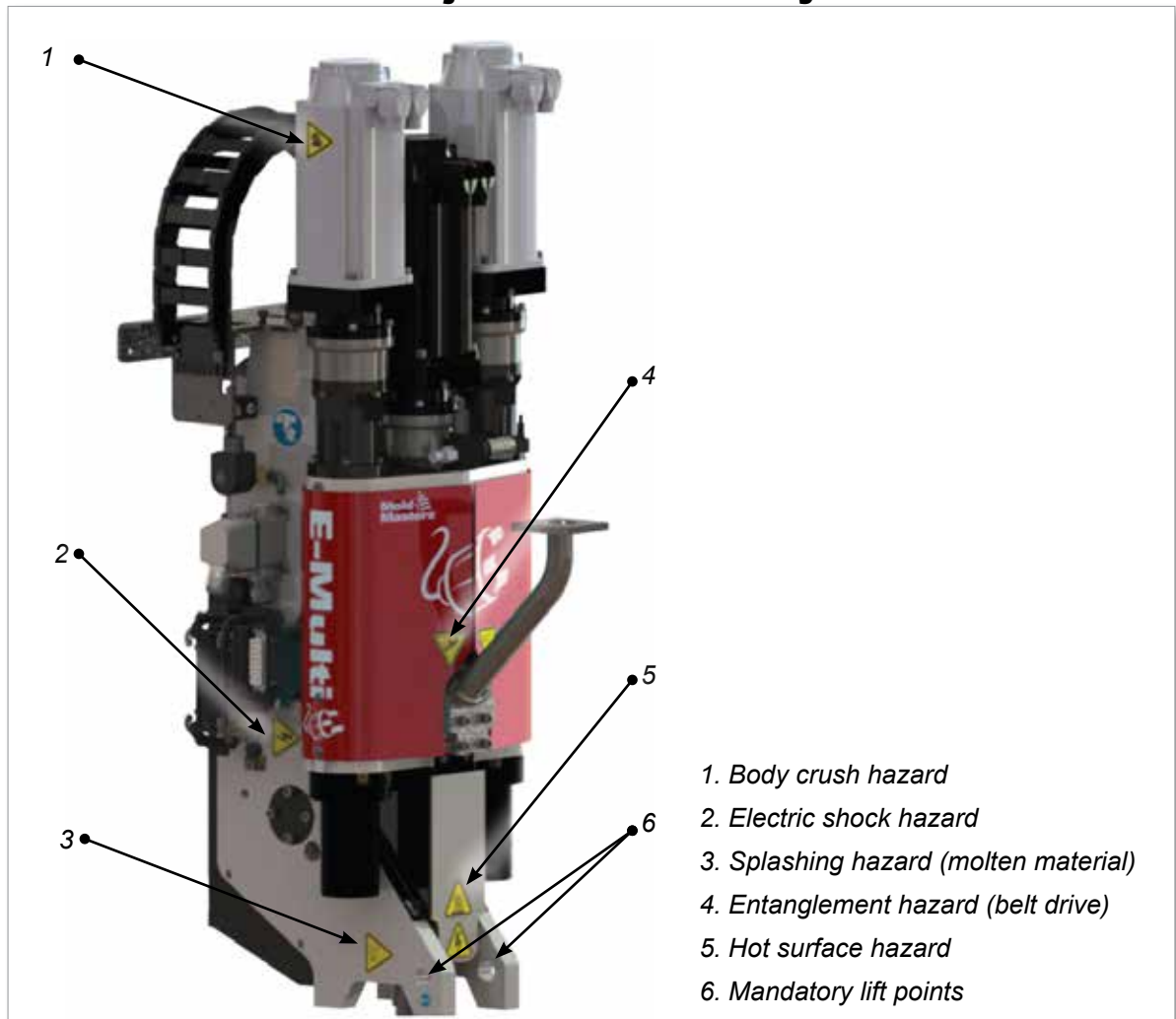


Figure 3-2 E-Multi safety hazards

**E-Multi Injection Unit Safety Hazards - continued**

<b>Table 3-4 E-Multi Injection Unit Safety Hazard Details</b>	
<b>Hazard Type</b>	<b>Potential Hazards</b>
<b>Mechanical Hazards</b>	
<b>Body Crushing Hazard</b>	End of motor moves back during hold or recovery. A hazard may exist between the end of the injection unit motor assembly and a nearby solid obstacle. Ensure proper guarding as part of integration.
	During installation of the E-Multi injection unit onto a mold, a crushing hazard exists between the adapter plate and the mounting surface of the mold.
	A crushing hazard exists between nozzle and mold melt inlet during carriage forward motion.
<b>Shearing Hazard</b>	A possible shearing hazard exists between the edge of the injection guard and the injection housing during injection.
<b>Cutting Hazard</b>	For horizontally-mounted machines with a high center line height, a person's head could hit the end of the injection unit causing a cut. Ensure proper guarding.
<b>Entanglement Hazard (Belt Drive)</b>	A person could become entangled in the drive belt or screw of the injection unit. Always keep guards in place.
<b>Entanglement Hazard</b>	The open feed port could present an entanglement hazard. Always keep guards in place.
<b>Molten Material Splashing Hazard</b>	High pressure molten plastic may spray from the nozzle. Always use personal protective equipment (PPE).
	High temperature molten plastic may spray from a blocked feed port. Always use personal protective equipment (PPE).
<b>Loss of Stability</b>	Injection unit could fall over if improperly installed on stand.
	Injection unit could fall over if transported on stand castors.
	Injection unit could fall from top of mold if not properly secured.
	Injection unit could fall over if stored vertically on the floor or a table without adequate support.
<b>Trip Hazard</b>	Controller cables are a tripping hazard on the floor between the controller and the press or E-Multi injection unit.
<b>Stored Energy</b>	There could be stored energy in compressed plastic which is not released when the machine is powered off.
	When installed vertically and powered off, there is stored energy in the injection assembly which could move downwards.
<b>Electrical Hazard</b>	
<b>Contact of Persons with High Voltage</b>	Heaters, servo motors and electrical components in the controller could come in contact with a person. Do not remove covers when energized.
<b>Thermal Hazards</b>	

### E-Multi Injection Unit Safety Hazards - continued

Table 3-4 E-Multi Injection Unit Safety Hazard Details	
Hazard Type	Potential Hazards
<b>Possible Contact of Persons with High Temperature Material.</b>	The injection barrel could result in burns.
	Melted plastic during routine purging could cause burns.
	Hot plastic or gasses could be released from the feed port when clearing a blockage.
	The electric servo motors could overheat presenting a hot surface which could cause burns to someone touching it.
<b>Hazards Generated by Materials or Substances</b>	
<b>Hazards from Contact With or Inhalation of Harmful Gases</b>	Hot plastic could result in harmful gases being emitted from the purged material or feed inlet.
<b>Fire or Explosion Hazard</b>	Hot surfaces of the barrel heaters could ignite flammable liquids or dust.
<b>Ergonomic Hazards</b>	
<b>Lift Hazard</b>	Attempting to lift or support the unit during installation could result in injury.
<b>Combination Hazards</b>	
<b>Failure / Disorder of Control System</b>	Incorrect connections can result in out-of-control or unexpected movement causing damage to the machine and a possible hazard.
<b>Errors of Fitting</b>	Incorrect design of the adapter plate or attachment or torquing of fasteners may result in a failure of the connection and subsequent loss of stability or falling of the machine.

### 3.9 E-Multi Servo Carriage Safety Hazard

Table 3-5 E-Multi Servo Carriage Safety Hazard Details	
Hazard Type	Potential Hazards
<b>Cutting or Severing Hazard</b>	A severing hazard may exist between the barrel guard and support beam when the carriage moves forward and the hard stop extension in the trunnion slot is not installed.

### 3.10 E-Multi Radial Unit Hazards

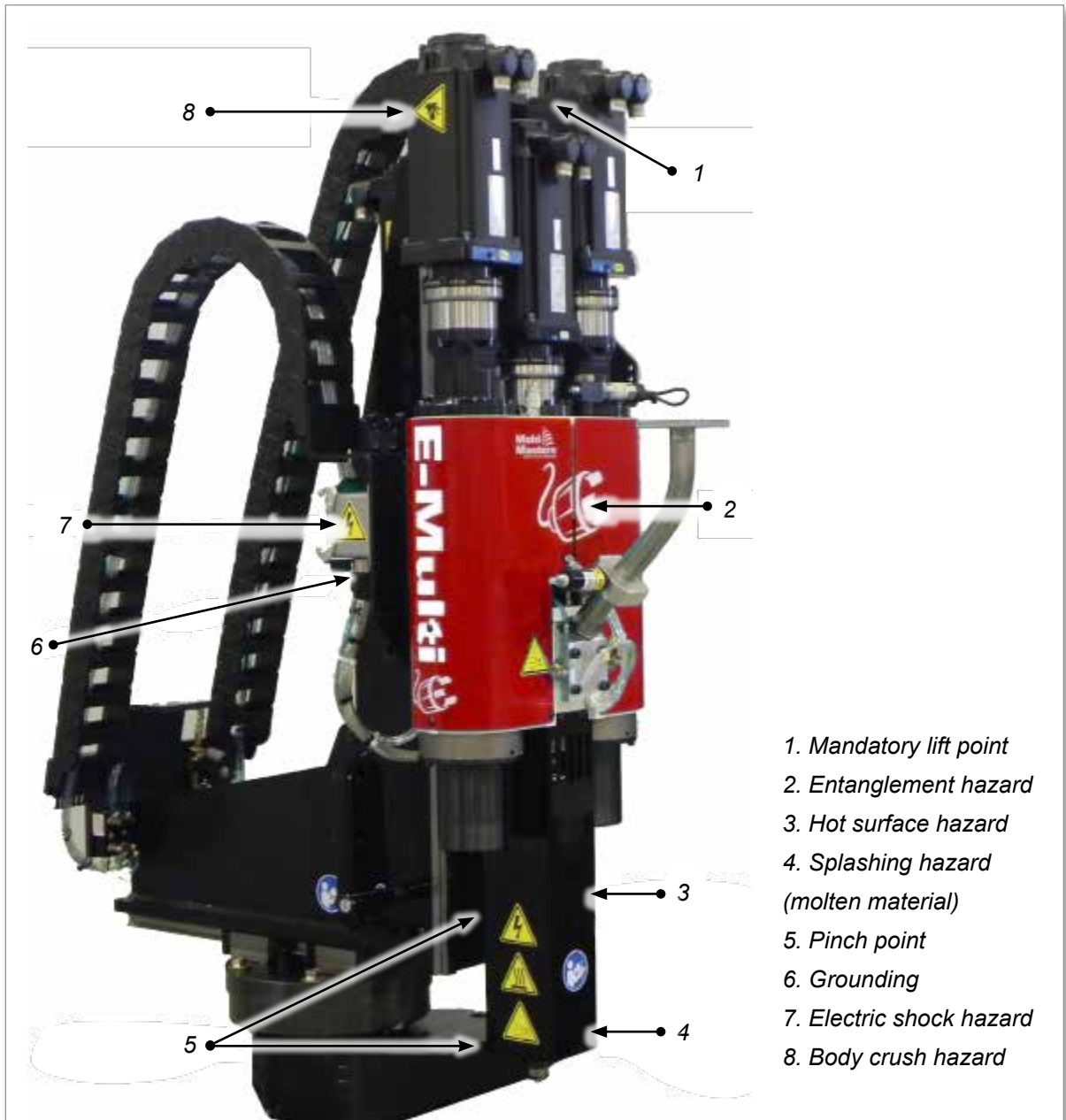












Figure 3-3 E-Multi Radial safety hazard locations



<b>Table 3-6 E-Multi Radial Safety Hazards Details</b>	
<b>Hazard Type</b>	<b>Potential Hazards</b>
<b>Body Crushing Hazard</b>	End of motor moves back during hold or recovery or during carriage return. A hazard may exist between the end of the injection unit motor assembly and a nearby solid obstacle. Ensure proper guarding as part of integration.
	During installation of the E-Multi Radial onto a molding machine, a crushing hazard exists between the E-Multi and the injection molding machine surface and guarding, as well as the mold.
	During installation, when the vertical beam is being raised, a crushing hazard exists between the vertical beam and the horizontal beam.
	A crushing hazard exists between barrel / barrel cover / nozzle and the adapter plate, as well as the mold and injection molding machine during carriage motion.
	A crushing hazard exists between the end of the E-Multi Radial and the injection molding machine, machine guards and the auxiliary equipment (e.g. hopper, loader, drier, etc.)
<b>Pinch Hazard</b>	A pinch hazard exists between the E-Multi Radial carriage assembly and the slot in the vertical beam, during carriage movement. Keep fingers and hands away from this area.
<b>Shearing Hazard</b>	A shearing hazard exists between the barrel / barrel cover / nozzle and the adapter plate, as well as the injection molding machine during Radial set-up and positioning, and during carriage motion.
	A shearing hazard exists between barrel / barrel cover / nozzle, and the adapter plate, as well as the mold and the injection molding machine during carriage motion.
<b>Cutting Hazard</b>	A cutting hazard may exist between the barrel / barrel cover / nozzle and a person's head when the unit is rotated to the side. For example, this can occur when unit is installed on small injection molding machines with narrow width and low height.
<b>Stored Energy Hazard</b>	There is stored energy in the carriage assembly due to the mass of the unit. If any of the carriage assembly components are removed including; the servo motor, any of the servo motor components, the gear box, or any of the mounting screws associated with this assembly, the E-Multi unit could move down (forward) unexpectedly, and may create a crushing and / or shearing hazard.

### 3.11 Safety Symbols on the E-Multi Injection Unit

Table 3-7 Safety Symbols Used on the E-Multi	
Symbol	General Description
	<b>General – Warning</b> Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death, and/or damage to equipment
	<b>Warning – Body Crush Hazard</b> End of motor moves back during hold or recovery. Hazard may exist between the end of the injection unit motor assembly and a nearby solid obstacle.
	<b>Warning – Tip Over Hazard</b> Injection unit could tip over when installed on stand or if stored vertically on the floor or a table without adequate support.
	<b>Warning – Electric Shock Hazard</b> Contact with hazardous voltages will cause death or serious injury. Turn off power and review electrical schematics before servicing equipment. May contain more than one live circuit. Test all circuits before handling to make sure circuits have been de-energized.
	<b>Warning – Hot Surface Hazard</b> Contact with exposed hot surfaces will cause serious burn injury. Wear adequate personal protective equipment (PPE) when working near these areas.
	<b>Warning – Entanglement Hazard (Belt Drive)</b> A person could become entangled in the drive belt of the injection unit. Always keep guards in place.
	<b>Warning - Pinch Point Hazard</b> A pinch point exists in this area which could result in a pinching, crushing or shearing injury to a person.
	<b>Warning – Splashing Hazard</b> Molten material or high pressure gas can cause death or severe burns. Wear personal protective equipment (PPE) while servicing the feed throat, nozzle, mold areas, and when purging the injection unit.
	<b>Mandatory – Read Service Manual Before Operation</b> Personnel should read and understand all instructions in the manuals before working on equipment. Only properly trained personnel should operate the equipment.
	<b>Mandatory Lift Points</b> Mandatory lift points must be used. If wrong lift points are used the unit could become unstable when being moved.

### 3.12 Safety Guards

**WARNING**

Guards should not be removed unless maintenance is required, and should be replaced after maintenance is complete. Do not run the machine with guards removed.

**CAUTION**

When installing the machine guards (front and rear covers) and the barrel covers, check that they do not pinch water lines, air lines or thermocouple wires when the unit moves.

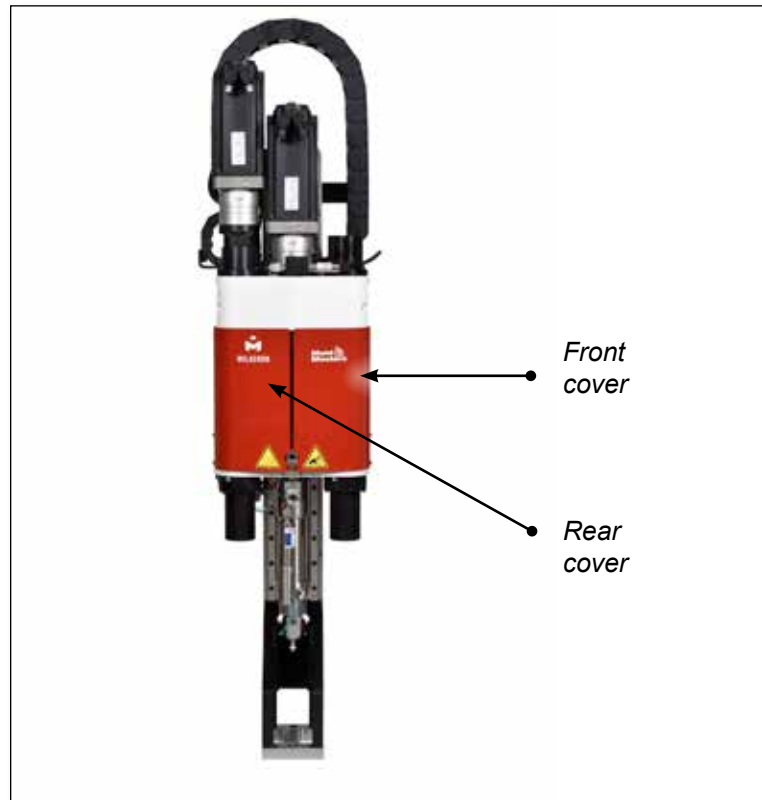


Figure 3-4 Guards layout

### 3.13 E-Multi Weight Specifications

Dimensions and weights shown are for packed wooden crates containing standard-optional units. Additional options may add weight or require additional crates. Specifications subject to changes without notice.



Table 3-8 Safety Symbols on the E-Multi Transport Stand	
Safety Symbol	General Description
	<b>Warning - Use Castor Locks</b> Failure to use castor locks may cause the stand to become unbalanced and / or move suddenly.
	<b>Caution - Maximum Load Capacity</b> Weights exceeding the maximum load capacity of the stand may cause damage to the stand and / or the E-Multi.

Table 3-9 E-Multi Injection Unit Shipping Dimensions and Weight					
Model		Length mm (in.)	Width mm (in.)	Height mm (in.)	Weight kg (lb)
EM1/EM2		1520 (60)	740 (29)	840 (33)	300 (660)
EM3		2080 (82)	840 (33)	910 (36)	500 (1100)
EM4		3302 (130)	914 (36)	991 (39)	1300 (2860)
ER1-15		1632 (64)	932 (37)	1056 (42)	400 (880)
ER1-30	400 (880)				
ER2-50	400 (880)				
ER2-80	500 (1100)				
ER3-100	Crate 1	3302 (130)	914 (36)	991 (39)	900 (1980)
	Crate 2	1543 (61)	975 (38)	670 (26)	700 (1540)
ER3-200	Crate 1	3302 (130)	914 (36)	991 (39)	900 (1980)
	Crate 2	1543 (61)	975 (38)	670 (26)	700 (1540)
ER4-350	Crate 1	3302 (130)	914 (36)	991 (39)	1200 (2640)
	Crate 2	1543 (61)	975 (38)	670 (26)	700 (1540)
ER4-550	Crate 1	3302 (130)	914 (36)	991 (39)	1300 (2860)
	Crate 2	1543 (61)	975 (38)	670 (26)	700 (1540)
EM1/EM2/EM3 Controllers		1702 (67)	788 (31)	1626 (64)	390 (860)
EM4 Controller		1880 (74)	788 (31)	1626 (64)	600 (1330)

### 3.14 Lift the E-Multi Injection Unit



**WARNING**

When doing any work on the machine that requires lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death.

Never use the motor as a lifting point.

Never use an E-Multi attached to the mold as a lifting point.



Figure 3-5 Do not use the motor as a lifting point

Table 3-10 E-Multi Injection Unit Lifting Kits	
EM1 / EM2	2 x 16 mm (5/8 in.) bow shackles 2 x 1220 mm (48 in.) slings
EM3	2 x 25 mm (1 in.) bow shackles 2 x 1830 mm (72 in.) slings

#### 3.14.1 Prior to Lifting the E-Multi Injection Unit

1. Choose lift equipment that is rated for the prescribed load. See equipment tag.
2. Define the **load path**: the path and orientation the item will move in while it is being lifted, and the location and orientation where it will be set down.
3. Use recommended attachment points only. See Section 3.15.
4. Identify and avoid potential **pinch points**: where an individual or a component of the lifting equipment or load may be caught between two surfaces.
5. Secure and balance the load in the chain or lifting device before it is lifted more than a few inches.
6. Minimize swinging by bringing the hook over the load appropriately.
7. Move powered hoists slowly into engagements with loads.

### 3.15 EM1 / EM2 / EM3 Lift Connections



**NOTE**

Review the information in “3.13 E-Multi Weight Specifications” on page 3-20 before performing any lifting procedure.

#### 3.15.1 EM1 / EM2 / EM3 Vertical Lift Connections

Table 3-11 EM1 / EM2 / EM3 Vertical Lift Connections	
EM1 / EM2	EM3
Connect sling to motor end of the support beam using one 16 mm (5/8 in.) shackle in lifting hole.	Connect sling to motor end of the support beam using a 25 mm (1 in.) shackle in lifting hole.

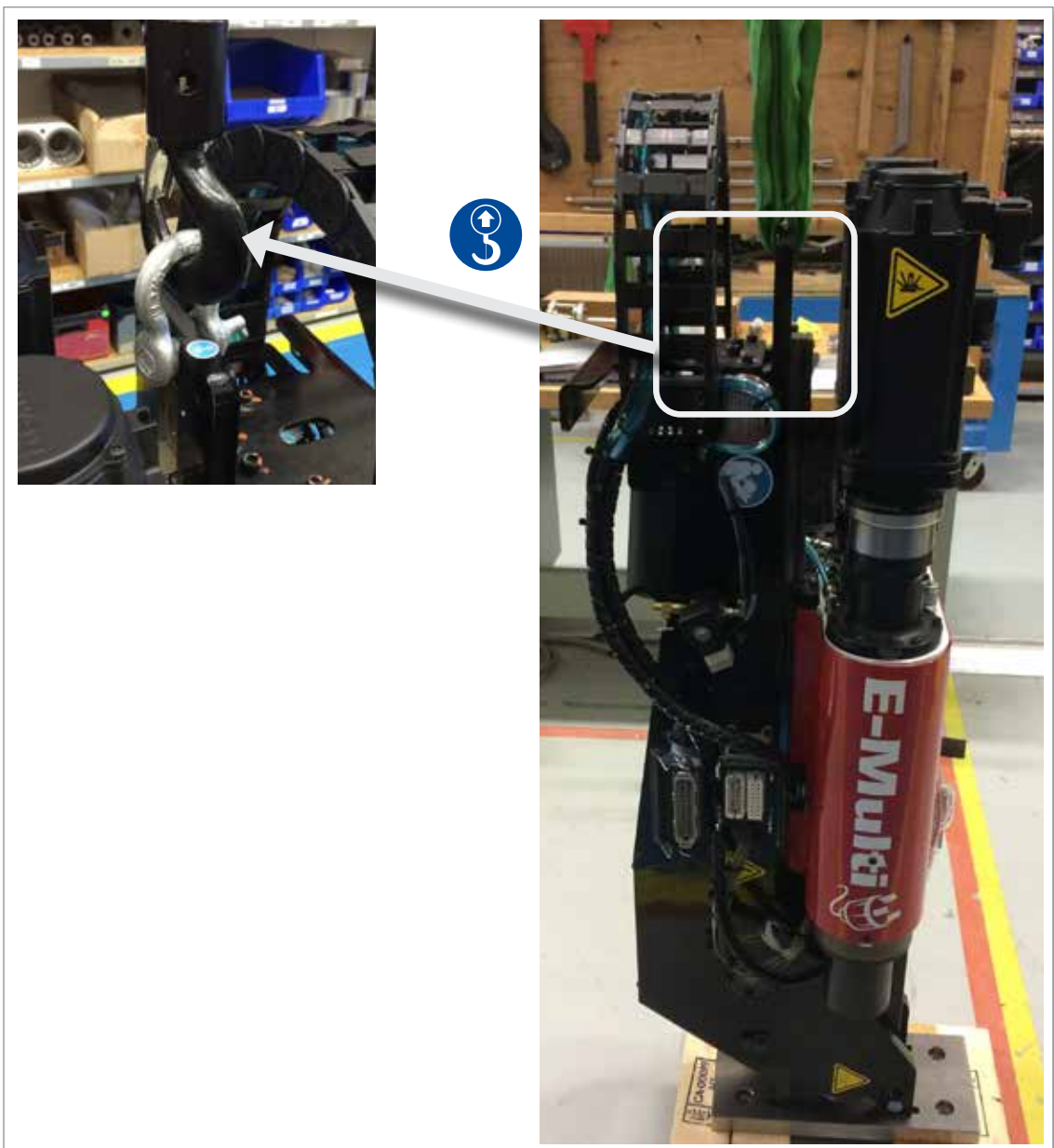


Figure 3-6 EM1 / EM2 vertical lifting connections (EM3 similar)

### 3.15.2 EM1 / EM2 / EM3 Horizontal Lift Connections

Table 3-12 EM1 / EM2 / EM3 Horizontal Lift Connections	
EM1 / EM2	EM3
*Note: For best results use an adjustable two leg chain bridle.	
<p>Connect one sling (A) to motor end of the support beam by feeding it through the lifting hole, with sling on either side of the motor.</p> <p>Connect other sling (B) to barrel end of the support beam using two 16 mm (5/8 in.) shackles in the lifting holes.</p> <p><b>NOTE:</b> EM1 / EM2 units require blocks or shipping brackets when set down horizontally to prevent damage to the linear actuator.</p>	<p>Connect one sling (A) to motor end of the support beam by feeding it through the lifting hole, with sling on either side of the motor.</p> <p>Connect other sling (B) to barrel end of the support beam using two 25 mm (1 in.) shackles in lifting holes.</p>



Figure 3-7 EM3 horizontal lift connections. EM1 / EM2 similar



## 3.16 EM4 Vertical Lift Procedures

### NOTE

Review the information in “3.13 E-Multi Weight Specifications” on page 3-20 before performing any lifting procedure.

The general procedure for lifting the EM4 unit vertically onto the injection molding machine is:

1. Place the EM4 horizontally on the floor from either
  - a) the shipping crate (see 3.16.1) or
  - b) a horizontal stand (see 3.16.2)
2. Attach the lifting bar (see 3.16.3)
3. Raise the EM4 to a vertical orientation with either
  - a) two lifting machines (preferred method) (see 3.16.4)
  - b) one lifting machine (see 3.16.5)
4. Install the EM4 onto the injection molding machine (see 3.16.6)

### 3.16.1 Horizontal Placement from the Shipping Crate

1. Unpack the E-Multi injection unit. See “Preparation” on page 5-1.
2. Connect the slings to the motor end of the support beam using the two attached shackles. Ensure the slings are on either side of the motor.
3. Connect slings to the barrel end of the support beam using two 25 mm (1 in.) shackles in the lifting holes.
4. Ensure that the slings are securely attached to the lifting machine. Ensure the slings are not twisted or kinked.
5. Lift the unit out of the crate slowly.
6. Remove the front shipping bracket.
7. Place the E-Multi injection unit in a horizontal position on the floor. The unit should rest on the attached stabilizing legs.



### NOTE

Ensure the floor area surrounding the E-Multi unit is large enough to walk around and move the lifting machines.

8. Install the adapter plate onto the E-Multi injection unit. See “Adapter Plate Removal and Installation” on page 9-10.
9. Verify that the nozzle does not protrude past the adapter plate. If the manifold inlet protrudes past the mold ensure the nozzle will not touch when installed.
10. Remove the slings from the E-Multi injection unit and the lifting machine.



### 3.16.2 Horizontal Placement from a Horizontal Stand

1. Purge plastic from the system. See “Purge Plastic from System” on page 9-8.
2. Retract the carriage so that the nozzle does not protrude past the adapter plate. If the manifold inlet protrudes past the mold ensure the nozzle will not touch when installed.
3. Allow the E-Multi injection unit to cool to room temperature.
4. Connect slings to the motor end of the support beam using the two attached shackles. Ensure the slings are on either side of the motor.
5. Connect slings to the barrel end of the support beam using two 25 mm (1 in.) shackles in the lifting holes.
6. Ensure that the slings are securely attached to the lifting machine. Ensure the slings are not twisted or kinked.
7. Support the weight of the E-Multi injection unit with the lifting machine.
8. Purge cooling water from the system. See “Purge Cooling Water from System” on page 9-8.
9. Disconnect water, pneumatic, I/O, heater and motor connections.
10. Remove the E-Multi injection unit from the stand.
11. Install the stabilizing legs to the bottom of the E-Multi beam.
12. Place the E-Multi injection unit, in a horizontal position on the floor. The unit should rest on the attached stabilizing legs.



#### NOTE

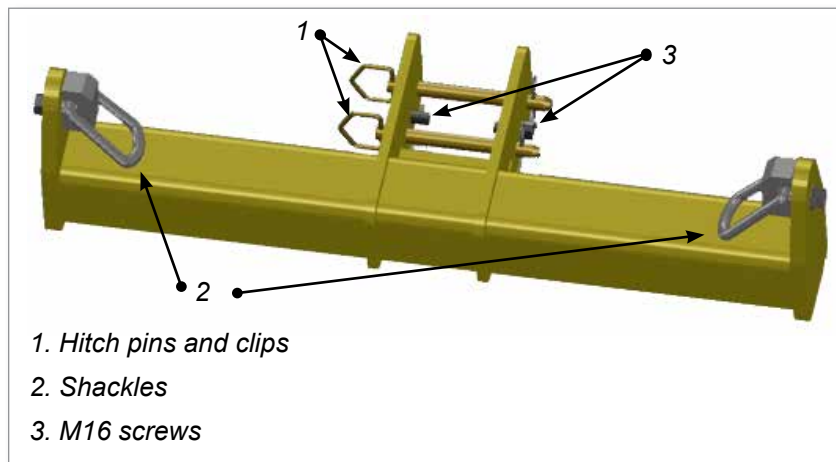
Ensure the floor area surrounding the E-Multi unit is large enough to walk around and move the lifting machines.

13. Remove the slings from the E-Multi injection unit and the lifting machine.

### 3.16.3 Attach the Lifting Bar

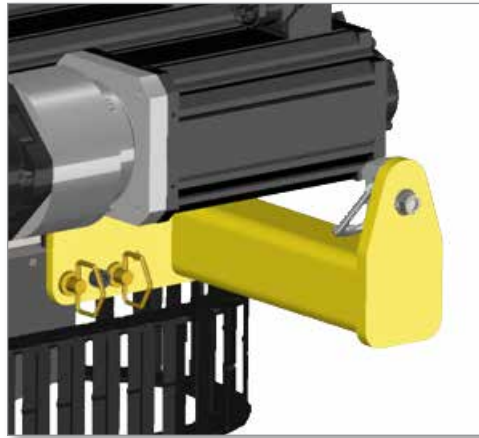
This procedure is done with the EM4 unit laying horizontal on the floor.

1. Remove the two shackles from the motor end of the support beam.
2. Screw the shackles to the inside of the lifting bar and secure with a nut. Torque the nut to 101 Nm (75 ft-lbs).

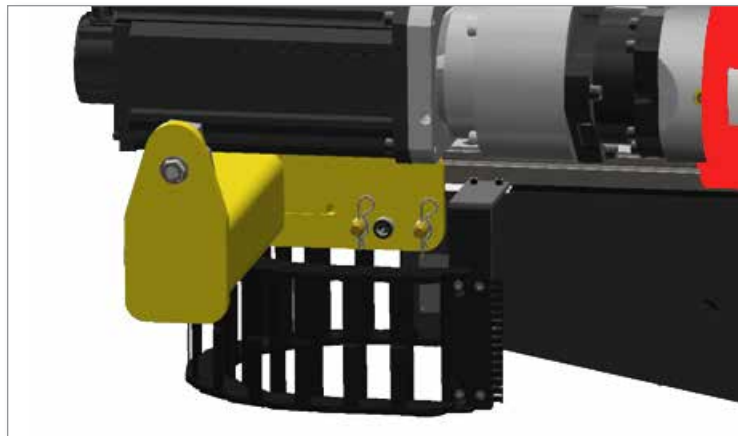


### Attach the Lifting Bar - continued

3. Place the lifting bar under the motor and secure in place with the two hitch pins provided.



4. Secure the hitch pins with the provided hitch pin clips.



5. Attach and tighten the two M16 screws to the holes in the lifting bar. Torque to 101 Nm (75 ft-lbs).
6. Check that the hitch pins are secure.
7. Attach the slings to the shackles on the lifting bar. The slings should be the same length.



### 3.16.4 Vertical Orientation with Two Lifting Machines



#### WARNING

Do not leave the E-Multi injection unit standing vertically without support. This is dangerous and can result in serious injury if the unit falls over.

This is the preferred method to raise the EM4 to a vertical position.

1. Attach the slings from the lifting bar to the lifting machine.
2. Connect slings to the barrel end of the support beam using two 25 mm (1 in.) shackles in the lifting holes.
3. Attach the barrel end slings to the other lifting machine.
4. At the same rate, slowly lift the E-Multi injection unit with both lifting machines. Keep the lifting machines centered over their respective lifting point.
5. Lift approximately 30 cm (1 ft) off of the floor.



6. Lift the motor end of the unit. Keep the lifting machines centered over their respective lifting point.



### Vertical Orientation With Two Lifting Machines - continued

7. Continue slowly until the unit is vertical and there is slack in the lower slings.



8. Rest the E-Multi injection unit on the adapter plate. Place the E-Multi injection unit on a surface that will not mar the adapter plate (wood, cardboard, etc.).
9. Carefully remove the lower slings and shackles. Do not remove the E-Multi injection unit from the upper lifting machine.

### 3.16.5 Vertical Orientation with One Lifting Machine



#### WARNING

Do not leave the E-Multi injection unit standing vertically without support. This is dangerous and can result in serious injury if the unit falls over.



#### CAUTION

Slowly lift to avoid any slipping of the E-Multi injection unit. Keep the hook over the E-Multi to avoid tipping.

It is preferred to use two lifting machines to raise the E-Multi injection unit to a vertical position. Use this procedure if only one lifting machine is available.

1. Remove any slings from the lower / adapter plate position.
2. Attach the slings from the lifting bar to the lifting machine. Ensure the slings are not twisted or kinked.
3. Raise the E-Multi injection unit very slowly, keeping the lifting machine centered over the unit.



4. Move the lifting machine up and forward (towards the barrel end of the E-Multi injection unit), keeping the lifting machine centered over the unit.

5. Continue to slowly raise the E-Multi injection unit until it is in a vertical orientation, keeping the lifting machine centered over the unit.



### 3.16.6 E-Multi Injection Unit Installation onto the Molding Machine



#### **WARNING - CRUSH HAZARD**

A crushing hazard exists between the adapter plate and the mounting surface of the mold.

This procedure begins with the E-Multi injection unit in a vertical position, attached to a lifting machine.

1. Remove the support legs of the E-Multi injection unit.
2. Clean the molding machine and mold where the E-Multi injection unit will be mounted. Any plastic residue on the manifold inlet must be removed to ensure proper nozzle contact.
3. Raise the E-Multi injection unit off the floor using the lifting machine.
4. Clean the adapter plate mating surfaces.
5. Lift the E-Multi injection unit into place above the manifold inlet.
6. Install screws and torque in a crosswise pattern. See “Screw Torque Specifications” on page 9-1.
7. Ensure the E-Multi injection unit is securely installed on the molding machine.
8. Remove the lifting equipment from the E-Multi injection unit.

### 3.17 EM4 Horizontal Lift Connections

Table 3-13 EM4 Horizontal Lift Connections
<b>EM4</b>
Connect one sling (A) to motor end of the support beam by feeding it through the lifting hole, with sling on either side of the motor.
Connect other sling (B) to barrel end of the support beam using two 25 mm (1 in.) shackles in lifting holes.

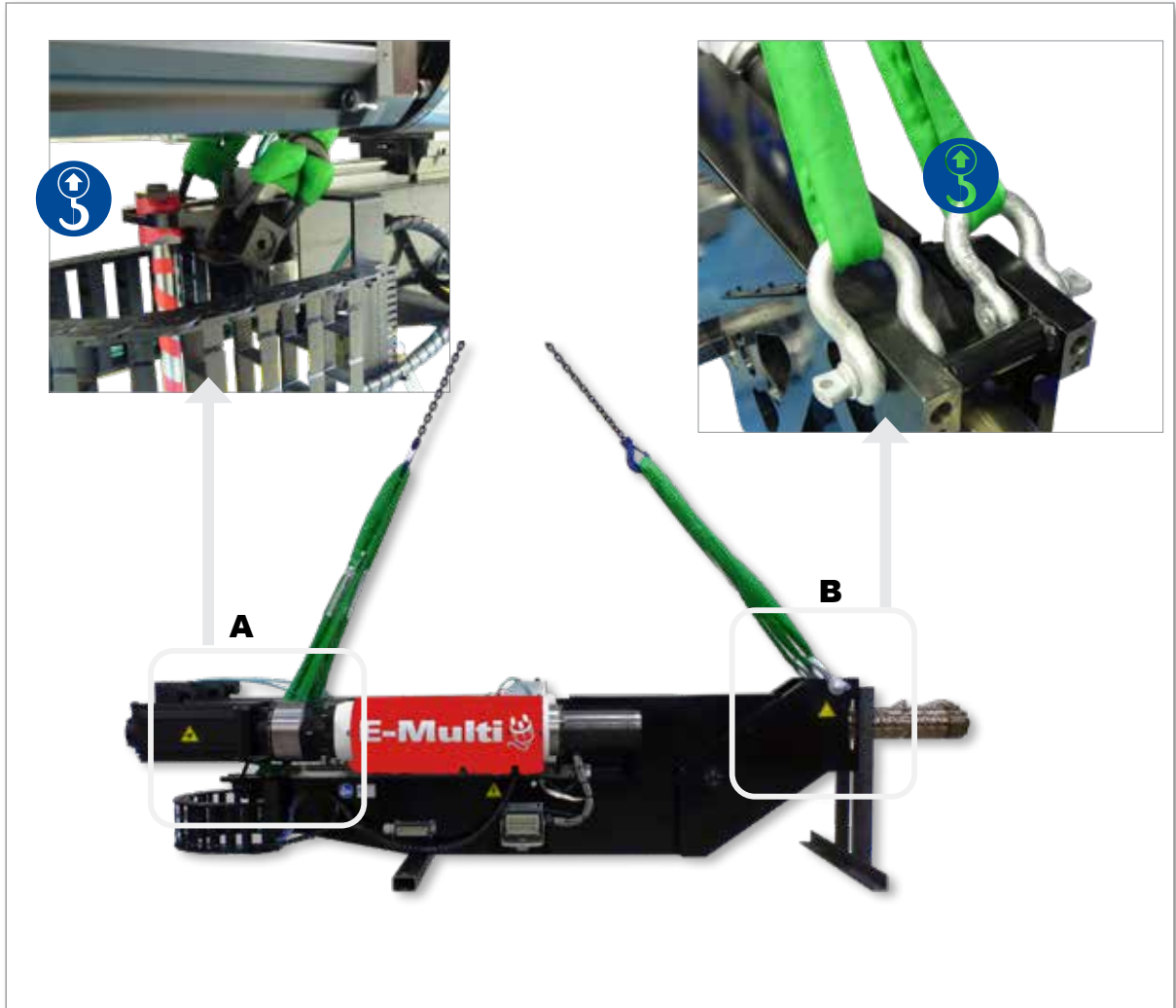


Figure 3-8 EM4 horizontal lift connections

# Section 4 - Overview

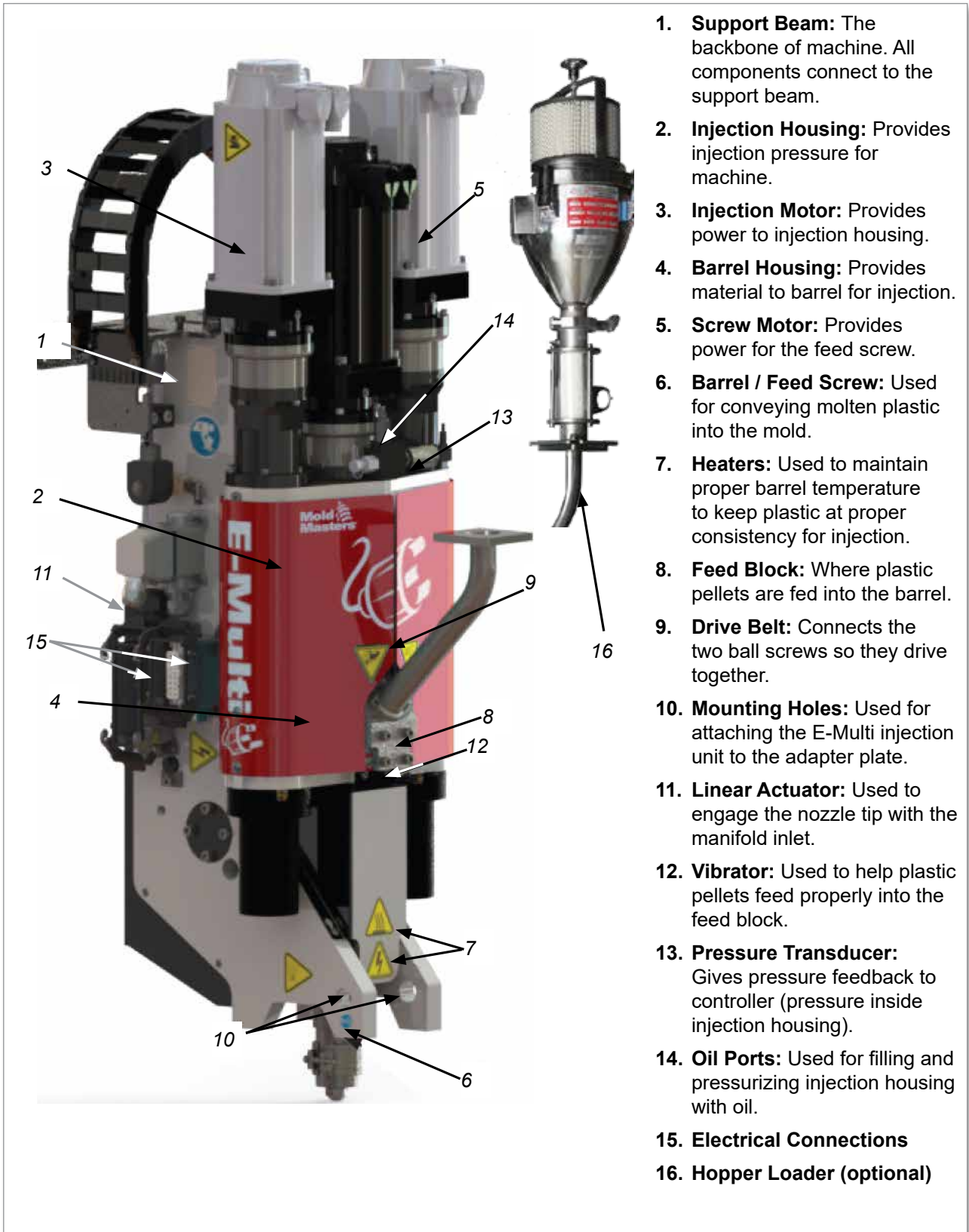
## 4.1 E-Multi Injection Unit Models



Figure 4-1 E-Multi injection unit models



## 4.2 E-Multi Injection Unit Components



1. **Support Beam:** The backbone of machine. All components connect to the support beam.
2. **Injection Housing:** Provides injection pressure for machine.
3. **Injection Motor:** Provides power to injection housing.
4. **Barrel Housing:** Provides material to barrel for injection.
5. **Screw Motor:** Provides power for the feed screw.
6. **Barrel / Feed Screw:** Used for conveying molten plastic into the mold.
7. **Heaters:** Used to maintain proper barrel temperature to keep plastic at proper consistency for injection.
8. **Feed Block:** Where plastic pellets are fed into the barrel.
9. **Drive Belt:** Connects the two ball screws so they drive together.
10. **Mounting Holes:** Used for attaching the E-Multi injection unit to the adapter plate.
11. **Linear Actuator:** Used to engage the nozzle tip with the manifold inlet.
12. **Vibrator:** Used to help plastic pellets feed properly into the feed block.
13. **Pressure Transducer:** Gives pressure feedback to controller (pressure inside injection housing).
14. **Oil Ports:** Used for filling and pressurizing injection housing with oil.
15. **Electrical Connections**
16. **Hopper Loader (optional)**

Figure 4-2 E-Multi injection unit components

# Section 5 - Preparation



## WARNING

Ensure you have fully read “Section 3 - Safety” before unpacking, cleaning or assembling the E-Multi injection unit.

When doing any work that requires lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death. See “E-Multi Weight Specifications” on page 3-20 for weight, dimensions and safe lifting instructions.

## 5.1 Shipping Contents

### E-Multi Crate:

- E-Multi injection unit
- Oil fill kit (optional)
- Lifting hardware
- Horizontal and vertical feed blocks, feed tube and feed adapter and hardware
- Hook spanner
- Adapter plate and hardware (optional)

### Controller Crate:

- E-Multi controller
- Heat, I/O and E67 cables
- SPI adapters (optional)
- Diagnostic kit (optional)
- KeTop remote pendant (optional)
- Documentation package

### Stand Crate:

- E-Multi stand and hardware



Figure 5-1 Oil fill kit (optional)

## 5.2 Unpacking

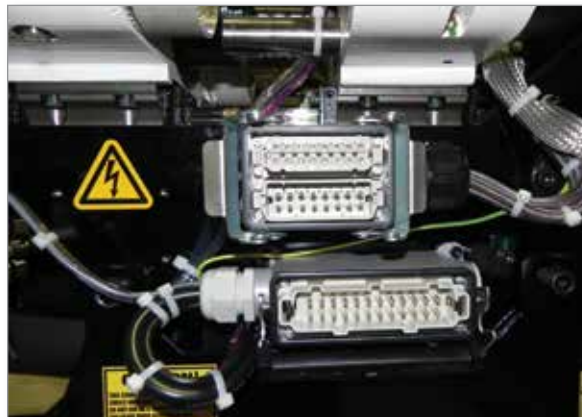
1. The crate should be moved using a forklift or pallet truck. If using a crane, the crate must be slung from underneath. Do not lift from the top of the crate.
2. Remove accessory boxes, manual and anything other than the E-Multi injection unit.
3. Remove plastic wrap as necessary.



4. Remove the four 3/8" lag screws from the ends of the shipping brackets using a 14 mm (9/16 in.) hex socket.
5. The E-Multi injection unit ships with lifting hardware installed. Use a two leg chain bridle to remove the E-Multi injection unit from the crate. See "E-Multi Weight Specifications" on page 3-20.

## 5.3 Inspection

1. Check that the E-Multi injection unit has not been damaged in transit.
2. Check all wires and cables. Ensure they are not kinked or damaged and are still connected properly.



3. Check for oil leaks on the machine. If oil is visible, find the source of the leak and correct. Check oil level. See "Check the Oil Bath Level" on page 9-7.

## Section 6 - Installation



### WARNING

Ensure you have fully read “Section 3 - Safety” before unpacking, cleaning or assembling the E-Multi injection unit.

It is the responsibility of the integrator to understand and follow international and local standards for safety of machinery when integrating the E-Multi injection unit into the molding system. This includes providing necessary e-stop connections, safety interlocks and guarding to protect operators.



### WARNING - TIP OVER HAZARD

The E-Multi injection unit presents a tip / crush hazard when being moved around on the stand for installation and is stored vertically on the floor or a table. The unit presents a tip / crush hazard when being moved from a vertical to horizontal position during installation.



### WARNING - LOCKOUT

Ensure that all energies are properly locked out in the controller and mold machine before installation of the E-Multi injection unit into the system.



### WARNING - LIFT POINTS

When doing any work on the machine that requires moving and lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death. See “E-Multi Weight Specifications” on page 3-20.



### CAUTION

E-Multi injection unit is designed to be used only with molds capable of accepting auxiliary injection units.

Ensure the E-Multi injection unit placement will not interfere with injection molding machine movement. Check that all coolant, hydraulic and air lines as well as electrical cables will not interfere with the moving parts of the mold, machine or robot. The lines must be of sufficient length so that they will not strain or pinch when the mold halves separate.

## 6.1 Attach E-Multi Injection Unit to the Mold / Machine



### **WARNING - BODY CRUSH HAZARD**

The end of the injection motor moves back 210 mm (8 in.) max stroke during hold or recovery. A hazard may exist between the end of the injection unit motor assembly and a nearby solid obstacle. Suitable safety guarding must be installed by the integrator to prevent a crush hazard.

During installation of the E-Multi injection unit onto a mold, a crushing hazard exists between the adapter plate and the mounting surface of the mold.



### **WARNING - CUT HAZARD**

For horizontally-mounted machines with a high centerline height, a person's head could hit the end of the injection unit presenting a cut hazard. Suitable guarding / warning should be installed by integrator.



### **WARNING**

The screws securing the adapter plate to the E-Multi injection unit and the adapter plate to the Injection molding machine must be tightened to the correct torque. See "Screw Torque Specifications" on page 9-1.



### **IMPORTANT**

Please refer to the installation drawing supplied with unit for complete information on services and connections.

1. Clean the molding machine and mold where the E-Multi injection unit will be mounted. Any plastic residue on the manifold inlet must be removed to ensure proper nozzle contact.
2. Install adapter plate onto E-Multi injection unit. See "Adapter Plate Removal and Installation" on page 9-10.
3. Verify that E-Multi carriage is retracted to prevent bending the carriage link.
4. Install the E-Multi injection unit horizontally or vertically as described below
  - a) For vertical installations, lift the E-Multi injection unit into place above the manifold inlet and install screws. Torque in a crosswise pattern.
  - b) For horizontal installations, move the E-Multi injection unit into place beside the manifold inlet. Verify the stand is at the correct height and install screws. Torque in a crosswise pattern. See "E-Multi Stands" on page 14-1.

## 6.2 Controller Installation



### WARNING

Ensure that you have fully read “Section 3 - Safety” before connecting or operating the controller.

It is the responsibility of the integrator to understand and follow international and local standards for safety of machinery when integrating the controller with the molding system.

The E-Multi controller should be located in such a way that the main disconnect is easily accessible in case of emergency.

E-Multi controllers are shipped with a power cable, which is a correct size to run the system. When you install a connector on the cable, ensure that the connector can safely withstand the full system load.

The E-Multi controller supply should have a fused disconnect or main circuit breaker according to local safety codes. Refer to the serial plate on the controller cabinet for confirmation of the main supply requirements. If the local supply is outside the specified range, please contact *Mold-Masters* for advice.



### WARNING - ELECTRIC SHOCK HAZARD

It is crucial to comply with these warnings to minimize any personal danger.

- Ensure that all energies are properly locked out in the controller and mold machine before installation of the E-Multi injection unit into the system.
- DO NOT enter the cabinet without first ISOLATING the supplies OR having a qualified person selecting the BYPASS SWITCH to ON, to gain live access to the controller. There are unguarded terminals inside the cabinet which may have a dangerous potential across them. Where a three-phase supply is used, this potential may be up to 600VAC.
- With the BYPASS SWITCH set to OFF opening the high power section of the controller will cause the circuit breaker to TRIP, disconnecting all power to the cabinet.
- Voltage and amperage cables are connected to the controller and the mold. There is also a cable connection between the servo motor and the controller. Electric power must be shut off and lockout / tagout procedures followed prior to installing or removing any cables.
- Integration should be done by properly trained personnel based on local codes and regulations. Electrical products may not be grounded when removed from the assembled or normal operating condition.
- Do not mix electrical power cables with thermocouple extension cables. They are not designed to carry the power load or list accurate temperature readings in each other's application.



### WARNING - TRIP HAZARD

The integrator should ensure that the controller cables do not present a trip hazard on the floor between the controller and the mold machine or the E-Multi.

### **6.3 Operational Environment**

The E-Multi controller should be installed in a clean, dry environment where the ambient conditions do not exceed the following limits:

- Temperature 0 to +45°C
- Relative Humidity 90% (non-condensing)

# Section 7 - System Setup



## WARNING

Ensure you have fully read “Section 3 - Safety” before setting up the E-Multi injection unit.

## 7.1 Connection of the Controller to the E-Multi Injection Unit

There are 3 sets of cables that connect the controller to the E-Multi injection unit:

1. servo power cables
2. servo feedback cables
3. heater - I/O - injection molding machine cables

The correct sequence must be followed when installing the cables. The servo power and feedback cables need to be routed through the cable track before being connected to the motors. The heater and the I/O cables can be connected directly and are not routed through the cable track. All cables should be routed so they do not interfere with the mold or molding machine operation.

### 7.1.1 Route and Connect Servo Cables



## WARNING

Make sure that the cables are connected to the correct motors. Cables and motors are clearly labeled. Reversing the cables can result in unexpected and uncontrolled motion causing a safety risk or damage to the machine.

1. Uncoil the servo cables and make sure they are not damaged or twisted.
2. Route the servo power cables on the higher side of the track, closest to the motor. Route the servo feedback cables, lower in the track, as far as possible from the motor.



Figure 7-1 EM3 Servo cable routing

3. Connect the servo cables to the motors.



### Route and Connect Servo Cables - continued

- Once cables have been routed, use cable ties to hold cables in place. See below for correct connector alignment.



Figure 7-2 Cables held with wire ties

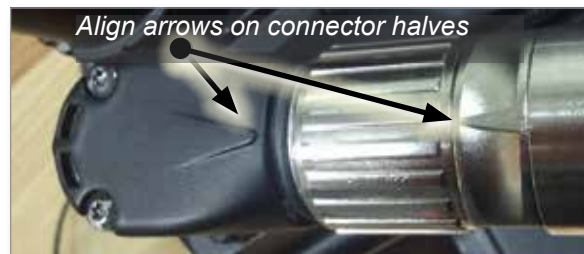


Figure 7-3 Correct connector alignment

#### 7.1.2 Route and Connect Heater, I/O, Injection Molding Machine Cables

- Uncoil the heater and I/O cables and make sure they are not damaged or twisted.
- Connect the “MOLD END” of the heater cable to the connector on the E-Multi injection unit.
- Connect the “MOLD END” of the I/O cable to the connector on the E-Multi injection unit.
- Route the cables towards the motor end of the E-Multi injection unit, taking care not to interfere with any moving parts or obstructing the air connection. The cables may be tied to the motor end shipping bracket, if required.
- Connect the “CONTROLLER END” of the cables to the “BARREL HEAT CONNECTOR” and “AUX INJ. UNIT” connectors on the controller. See Figure 7-4 on page 7-3.

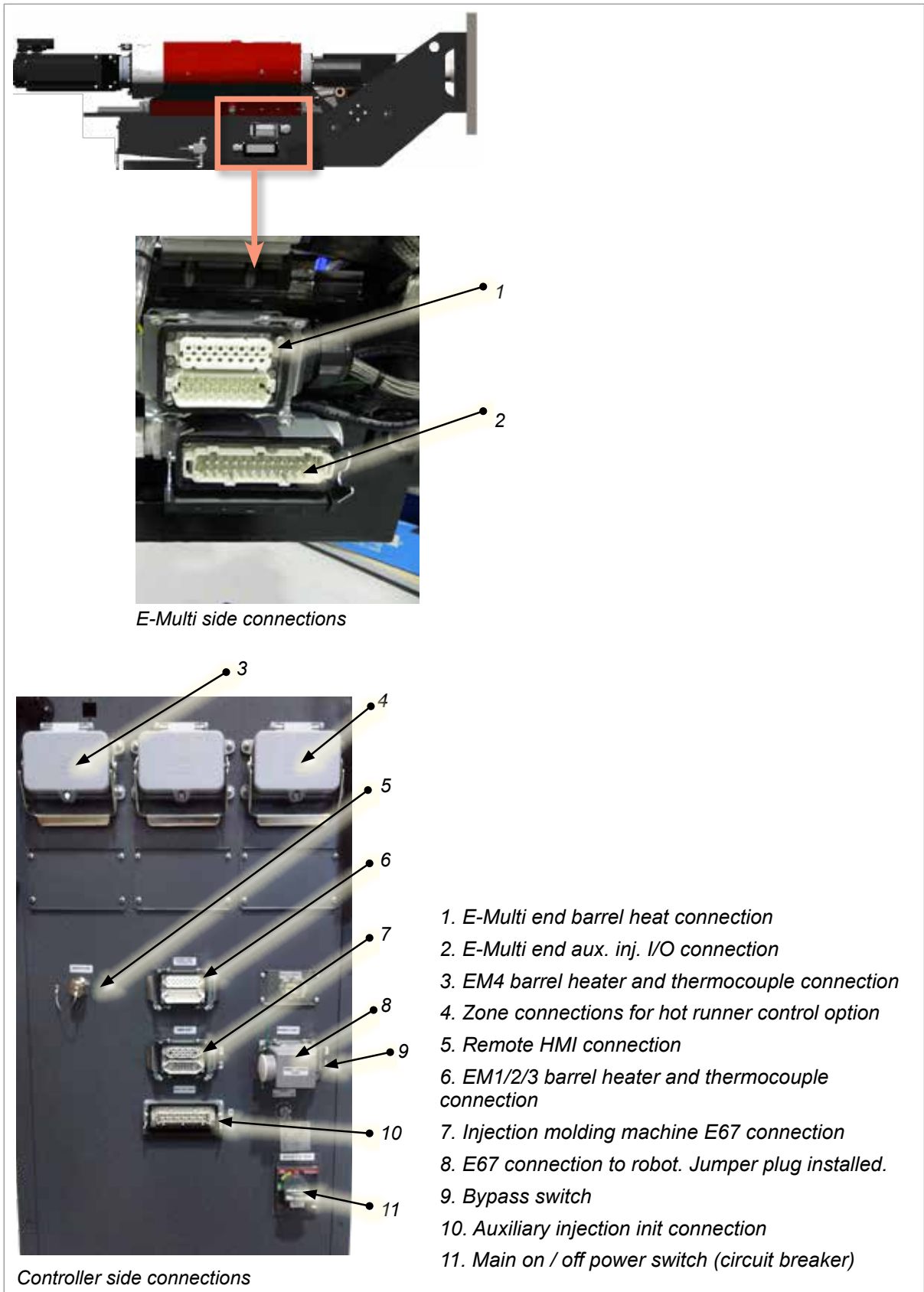


Figure 7-4 E-Multi connection locations

## 7.2 Connection to a Robot

E-Multi units are compatible with both E67 and SPI robots. In all cases, the controller is shipped with a robot jumper plug.

If no robot is used, connect the robot jumper plug to the “ROBOT E67” connector on the controller (see Figure 7-4 on page 7-3).

If an E67 robot is to be used, connect the robot’s E67 cable to the “ROBOT E67” connector on the controller. If an SPI robot is to be used, attach the optional “ROBOT SPI ADAPTER” to the “ROBOT E67” connector on the controller, and connect the robot’s SPI cable into the “ROBOT SPI ADAPTER.”



Figure 7-6 Robot jumper plug

## 7.3 Connection of the Controller to the Molding Machine

E-Multi injection units are compatible with both E67 and SPI injection machines. All units ship with an injection molding machine E67 cable. The cable always connects to the injection molding machine E67 connection on the controller. If used with an E67 injection molding machine, the cable plugs into the injection molding machine’s E67 connection directly. If an SPI injection molding machine is used, the cable plugs into the optional Injection molding machine SPI adapter, which then plugs into the injection molding machine SPI connection.

## 7.4 Connection a Handheld HMI (Optional)

E-Multi units are available with optional handheld Human Machine Interface (HMI) units to allow control of the E-Multi injection unit when access to the controller is inconvenient. The handheld HMI connects to the “HANDHELD HMI” connector on the controller (see Figure 7-4 on page 7-3).



### IMPORTANT

If a handheld HMI is not connected then a jumper plug is required.



Figure 7-5 Hand-held HMI and connection

## 7.5 Air Connections



### WARNING

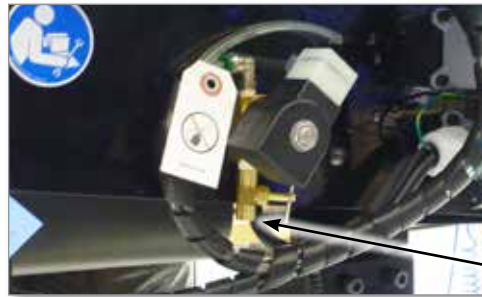
Hoses fitted to the E-Multi injection unit will contain high or low temperature air under high pressure. The operator must shut down and lockout these systems as well as relieving any pressure before performing any work with these hoses.



### CAUTION

Using compressed air at pressures higher than 4.13 bar (60 PSI) will drastically shorten the life of the pneumatic vibrator. Damage to the vibrator as a result of using air pressure over 4.13 bar (60 PSI) is not covered under warranty.

1. Install a 1/8NPT fitting (customer supplied) into the vibrator needle valve.
2. Connect a clean, dry, non-lubricated air supply, not exceeding 4.13 bar (60 PSI), to the vibrator needle valve.



• *Vibrator needle valve*

3. Open the air supply slowly, check for leaks and correct if necessary.

## 7.6 Water Connections

All units have water-cooled housings to prevent overheating of the injection unit. The EM3 and EM4 have water cooled servo motors. Figure 7-7 below shows the water inlet and outlet manifolds on the support beam.

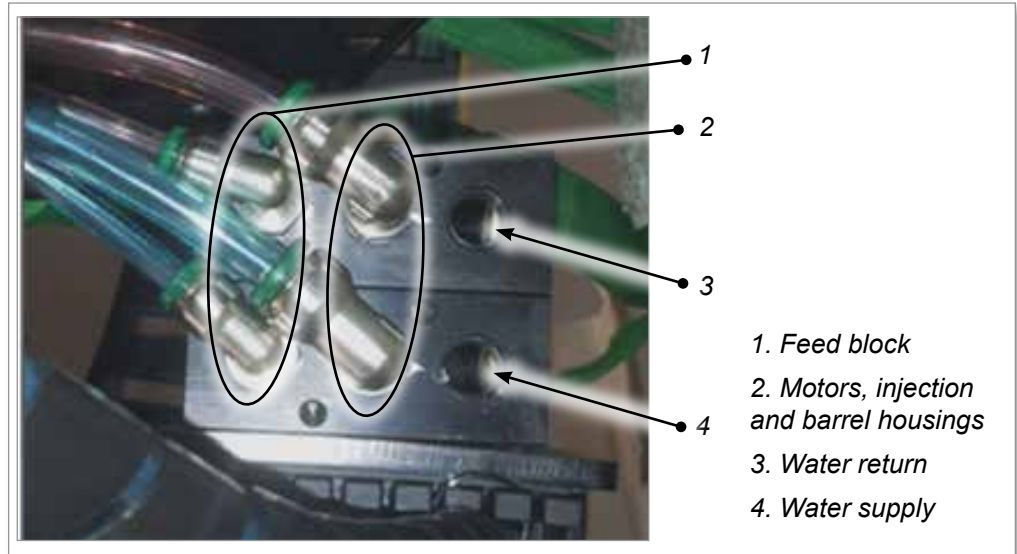


Figure 7-7 EM3 / EM4 water supply and return manifolds



Figure 7-8 EM3 / EM4 Servo motor cooling connections

Both inlet and outlet are 1/4NPT connections. If the 3/8NPT ports are used then the 1/4NPT ports must be plugged.

Contact your local service representative for replacement parts.

Table 7-1 Cooling System Water Limits	
Property	Limits
Flow rate	3 - 6 liters (102 - 202 oz) per minute
Maximum pressure	6 bar (87 PSI) at the motor inlet
Temperature	Minimum 5°C (41°F) above dew point or at ambient to prevent condensation. Maximum 50°C (122°F)

### 7.6.1 Cooling Water Schematic

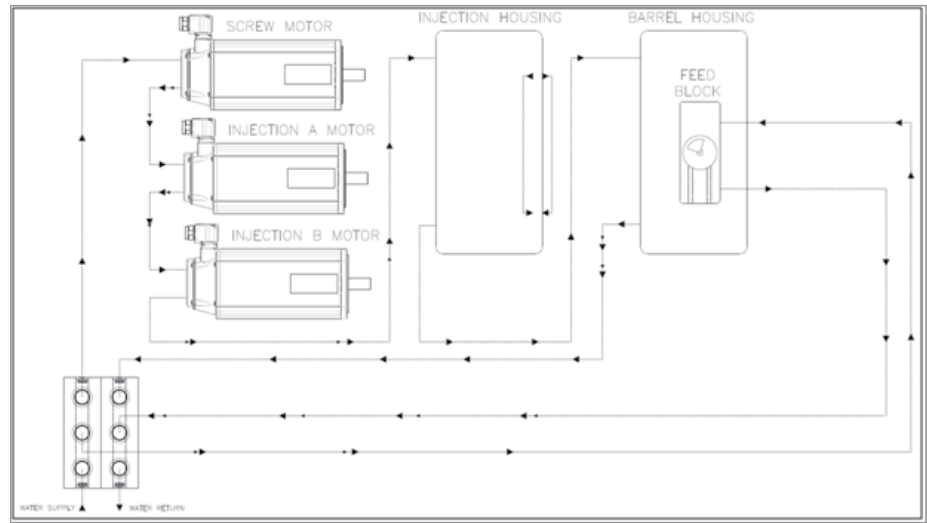


Figure 7-9 Water cooling schematic diagram

### 7.6.2 Corrosion Caused by Condensation

Control the cooling temperature to prevent condensation on the injection unit. Condensation can cause corrosion of critical mechanical components. This damage will not be covered by the warranty.

Install manual control valves or automatic temperature controls to ensure condensation does not occur.

### 7.6.3 Cooling Water Quality



#### CAUTION

Use clean water. Contaminated water will clog the servo motor cooling channels. It may result in decreased cooling performance and necessitate replacement of the servo motors.

*Mold-Masters* recommends the use of our optional closed loop cooling system. Contact your *Mold-Masters* representative for more information.

Table 7-2 Basic Water Quality Specification	
Constituents	Recommended Value
pH	7.2 - 8.5
CaCO <sub>3</sub> (ppm)	< 10
Ryznar Stability Index (RSI)	5.0 - 6.0
Temperature °C (°F)	5 - 25 (41-77)
Flow rate l/min (oz)	3 (102)

A more detailed water quality specification is found in “Section 16 - Water Quality” on page 16-1. The values in “Table 7-2 Basic Water Quality Specification” on page 7-7 represent conditions that will prevent most problems associated with poor water quality. These recommended values do not guarantee that corrosion will not occur.



Figure 7-10 Water quality specification tag on E-Multi

#### 7.6.4 Coolant and Additives



##### **CAUTION**

Damage caused by corrosion or condensation is not covered under warranty.

If the closed loop system volume is small, use a packaged ready made preserved cooling water kit which contains corrosion and microbiological inhibitors. Dow Chemical Company’s “DOWFROST” Heat Transfer Fluid is recommended.

## 7.7 Connection to a Diagnostic Computer (Optional)

1. Connect one end of the crossover cable to Ethernet port on the controller. The Ethernet cable can be connected with the power on.



2. Connect the other end of the crossover cable to the Ethernet port on the diagnostic computer. Note that the diagnostic computer may differ from the one shown.



3. Connect the diagnostic computer power supply and connect to mains power. Use the included adapter for 220 V mains.
4. Power up the diagnostic computer and log in with the following credentials:

User name: emulti

Password: nopassword



5. Connect the diagnostic computer to a WIFI network with internet access. To see a list of available networks, click the wireless network icon next to the clock on the taskbar.

**NOTE**

The diagnostic computer must be connected to the internet using its wireless network adapter. The wired connection must be used to connect to the controller. *Mold-Masters* does not support alternate network configurations. Connection problems when using alternate configurations are not covered under warranty and may result in increased support times and additional costs.



Figure 7-11 Wireless network icon

6. Open a browser and perform a search to verify internet connectivity.

# Section 8 - Operation



## WARNING

Ensure that you have fully read “Section 3 - Safety” before setting up the E-Multi injection unit.

## 8.1 Introduction

Before the E-Multi injection unit can be used, the controller will need to be set up. Please see Section 9 for details on setting parameters such as:

- heating
- control
- injection speeds
- trigger signals, etc.

## 8.2 Controller Startup and Shutdown



### CAUTION

Although the main switch has the capacity to switch the whole system off, it is recommended that this is only done in an emergency.

The controller uses computer technology and should be switched off in stages.

A sequenced method for switching on and off protects the console and keeps the switched load to a minimum to extend the life of the main isolator.

For all E-Multi controllers, the main power switch is a rotary circuit breaker at the rear of the cabinet. This switch is rated to safely disconnect the total load current during switch on and switch off.

You can use a suitably-sized padlock, or similar device to lock the switch in the off position to lockout electrical supply during maintenance.

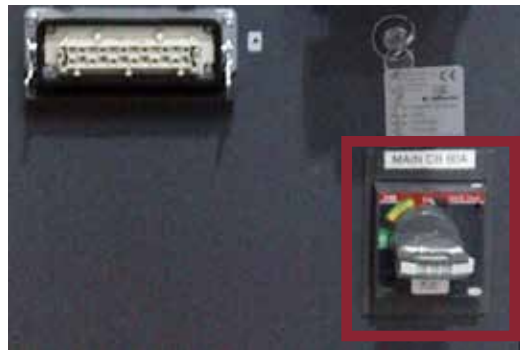


Figure 8-1 E-Multi main power switch

## 8.3 Switch On

When the main power switch is turned to on, the servo motors will not be enabled.

Once the software has finished loading and the display shows the Overview page, the system is in Manual mode and is ready to have the heaters switched on to bring the barrel heaters to temperature.

Servo motors may be enabled by pressing the [F1] button on the button strip located below the display. Once the servo motors are enabled, the LED at the top left of the button will turn on.



Figure 8-2 Button strip below controller display (HMI)

The E-Multi controller can be used in Manual, Setup and Auto/Ready mode.

## 8.4 Switch Off (Shutdown)

*Mold-Masters* recommends that you use the console to shutdown the heating load, and only use the main current breaker switch to turn off the dormant controller.

### 8.4.1 Shutdown the Heating

Press the [F8] button located on the button strip located below the display.

The LED at the top left of the [F8] button indicates heating status.

- If the LED is lit, heating is active.
- If the LED is not lit, heating is off.

### 8.4.2 Shutdown the Controller

Once heating has been turned off, the system may be turned off using the main switch on the back of the controller.

# Section 9 - Maintenance



## WARNING

Ensure that you have fully read “Section 3 - Safety” before doing maintenance procedures on the E-Multi injection unit.

## 9.1 Preventive Maintenance Schedule

Table 9-1 Preventive Maintenance Schedule	
Preventive Maintenance	Frequency
Verify injection pressure oil circuit	Check preload pressure on controller at start of every shift. Preload pressure is shown in the top right hand corner of the screen when the machine is in manual or when waiting for a start trigger in auto.
Clean unit, remove spilled plastic pellets and any accumulated drool from nozzle	Start of every shift
Check for condensation on external surfaces	Start and end of every shift
Controller fan filters	Check monthly, replace if necessary
Oil bath level	Check every 3 months, add oil if necessary
Lubricate linear guides	Check every 3 months, add grease if necessary
Lubricate ball screws	Check every 3 months, add grease if necessary
Lubricate ball screw nut (E-Multi Radial Option only)	Check every 3 months, add grease if necessary
Belt Tension	Check every 6 - 12 months, adjust if necessary

## 9.2 Screw Torque Specifications



## WARNING

All screws must conform to DIN 912 (socket head cap screws) and ISO 12.9 (grade 12.9) unless noted otherwise. Using low quality screws can result in screw failure and potentially serious injury.

Table 9-2 Screw Torque Specifications		
Nominal Thread Size	Nm	ft-lbs (in-lbs)
M4	4.6	3.4 (40.8)
M5	9.5	7 (84)
M6	16	11.5 (138)
M8	39	29 (348)
M10	58	42.5 (510)
M12	101	75 (900)
M14	161	119 (1428)
M16	248	182 (2184)
M20	488	360 (4320)
M24	825	608 (7296)



## NOTE

Screws should be retorqued after an initial run of one shift (approximately eight hours). Screws should be retorqued again after 1 week of service.

### 9.3 Other Torque Specifications

Description	Model	Nm	lb-ft
Nozzle Tip	All	135	99.5
Eccentric Shaft Locking Plate	EM1/EM2	9.5	7
	EM3	29	21
	EM4	50	37

Description	Model / Screw Size	Nm	lb-ft
Feed Block	EM1 / M8	23	17
	EM2 / M8	28	20.5
	EM3 / M10	50	37
	EM4 / M12	65	48

### 9.4 Belt Tension Specifications

Description	Model	Hz
Belt Tension	EM1 / EM2	216 - 241
	EM3	150 - 168
	EM4	150 - 168



**NOTE**

Belt tension should be measured with a sonic or laser frequency meter. If a frequency based belt tension meter is not available, an instrument tuner smartphone app may be used.

## 9.5 Lubrication Guidelines

Table 9-6 E-Multi Injection Unit Lubrication				
Location	MM P/N	Type	Manufacturer	Manufacturer's P/N
Drive Shaft Bearings Linear Guides Ball Nuts Carriage Spring Pack	104L1111I	Spindle bearing grease	Klüber Lubrication	ISOFLEX NBU 15
		Barium based thickening agent	Klüber Lubrication	Staburags NBU 8EP
		Lithium based thickening agent	Klüber Lubrication	Klüberplex BEM41-141
		Aluminum based thickening agent	Lubcon	Thermoplex ALN 1001
Oil Bath Level (Ball Screw Spindle Bearings) High Pressure Oil Circuit	104L11081	75W-90 EP Synthetic extreme pressure gear oil GL-5	Mobil	Mobil Delvac 75W-90
			Pennzoil	Pennzoil Synthetic 75W-90 (GL-5)
			Shell	Spirax S6 AXME 75W-90
			BP	Energear SHX-M 75W-90
General Assembly	104L1111I	Soap-based lithium grease	Klüber Lubrication	ISOFLEX NBU 15
			Shell	Gadus S2
			Loctite	30530
		Barium based thickening agent	Klüber Lubrication	Staburags NBU 8EP
		Lithium based thickening agent	Klüber Lubrication	Klüberplex BEM41-141
Aluminum based thickening agent	Lubcon	Thermoplex ALN 1001		
High-Temperature Bolts Thermocouples Barrel-to-Housing Feed Block Retaining Bolts Screw Drive Gearbox Output Shaft Screw Spline or Threads Screw Bushing and / or Collet Ring Check Threads and Seating Face	n/a	Anti-seize compound, silver grade	Loctite	767
Actuator Rod End Actuator Link Ball-screw Back Stops Spring Pack Set Screw Vibrator Mounting Screws Manifold-to-Shipping Bracket Screws	n/a	Thread lock compound, removable	Loctite	242 243
Pipe Plugs Needle Valve to Solenoid Valve	n/a	Pipe thread sealant	Loctite	567
		Teflon tape	Any	-

## 9.6 Preload Oil Pressure Verification

The E-Multi controller uses a pressure transducer in the injection pressure oil circuit to monitor injection pressure during the injection cycle. The pressure in the circuit should be within specifications shown in Table 9-7.

### 9.6.1 Check the Preload Oil Pressure



#### WARNING

Do not open the high pressure port plugs. High pressure port plugs have plastic plug caps installed to prevent accidental opening.

1. Always check with E-Multi injection unit preload pressure at operating temperature and idle pressure.
2. On the controller, tap the Operation Mode Select button and choose Set Up mode. Check the [F1] LED. If it is not blinking, press the [F1] button to put the controller into setup mode.
3. Check the screw position. If the position is greater than half the stroke, move the screw to the half stroke position, and then move the screw back approximately 25 mm (1.0 in.) further.  
This will decompress the screw and make sure the pressure value is showing idle pressure.
4. Check the pressure reading on the controller.  
If the pressure is below the lower limit, the high pressure circuit will need to be recharged using the E-Multi oil fill kit.
5. Navigate to the screw settings page. Verify that the actual voltage is within the limits in Table 9-7.

### 9.6.2 Assemble the Injection Pressure Oil Fill Kit



#### NOTE

The oil fill kit may have been supplied with the E-Multi injection unit and is also available from *Mold-Masters*. The fill kits are supplied without oil. The oil circuit requires 75W-90 synthetic gear oil.

High pressure oil fill kit components:

- Oil gun
  - Tee with fittings
  - Pressure gauge
  - Flexible hose, 2 m (6.6 ft) with quick connects
1. Thread the gauge into the tee and tighten.
  2. Fill the gun with 500 ml (16.90 oz) of the 75W-90 synthetic oil.
  3. Connect the tee to the quick disconnect port on the injection housing.
  4. Connect the flexible hose to the oil gun and tee.

### 9.6.3 Charge the High Pressure Oil Circuit with the Oil Kit

**WARNING**

Never run the E-Multi injection unit with the fill kit attached. Serious injury to the operator and / or damage to the machine may result.

1. Connect the oil gun to the oil manifold on the E-Multi injection unit using the flexible hose quick connect.
2. It is necessary to see the controller, specifically the preload pressure reading. If required, a helper can watch the controller and say what the pressure is.
3. Holding the oil gun with the hose pointing down, pump the gun until the pressure is 2x the upper limit.
4. Place a clean, absorbent cloth below the manifold bleed screw.
5. Open the bleed screw slightly. It is possible air will come out and the pressure will drop significantly. If this happens, open the bleed screw about ¼ turn and examine the oil that comes out.

**NOTE**

The oil should be clear, without bubbles and not foamy.

6. Close the bleed screw and pump the pressure up to 2x the upper limit for the oil kit pressure gauge.
7. Continue bleeding and pumping until no air, bubbles or foam come from the bleed screw.
8. Pump the pressure up one more time.
9. Disconnect the oil fill kit.
10. Open the bleed screw slightly and bleed the oil until the preload pressure on the controller reaches the upper limit.
11. If possible, cycle the injection unit in Auto mode for 10-20 cycles and check the preload pressure again.
12. Bleed or fill as required to get the pressure to remain stable and within the preload oil pressure specifications when cycling in Auto mode.



## 9.7 E-Multi Preload Pressures

Table 9-7 E-Multi Preload Pressures (1.34 Software)													
Model	Screw Diameter	Calibration (Melt) Pressure at 10V		Preload Oil Pressure on HMI				Preload Oil Pressure on Gauge				Preload Pressure Transducer Voltage	
	mm	bar	psi	bar		psi		bar		psi		V	
				Max	Min	Max	Min	Max	Min	Max	Min		
EM1 15 & 30	12	3 521	51 063	155	135	2 250	1 953	4.6	4.0	66	57	2.35	2.31
	14	2 587	37 515	114	99	1 653	1 435						
	16	1 980	28 723	87	76	1 265	1 099						
	18	1 565	22 694	69	60	1 000	868						
	22	1 047	15 192	46	40	669	581						
EM2 50 & 80	18	3 256	47 222	83	64	1 205	931	2.6	2.0	38	30	2.20	2.16
	20	2 637	38 250	67	52	976	754						
	22	2 180	31 612	56	43	806	623						
	25	1 688	24 480	43	33	624	482						
EM3 100 & 200	22	4 135	59 969	81	57	1 178	830	2.0	1.4	29	21	2.16	2.11
	25	3 202	46 440	63	44	912	643						
	28	2 553	37 022	50	35	727	513						
	32	1 954	28 345	38	27	557	392						
EM3 250	32	2 834	41 111	38	27	557	392	2.0	1.4	29	21	2.11	2.08
	38	2 010	29 153	27	19	395	278						
EM4 350 & 550	32	3 955	57 364	66	50	950	721	2.5	1.9	36	27	2.13	2.10
	35	3 306	47 951	55	42	794	602						
	40	2 531	36 713	42	32	608	461						
	45	2 000	29 008	33	25	480	364						
	50	1 620	23 496	27	20	389	295						
	55	1 339	19 418	22	17	322	244						

**Table 9-8 Grease Lubrication Mass - Injection Ball Screws**

Model	Mass g (oz)
EM1	1.8 (0.063)
EM2	2.4 (0.085)
EM3	3 (0.11)
EM4	4 (0.14)

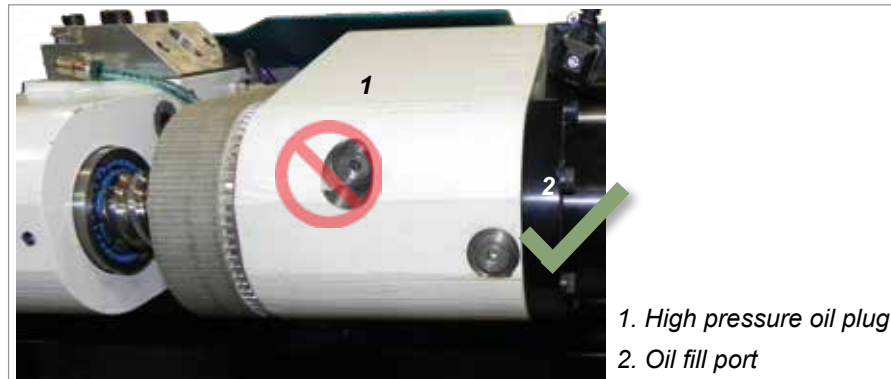
## 9.8 Check the Oil Bath Level



### WARNING

Do not confuse the low pressure oil port with the high pressure oil system plug.

1. The E-Multi injection unit should be in horizontal or vertical position and the injection unit moved fully back.
2. The oil fill port is positioned so that the oil level may be checked with the E-Multi injection unit mounted vertically, horizontally, or at any angle in between.



3. Remove the plug from the fill port. The oil level should be up to the lower threads of the fill hole.
4. Fill with synthetic gear oil as indicated in Table 9-6 on page 9-3, as required.

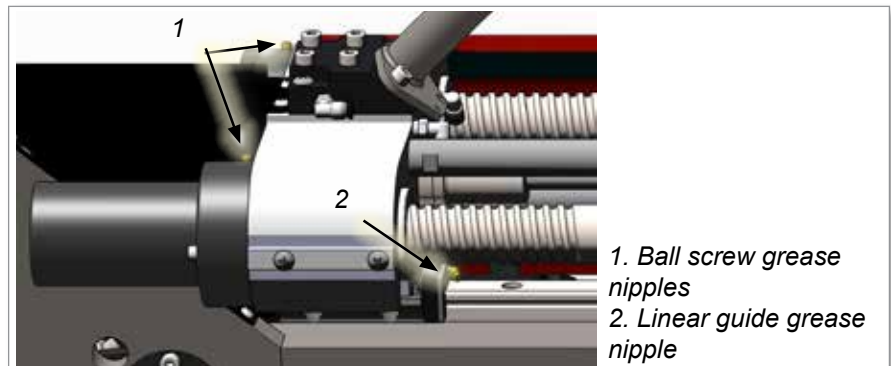


### NOTE

For continued warranty support use only approved synthetic gear oil as specified in Table 9-6.

## 9.9 Check Lubrication of Linear Guides and Injection Ball Screws

1. Reference the installation drawing supplied with your unit for grease fitting locations.
2. Ensure the grease fitting is clean.
3. Place the grease gun to the grease fitting and pump to apply adequate grease for relubrication. See Table 9-8 on page 9-6 for the amount of grease appropriate for your unit.



## 9.10 Purge Plastic from System



### WARNING

Material purged from machine will be extremely hot. Ensure protective guards are in place around the nozzle to prevent molten plastic from splashing. Use proper personal protective equipment.



### CAUTION

Leaving a rotating screw unattended may result in serious damage to the screw, barrel and ring check.

1. Retract the carriage from the mold.
2. Switch the barrel heats on and allow them to reach operating temperature.
3. Turn the servo motors on and allow the auto soak routine to complete.
4. Put the controller in Setup mode by pressing the [F1] button. The controller is in Setup mode when the [F1] LED is flashing.
5. Press and release the [F5] button to start screw rotation. The screw will continue to rotate until it is turned off manually.
6. Once no more material flows from the nozzle, press and release the [F5] button again.
7. Move the screw forward by pressing and holding the [F7] button until the screw position is almost at 0.
8. Press and release the [F5] button to start screw rotation. Once no more material runs out of the nozzle, press and release [F5] again.
9. Disable servo motors.
10. Turn off barrel heaters.

## 9.11 Purge Cooling Water from System



### WARNING

Water contacting the hot barrel quickly becomes extremely hot and is a burn hazard. Purge hot plastic from the system and cool the barrel before disconnecting water cooling fittings.

Use compressed air safely.



### CAUTION

Do not get water on unpainted surfaces such as ball screws, barrel, feed screw, belt tensioner, etc. as they will rust, causing damage to the machine. Never run the system without water cooling. Serious damage to the machine will result.

1. Turn off water connections and disconnect supply line at the manifold. Disconnect return line and place in a bucket or other suitable container.
2. Using low pressure (<50 psi) compressed air, blow into the supply line until no more water comes out of the return line.
3. Check transparent cooling lines on machine to ensure no water remains.

## 9.12 Move the E-Multi Injection Unit for Maintenance

1. Purge plastic from the system.
2. Retract the carriage so that the nozzle tip is on the E-Multi side of the adapter plate.
3. Secure the machine. See “E-Multi Weight Specifications” on page 3-20.
4. Unbolt and separate the E-Multi injection unit from the molding machine.
5. Purge cooling water from the system.
6. Disconnect water, pneumatic, I/O, heater and motor connections from the E-Multi injection unit.
7. Place the E-Multi injection unit, in horizontal position, onto a work bench or machine maintenance stand capable of supporting the full machine load.

## 9.13 Clean Servo Motor Cooling Lines



### CAUTION

Open loop cooling can result in hard water deposits that may clog the narrow cooling channels inside the motors. See “9.13.1 Indications of Cooling Line Contamination” for more information.

Lines that are partially blocked can be cleaned. See “9.13.2 Cleaning Recommendations”. If the channels are completely blocked then the motor must be rebuilt or replaced. Contact your service representative.

*Mold-Masters* recommends using closed loop cooling to keep the cooling channels free of contamination.

### 9.13.1 Indications of Cooling Line Contamination

The condition of the cooling lines can be seen by inspection. The figure below shows three examples of clear blue 3/8 in. tubing. Calcium deposits make the tubing appear green (or pink in the case of clear red tubing) and opaque.

Consistently high servo motor temperature, at or above the warning or alarm levels default 75°C and 80°C (167°F and 176°F) respectively, may also indicate that cooling lines are contaminated.

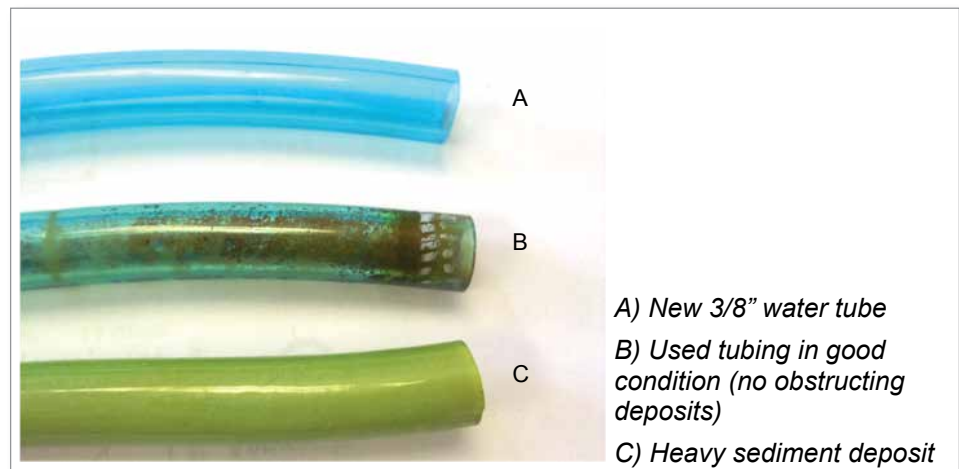


Figure 9-1 Comparison of clean and contaminated cooling lines

### 9.13.2 Cleaning Recommendations



#### CAUTION

The motor inlet pressure must not exceed 6 bar.

Do not use cleaning solutions that are aggressive on aluminum, steel, brass, Viton or polyurethane.

- Use a pump capable of 4.5 bar (65 PSI) minimum pressure in a 45 m (147 ft) water head
- Set the flow rate to 3 l/min (0.75 gal/min) minimum
- Use at least 4.5 l (1.19 gal) of 5% acetic acid (white vinegar)
- Circulate the acetic acid through the motors connected in series for at least 24 hours
- Finish with a de-ionized water rinse through the entire system
- Install a closed loop cooling system

### 9.14 Adapter Plate Removal and Installation



#### NOTE

Adapter plates are specific for each E-Multi injection unit and mold pair. Adapter plates may not be as shown.

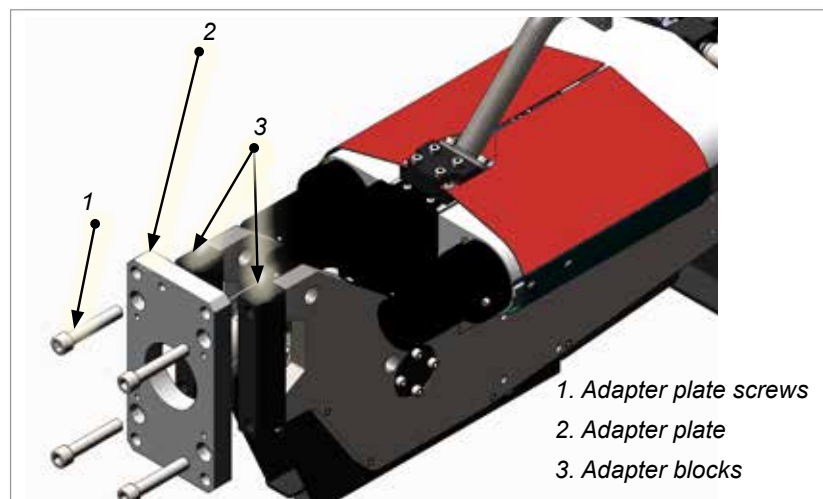
1. Purge the system of plastic and cooling water.
2. Place the E-Multi injection unit, in horizontal position, onto a work bench or machine maintenance stand capable of supporting the full machine load.



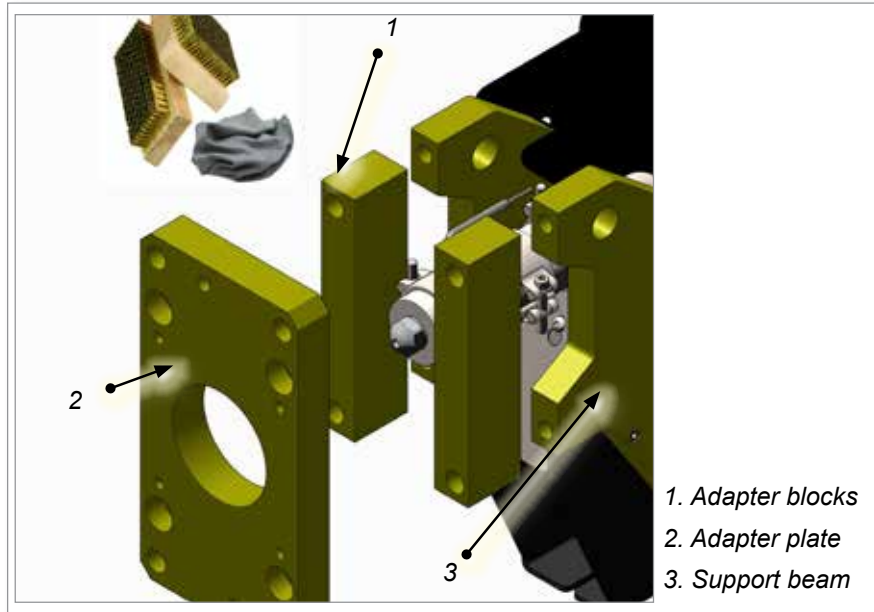
#### NOTE

For servo carriage systems, move the carriage so the nozzle tip is flush with the face of the adapter plate if possible.

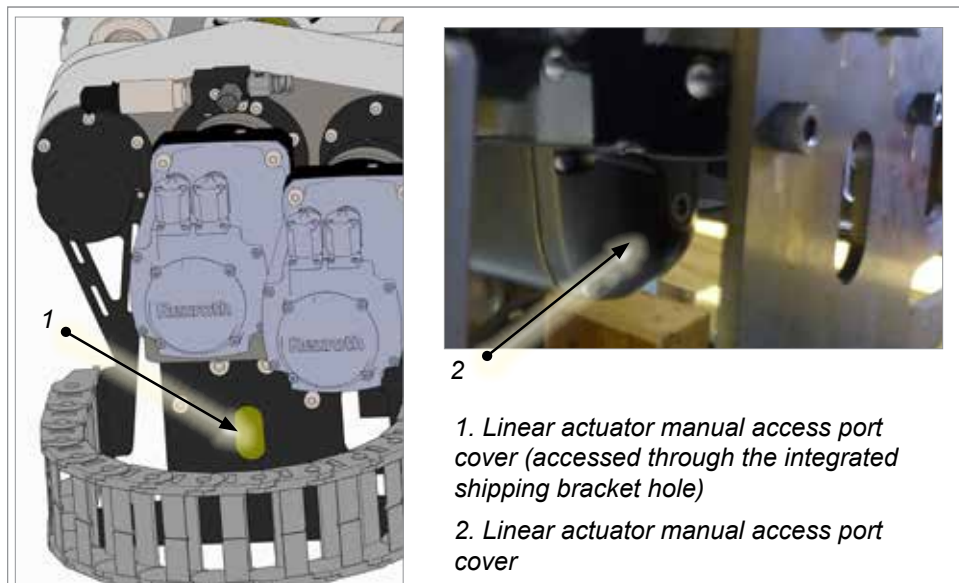
3. Remove adapter plate screws and lift adapter plate away. On models with adapter blocks, take care not to drop the blocks. Long screws with the heads removed may be used to support the adapter blocks and adapter plate when removing screws.



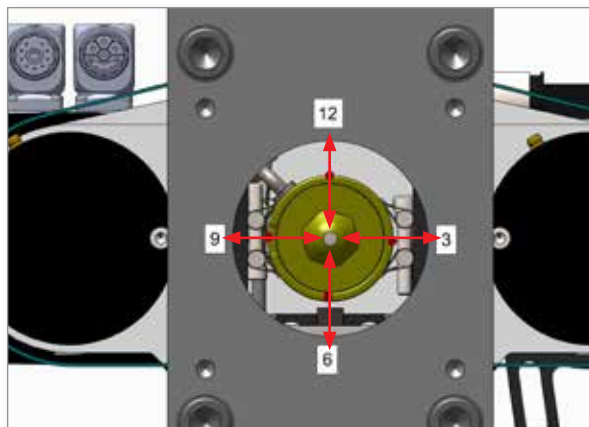
4. Remove replacement adapter plate shipping bracket, if necessary.
5. With solvent, clean the mating surfaces of the replacement adapter plate, adapter blocks (if used) and support beam. Wipe with a clean, lint free cloth.



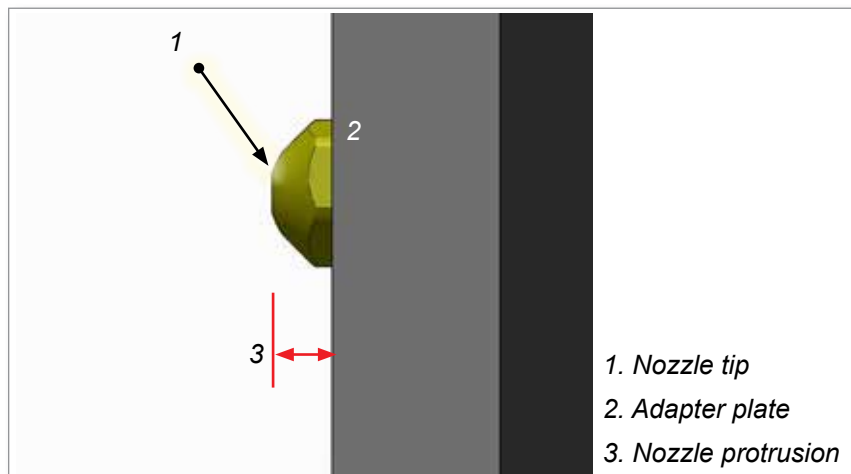
6. Apply a light coat of oil to the contact surfaces.
7. Install the adapter plate and leave the screws loose. If required, install adapter blocks with the adapter plate.
8. Remove the linear actuator manual access port cover to expose the jam screw and adjusting screw.
9. Loosen the jam screw on the carriage link. The adjuster screw can then be turned to move the nozzle so it is flush with the face of the adapter plate.



10. Tighten bolts lightly so adapter plate can be moved by tapping with a rubber mallet.
11. Measure the distance from the nozzle to the adapter plate bore at 12, 3, 6 and 9 o'clock and align the plate by tapping so the distance is equal at all positions. Then torque adapter plate screws. See "9.2 Screw Torque Specifications" on page 9-1.



12. Set correct nozzle protrusion for the mold being used. See "Nozzle Protrusion Adjustment - Toggle Link Models" on page 9-13. When protrusion is correct, tighten the clamping screw to the proper torque. See "Table 9-2 Screw Torque Specifications" on page 9-1.



13. Manually retract the nozzle past the adapter plate using the carriage motor manual adjusting screw to allow installation onto the mold.
14. Replace the linear actuator manual access port cover and hand tighten. The E-Multi injection unit is ready to install onto the molding machine.

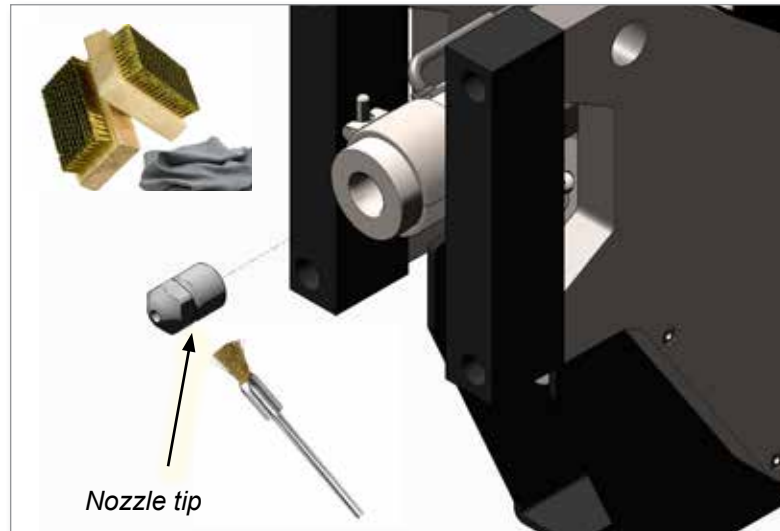
## 9.15 Injection Nozzle Replacement



### WARNING

The injection nozzle area should be kept clean of debris, dust and plastic.

1. Clean the nozzle and barrel area. Remove any plastic residue, using soft brass tools only.
2. Remove the nozzle tip and clean plastic from the nozzle opening and inner cone.
3. Apply anti-seize compound to the nozzle tip threads and reinstall the nozzle tip. See "Other Torque Specifications" on page 9-2.



### NOTE

Because of variations between nozzles, it is recommended that any time a nozzle is changed, the adapter plate is realigned as described in "9.14 Adapter Plate Removal and Installation".

## 9.16 Nozzle Protrusion Adjustment - Toggle Link Models

### 9.16.1 Introduction



### WARNING

This procedure must be done with the barrel at operating temperature. Wear appropriate personal protective equipment. Setting the nozzle protrusion when the barrel is cold may cause damage to the carriage linkages. This damage is not covered under warranty.



### CAUTION

The nozzle should not touch the mold during installation before the adapter plate bolts are tight. If the nozzle touches the mold during installation damage to the system may occur. This damage is not covered under warranty. Before mounting the E-Multi injection unit, move the carriage back far enough to prevent the nozzle from touching the mold during installation.





**CAUTION**

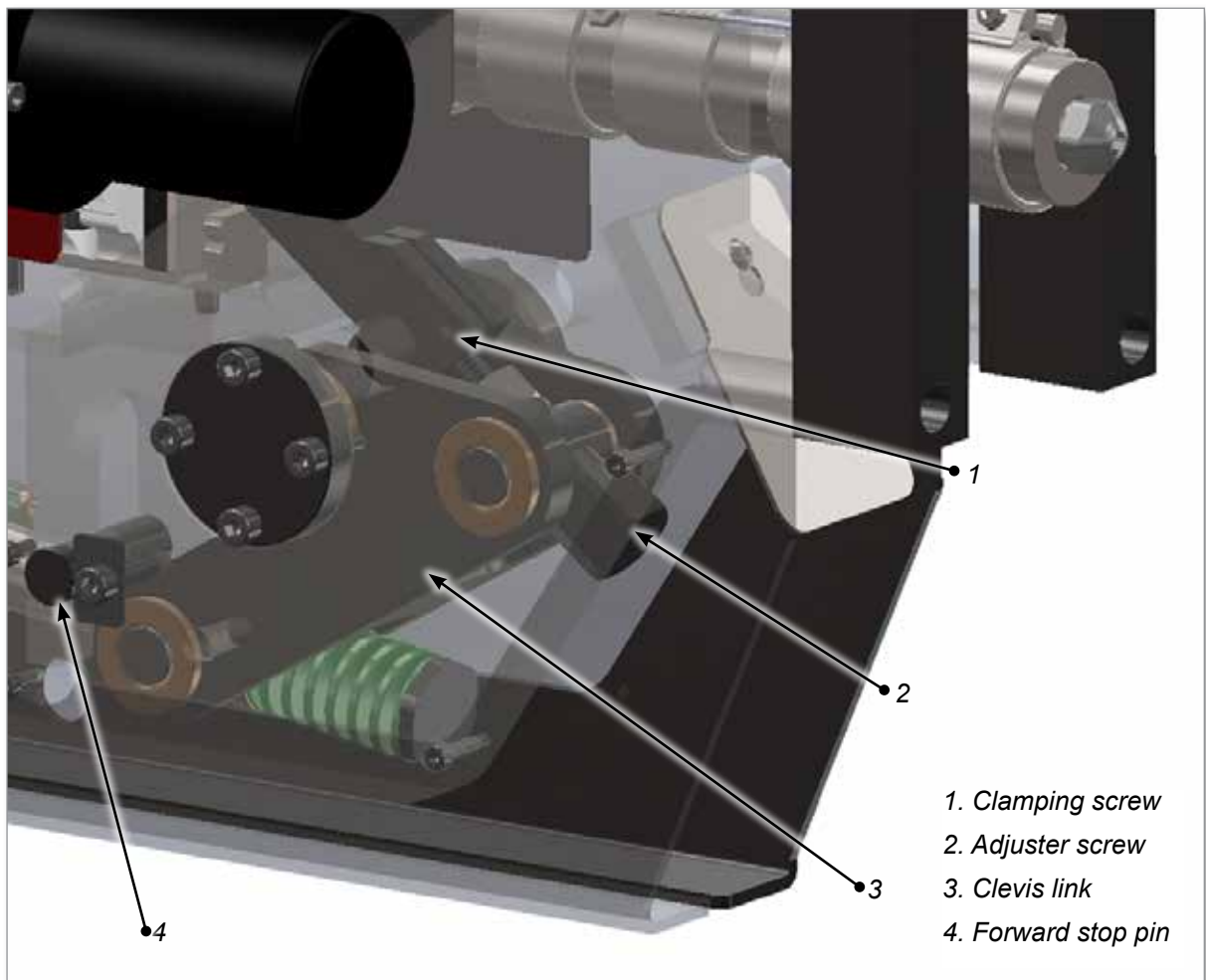
This procedure only applies to E-Multi units with toggle link carriage adjustment as shown in Figure 9-2.

The nozzle protrusion must be properly adjusted to ensure that the nozzle contacts the mold with the necessary force. An incorrectly adjusted nozzle may leak or cause components in the carriage linkage to fail.

Some installations use spacer blocks to achieve correct nozzle protrusion. On these systems, it will not be possible to set the correct protrusion without these blocks.

It is also necessary to check the manifold inlet (sometimes also called the sprue bushing or backplate) depth to verify that it is within the allowable limits of the E-Multi injection unit. The nozzle protrusion range varies by model and options. The correct protrusion range is specified on the installation drawing and / or General Assembly drawing.

Figure 9-2 Protrusion adjustment parts. EM1 shown, other models are similar.



- 1. Clamping screw
- 2. Adjuster screw
- 3. Clevis link
- 4. Forward stop pin

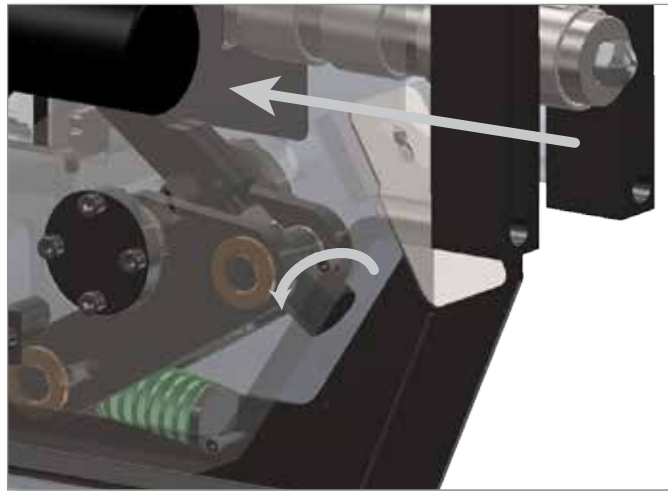
**9.16.2 Adjust the Nozzle Protrusion Manually**

**IMPORTANT**

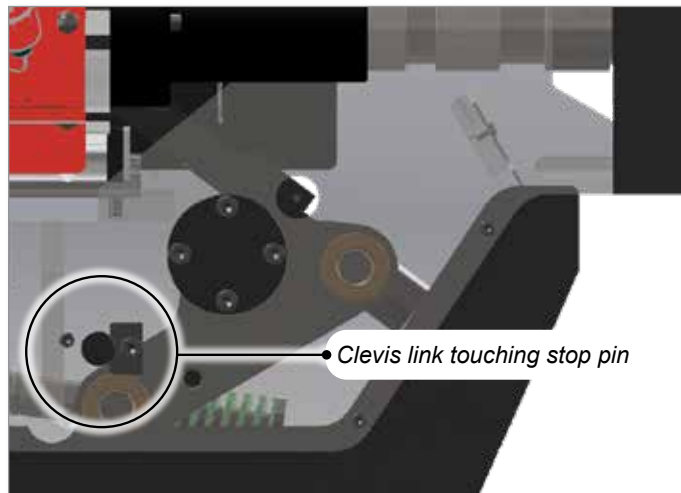
For an EM3, do not move the nozzle back too far. The adjuster screw may fall out of the linkage. This will not damage the system but it is difficult to reinsert the screw. Visually note the position of the adjuster screw in the linkage.

This procedure is used to correctly adjust the carriage linkage for optimum nozzle contact force.

1. Loosen the carriage adjuster clamping screw.
2. Put the controller in Setup mode.
3. Use the adjuster screw to move the nozzle back as shown below. The nozzle should be screwed far enough back to not touch the mold when moving the carriage forward.

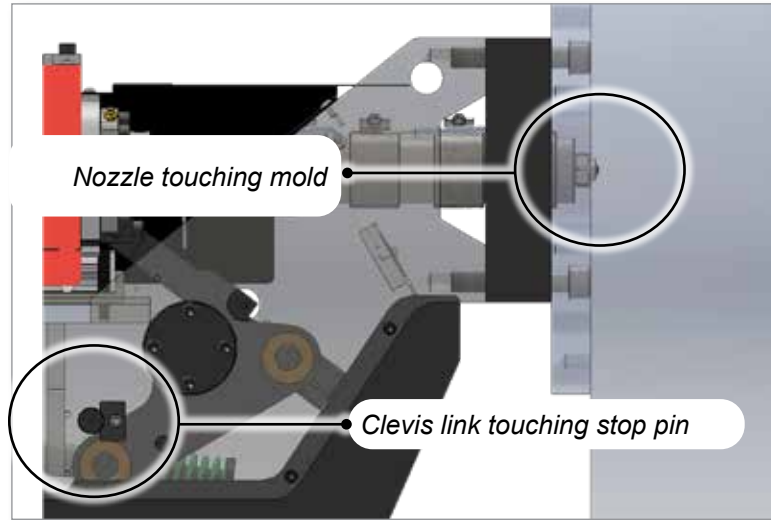


4. Use the **[F4]** button to move the carriage forward until the clevis link touches the stop pin as shown below. On EM1 models with an updated support beam a 10mm window next to the stop pin allows viewing the clevis link. When the window view is filled by the link, it is touching the stop pin. If the nozzle touches the mold before the clevis link touches the stop pin, move the carriage back using the **[F3]** button and return to step 3.



5. With the clevis link touching the stop pin, use the adjuster screw to move

the nozzle forward until it just touches the mold as shown below.



6. Use the [F3] button to move the carriage so there is a 1-3 mm (1/16-1/8 in.) gap between the nozzle and the manifold inlet.
7. Use the adjuster screw to move the nozzle forward until it just touches the manifold inlet as shown in Figure 9-3.



**IMPORTANT**

Note the gap between the clevis link and the stop pin. The clevis link should be within 0 - 3/16 in. of the stop pin. On EM1 models the clevis link should be visible in the 10mm window but not completely covering it. This is the reference position.

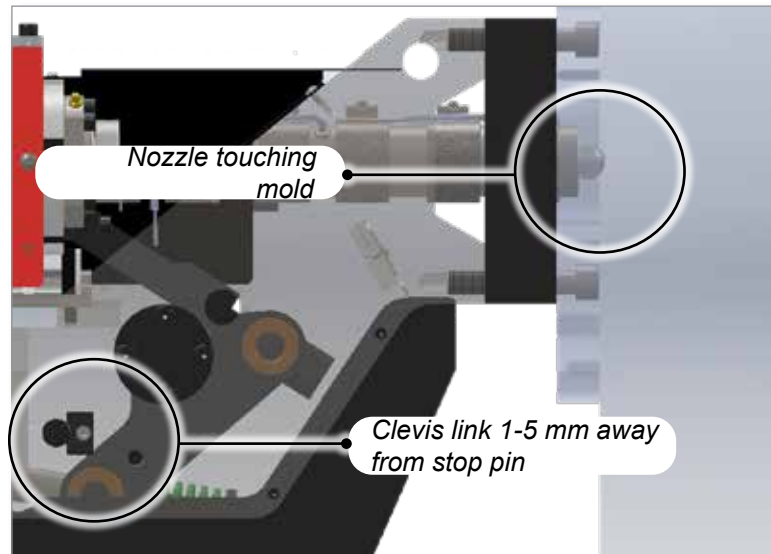


Figure 9-3 Nozzle touching mold

8. Set carriage home position following procedure “9.17 Nozzle Protrusion Adjustment - Automatic Adjustment” on page 9-17.
9. Tighten the clamping screw. Use the controller (i.e. buttons F3 and F4) to move the carriage as required.

## 9.17 Nozzle Protrusion Adjustment - Automatic Adjustment

### 9.17.1 Calibrate the Carriage Home Position



#### WARNING

This procedure requires visual inspection of the machine while it is moving. Wear eye protection.

The first time the E-Multi injection unit is installed, and any time it is transferred to a new machine with a different mold, the carriage home position and contact force must be set.

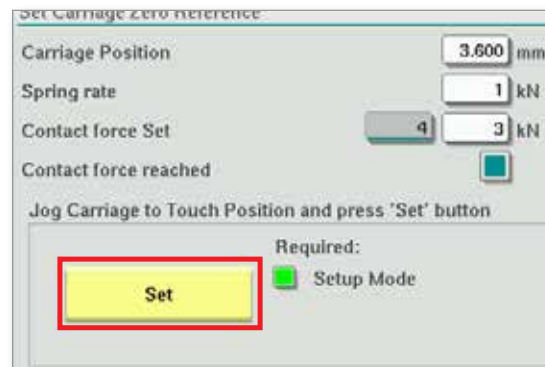


#### IMPORTANT

For proper calibration, ensure the nozzle protrusion is set correctly. See “Nozzle Protrusion Adjustment - Toggle Link Models” on page 9-13 before setting the home position.

### 9.17.2 Calibrate Manually

1. Put the E-Multi injection unit into Setup mode.
2. Navigate to the Reference Settings page. See the E-Multi Controller User Manual for more information.
3. Move the carriage forward until the nozzle is just touching the manifold inlet. This is the reference position as described in 9.16 on page 9-13.
4. Choose Set.



5. Press the [F4] button on the controller to increase nozzle contact force. Continue pressing until the motor stops moving and the “Contact force Set” display field stops increasing. At this point, the value in the display field is the maximum contact force that can be generated with the current setup.
6. Use the “Contact force Set” entry field (the field to the right) to set the desired nozzle contact force. A typical setting is 25-50% of the maximum observed in the previous step.
7. Put the controller in Manual mode.
8. Use the [F3] button to move the nozzle away from the mold until there is a gap.
9. Press and hold the [F4] button to move the nozzle towards the mold until it stops. Verify that the contact force is equal to or slightly greater than the set point chosen in step 6.

### 9.17.3 Automatic Calibration

1. Put the controller in Setup mode.
2. Make sure barrel heaters are at operating temperature.
3. Touch the **[Start]** button.

If the nozzle is adjusted correctly, the routine will complete and the nozzle tip position graphic will show the nozzle tip in the green region.

If the nozzle is not adjusted correctly, the carriage will move to a preset position and tell the operator to adjust the nozzle using the manual adjuster screw. Once the adjustment is made, press the Start button again to run the calibration routine again.

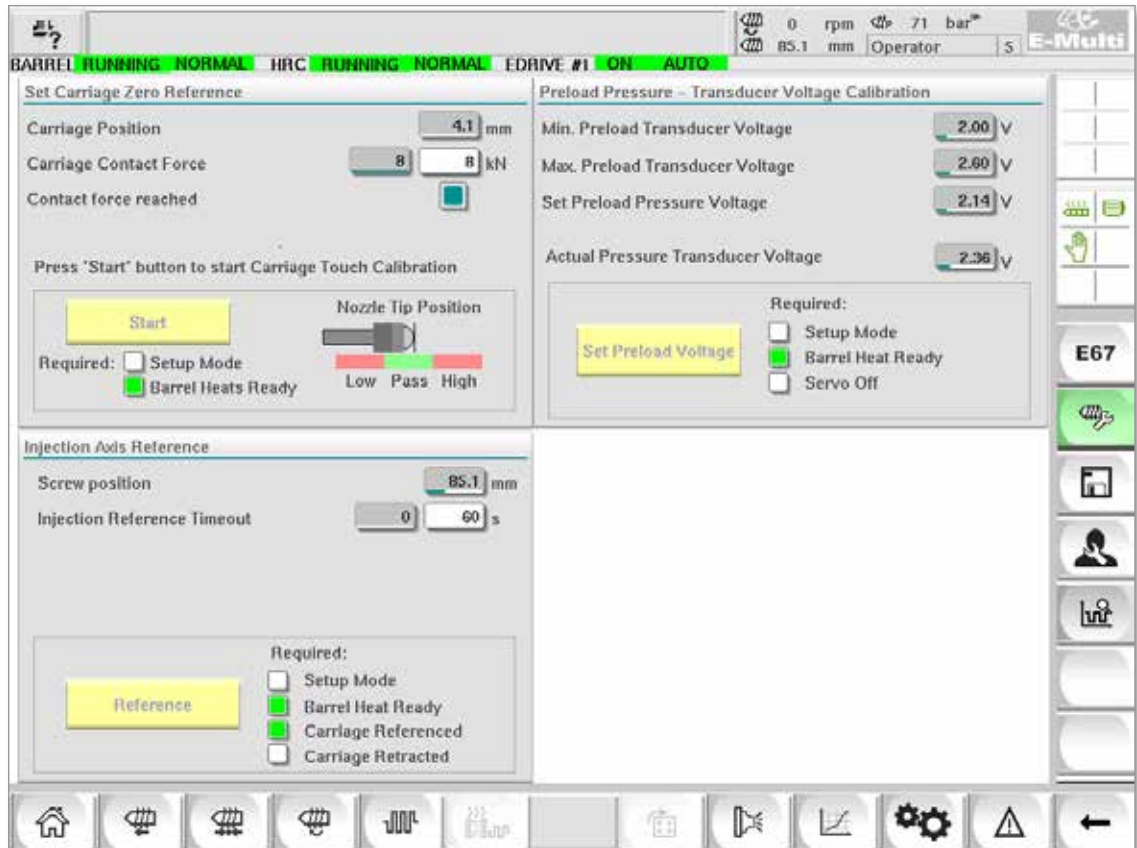


Figure 9-4 Automatic calibration

## 9.18 Injection Axis Referencing



### CAUTION

The injection referencing routine verifies the injection stroke by moving the screw fully back and then fully forward.

Referencing will fail if the screw cannot achieve the full stroke.

1. Controller must be in Setup mode with heats on and up to operating temperature, carriage referenced and carriage retracted from the mold.
2. Navigate to the screw settings page.
3. In the lower left-hand area, tap the [**Reference**] button.
4. Confirm the dialog box that appears.
5. Wait for the screw to move fully back and then fully forward. Referencing is complete when the screw position is just below 0.

## 9.19 Bolt Type Shut Off Nozzle Maintenance



### WARNING

This procedure is done in the hot condition. Wear appropriate personal protective equipment such as heat resistant gloves and goggles or a face shield. Failure to do so can result in serious injury.

Failure to lower the shutoff heater temperature setpoint to ambient temperature before removing the heater band will result in heater damage and may result in injury.

Compressed air will cause the molten plastic to splash. Wear appropriate protective clothing.



### CAUTION

If the E-Multi injection unit is installed in the horizontal orientation, the well surrounding the shut off nozzle bolt will accumulate plastic material. The material must be regularly cleaned out or the bolt may not function properly or it may seize. In a vertical orientation, any excess plastic material will drain out and regular cleaning is not needed.

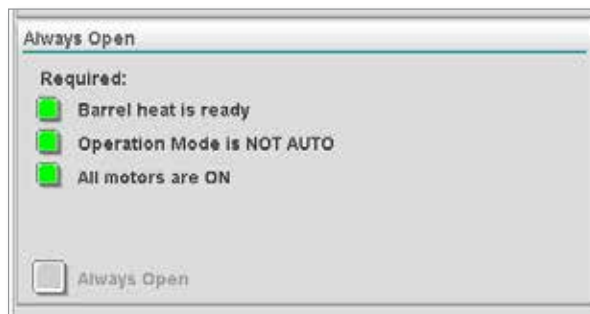
1. Open the shut off valve using the controller software.
  - a) Navigate to the Valve Gate screen by tapping the valve gate button.



- b) Navigate to the Shut Off Nozzle screen by tapping the shut off nozzle button.



- c) Open the shut off nozzle by tapping the Always Open button. For this button to be enabled the three indicator lights must be on.



2. If possible, remove the heater band from the nozzle to allow better access to the shut off bolt.

**NOTE**

This procedure can be done without removing the heater band.

3. Use a small pick to remove the residual plastic from the well surrounding the pin. Compressed air can be used to blow the plastic from the bolt.

**NOTE**

If the bolt is seized completely a heat gun may be used to help soften the residual plastic.

4. If necessary, replace the heater band.
5. Close the shut off valve using the controller software.



## 9.20 Barrel Head Removal and Replacement



### WARNING

This procedure is done in the hot condition. Wear appropriate personal protective equipment such as heat resistant gloves and goggles or a face shield. Failure to do so can result in serious injury.



### NOTE

The procedure applies to EM3 and EM4 units only.

The barrel head must be removed to change the barrel, the screw or the check-ring. If the entire screw and barrel assembly is being changed, barrel head removal is not necessary.

1. Remove the bolts from the perimeter of the barrel head.
2. Remove the barrel head. The barrel head should be easily removed in the hot condition. It is not necessary to remove the nozzle tip from the barrel head to remove the barrel head.
3. Perform maintenance to the barrel, screw or check-ring as required.
4. Clean the faces of the barrel head and the barrel. Check the barrel head mating surface on the barrel head and barrel for any plastic residue, nicks or scratches. A damaged sealing surface will result in leaks.



5. Apply anti-seize compound to the bolts of the barrel head.
6. Mount the barrel head to the barrel and torque the bolts in a cross-wise pattern.
  - EM3 units - torque the M10 bolts to 58 Nm (42 ft-lbs)
  - EM4 units - torque the M12 bolts to 101 Nm (75 ft-lbs)

## 9.21 Heater Replacement



### WARNING

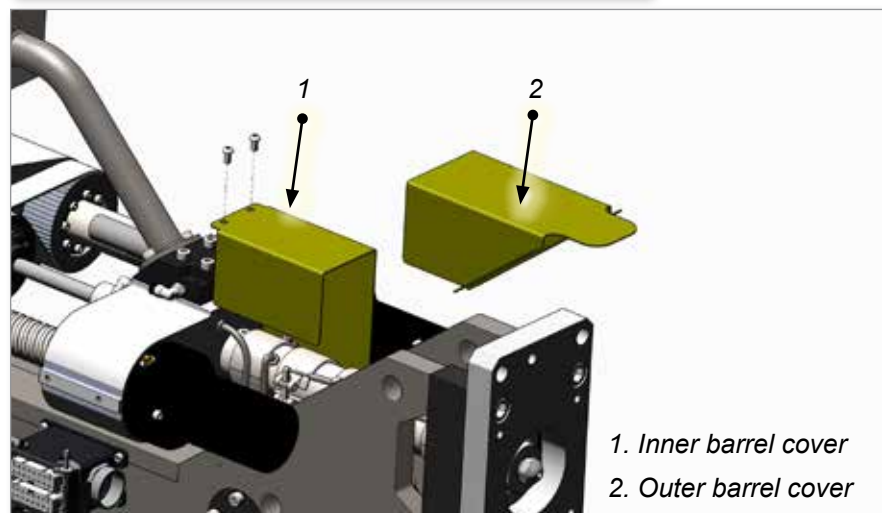
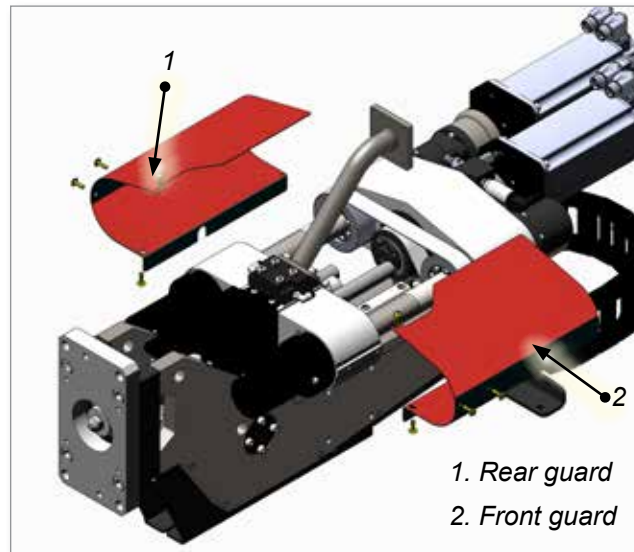
Contact with the barrel can cause severe burns. Exercise caution and wear appropriate PPE when working on or around a hot barrel.



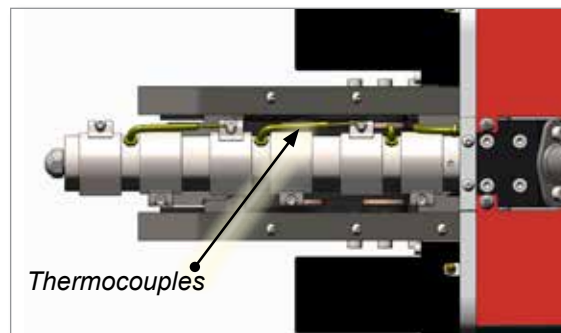
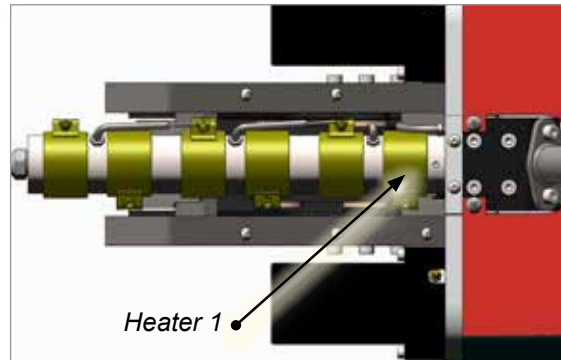
### CAUTION

Do not overtighten thermocouple sockets. It is extremely difficult to remove seized sockets.

1. Move the carriage to the fully back position.
2. Remove the front and rear guards. Remove the outer barrel cover and the inner barrel cover.

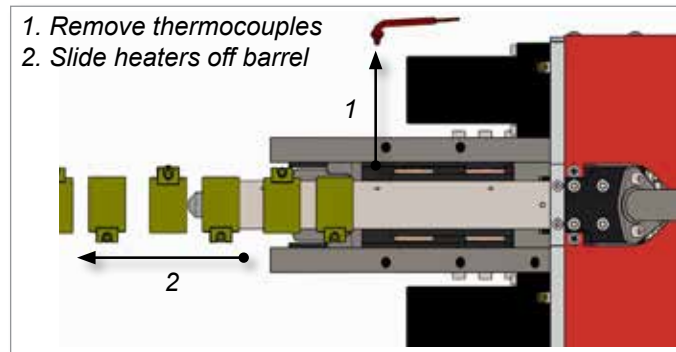


3. Number all heaters and thermocouples and note orientation of connectors and wires. Heaters and thermocouples are numbered starting with #1 at the housing end of the barrel.



4. Remove any plastic residue and clean the end of the barrel.
5. Remove any wire ties.
6. Remove the heater connector insert from the connector base.
7. Unscrew the heater wires from the insert.
8. Loosen the lock nut on the strain relief.
9. Pull the heater cable out of the connector base.
10. Remove the connector base.
11. Loosen the heater clamping screw(s).
12. For socket type thermocouples:
  - a) Remove the thermocouples from their mountings
  - b) Remove the thermocouple sockets from barrel
13. For nozzle type thermocouples:
  - a) Remove the thermocouple from their mountings

14. Slide the heater(s) off end of barrel. Remove heaters before failed heater as well.



15. Using the old heater as a template, cut new heater wires to the same length. Cut the braided shield back from the wire 50 mm (2 in.). Strip the insulation off the heater wires to 10 mm (0.4 in.). Install ferrules using ferrule crimper.
16. Label new heater cable with same number as replaced heater.
17. Install heaters in reverse order of removal. Barrel will have alignment markings that show correct heater locations. Tighten clamping screws on heaters.



**NOTE**

Take care that heater cables are not twisted when installing heaters.

18. For socket type thermocouples:
  - a) Apply anti-seize compound to thermocouple sockets and install
  - b) Tighten to finger tight plus 1/8 turn more
  - c) Install thermocouples into sockets

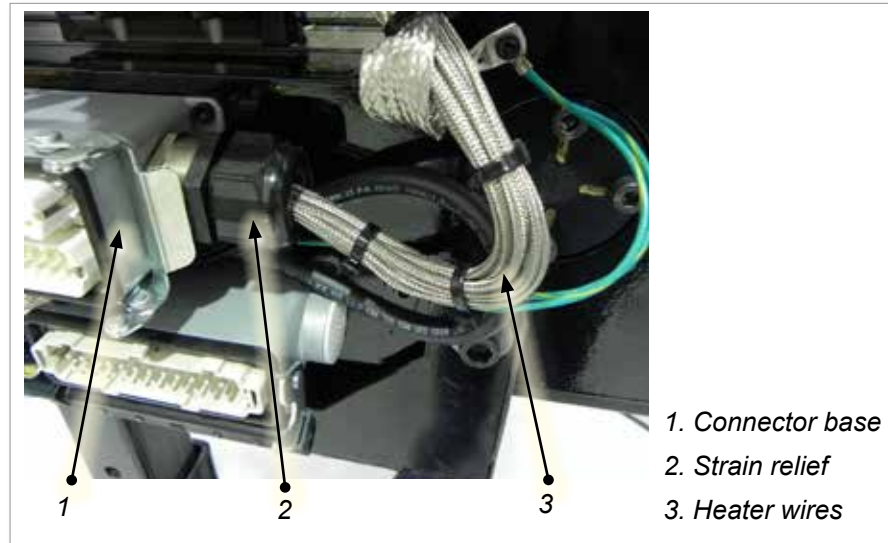


**NOTE**

Thermocouples should be tight in sockets, if thermocouples are not tight, move nut on thermocouple housing so that thermocouple is tight when attached to socket.

19. For nozzle type thermocouples:
  - a) Apply anti-seize compound to the thread
  - b) Thread the thermocouple onto the base
  - c) Tighten to finger tight plus 1/8 turn more
20. Reconnect ground strap and torque to 16 Nm (12 ft-lbs).
21. Install new wire ties if required.

22. Feed the new heater cables through the strain relief on the connector base.



23. Reinstall the connector base onto the support beam.  
24. Install new wire ties.  
25. Tighten the lock nut on the strain relief.  
26. Insert the heater wires into the terminals on the connector insert and tighten.  
27. Reinstall the connector insert.  
28. Test heater resistance using a multimeter on the connector insert pins.  
29. Reinstall the barrel cover(s).



**NOTE**

Ensure that there is no interference with heater and thermocouple wires.

## 9.22 Feed Assembly Removal and Replacement

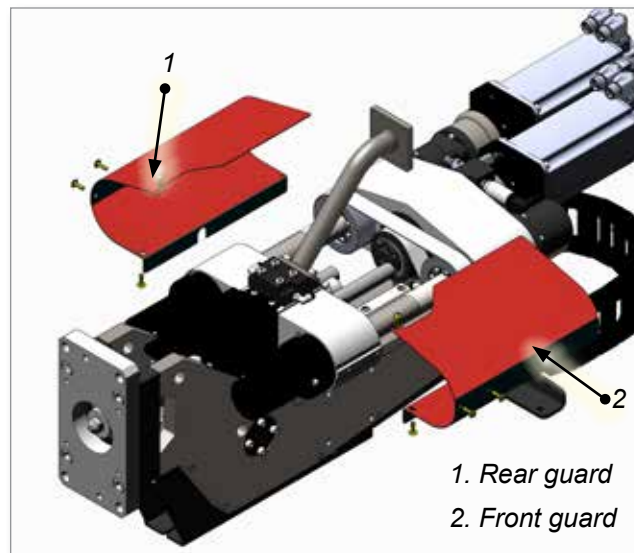
It is recommended that the barrel be purged before the assembly is changed. See “Purge Plastic from System” on page 9-8.

If the barrel cannot be purged and the machine is oriented vertically, it is recommended that a container be placed underneath the feed tube to feed block connection to catch the remaining pellets from the feed tube.

If the machine is oriented horizontally, it is recommended that pellets be removed using a vacuum cleaner to prevent pellets from spilling onto the machine.

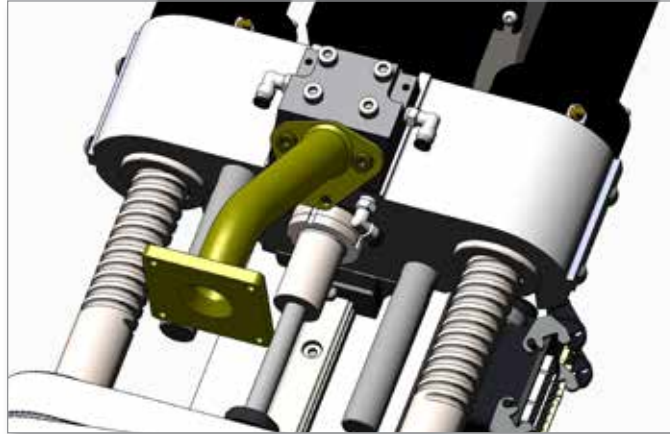
### 9.22.1 Remove Feed Assembly

1. Purge cooling water from E-Multi injection unit, see “Purge Cooling Water from System” on page 9-8.
2. Remove front and rear guards.

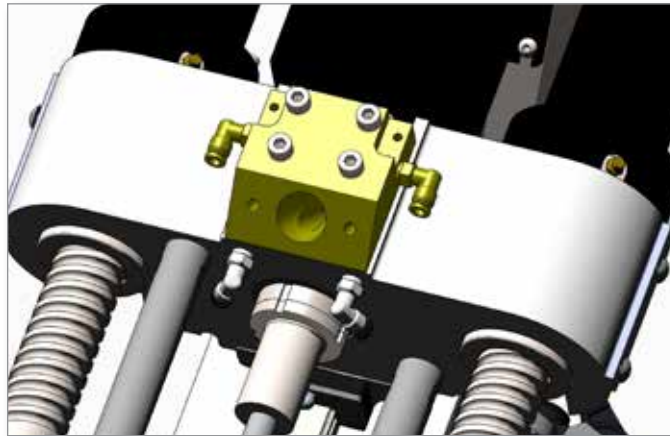


3. Disconnect any connections to the feed system.
4. For horizontal installations, remove the feed hopper from the feed block and then go to step 8.
5. Disconnect and remove the feed hopper from the feed tube.

6. Remove screws attaching feed tube to feed block and lift the feed tube away and remove the feed tube. If a vibrator is used, disconnect air supply from the vibrator.



7. If pellets are not purged from the unit, use a vacuum cleaner to remove pellets from feed block and barrel.
8. Disconnect the cooling lines.
9. Remove the feed block from the system.



10. Check the feed block and barrel mating surfaces and clean if necessary. Remove any remaining pellets from barrel.

### 9.22.2 Install the Feed Block

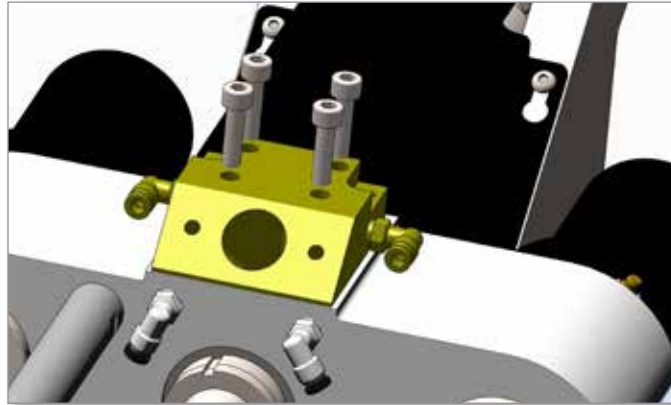


#### CAUTION

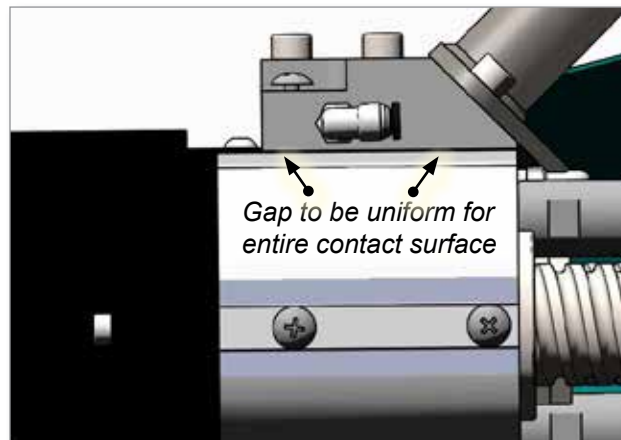
Tightening the screws incorrectly can result in uneven clamping of the barrel and may cause damage to the machine.

Do not reuse purged pellets. Damage to the E-Multi injection unit from contaminated pellets is not covered under warranty.

1. Install the feed block into barrel housing.
2. Apply a light coat of synthetic grease to the screws, install and finger tighten.



3. In a cross pattern, torque the screws in steps, ensuring that the gap for the entire contact surface remains uniform as the screws are tightened. See Table 9-2 for torque specifications.



4. Connect the water cooling lines.
5. Reinstall the vibrator and torque. See Table 9-2 for torque specifications.
6. For vertical installations, reinstall feed tube and torque screws.
7. Reinstall the feed hopper.
8. Reconnect the feed connections and water cooling hoses.
9. Replace the guards.



## 9.23 Feed Screw Cleaning and Replacement

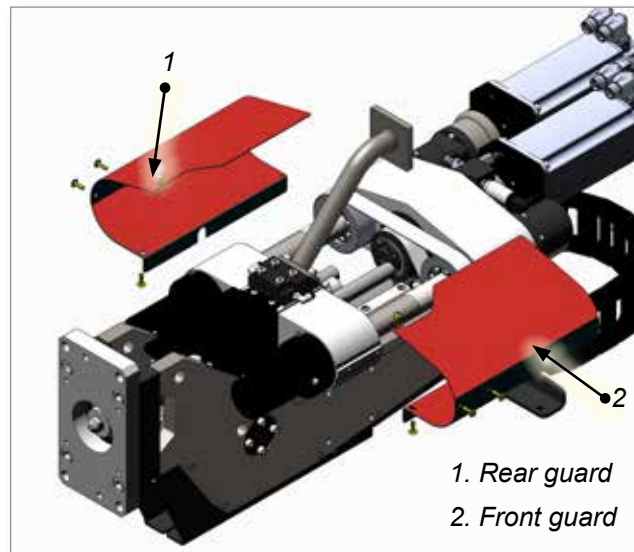
### 9.23.1 Prepare for Feed Screw Removal



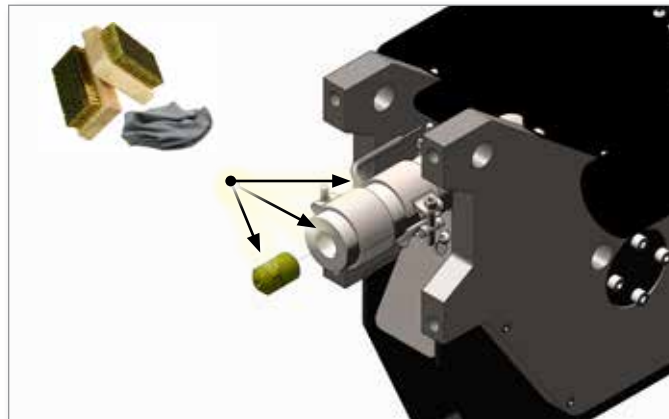
#### **WARNING**

This procedure is done in the hot condition. Wear appropriate personal protective equipment such as heat resistant gloves and goggles or a face shield. Failure to do so can result in serious injury.

1. Move the machine to a work surface. See “Move the E-Multi Injection Unit for Maintenance” on page 9-9.
2. Remove front and rear guards.



3. Clean the nozzle and barrel area. Remove any plastic residue, using soft brass tools only.
4. Remove the nozzle tip and clean plastic from the nozzle opening and inner cone.



### 9.23.2 Remove the Feed Screw

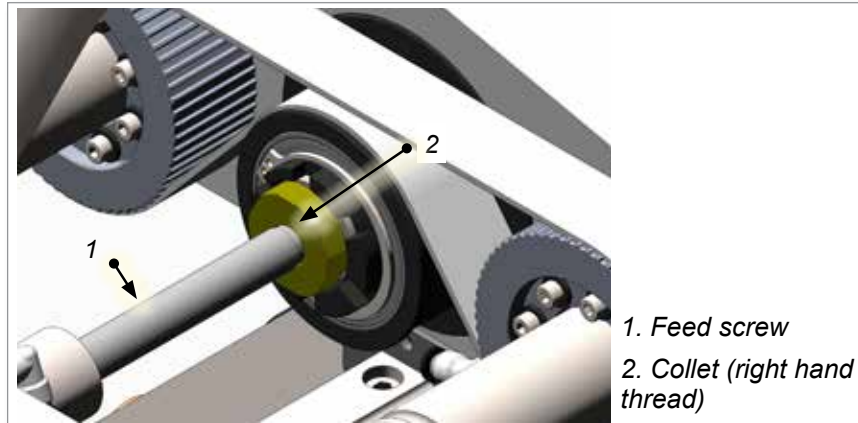


**NOTE**

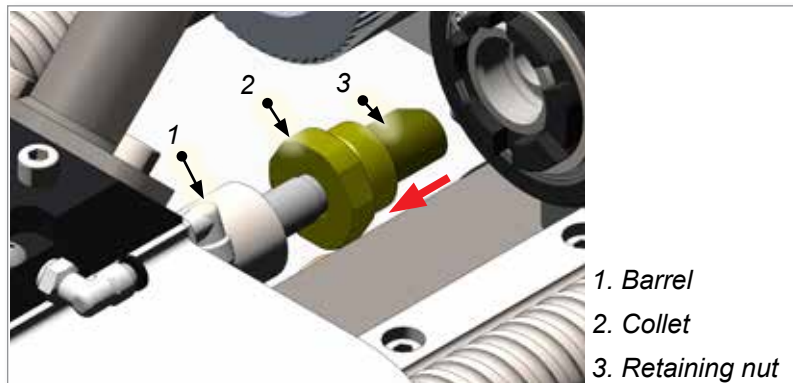
Step 1 is different for EM1 / EM2 units and for EM3 / EM4 units. Refer to the correct step 1 for your system. The remaining steps are the same for all units.

**EM1 / EM2 Units**

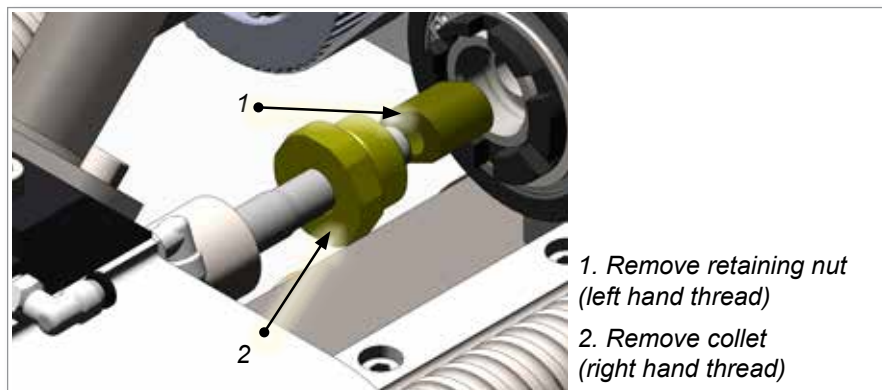
1. Release the feed screw from the drive shaft.
  - a) With the drive power on, unscrew the collet securing the feed screw to the feed drive shaft.



- b) Push the feed screw, the collet and the retaining nut out of the feed drive shaft toward the barrel.



- c) Remove the retaining nut from the screw. The nut is left-hand thread.

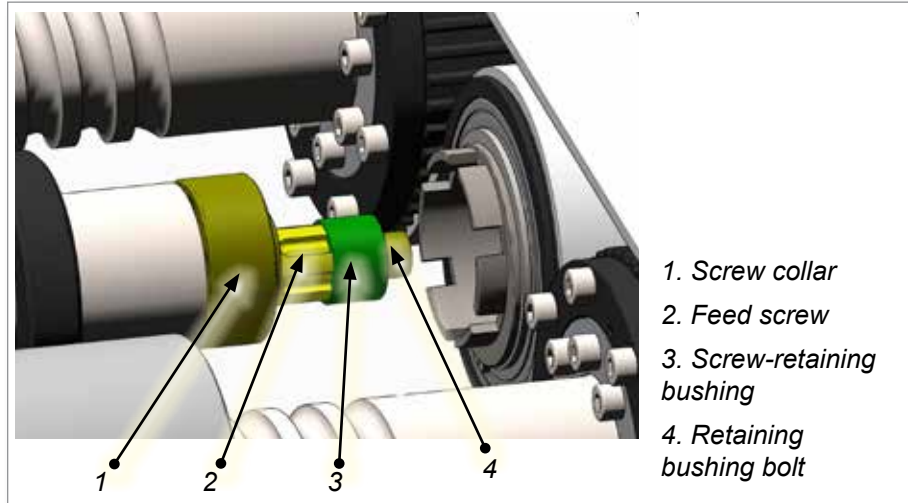


### EM3 / EM4 Units

1. Release the feed screw from the drive shaft.
  - a) Remove screws securing screw collar to feed drive shaft.

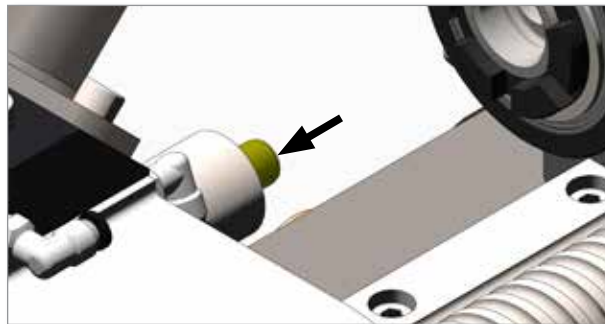


- b) Push the screw towards the barrel until the bolt securing the screw-retaining bushing is accessible.
  - c) Remove the bolt, the screw-retaining bushing and the screw collar.



### All Units

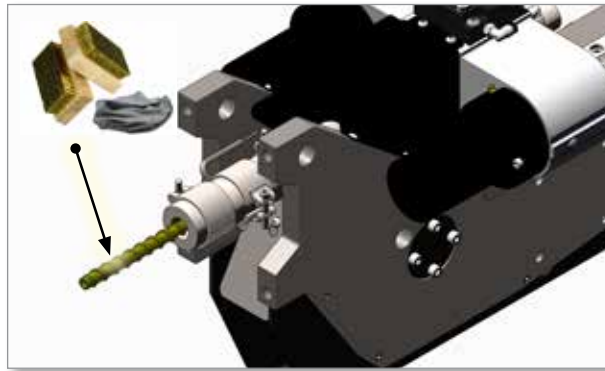
2. Push the feed screw towards the barrel as far as possible.



3. Pull the feed screw out through the nozzle end of barrel.

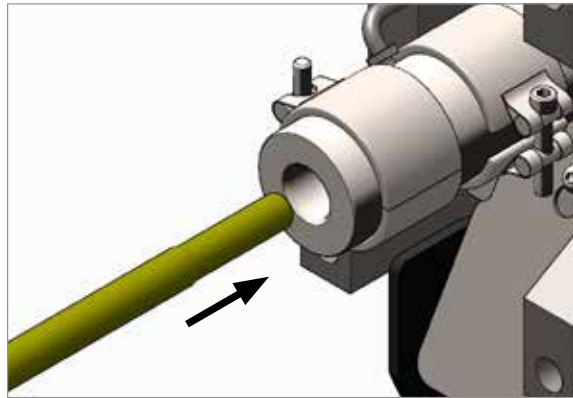
### 9.23.3 Cleaning

4. Use a brass bristled brush to clean plastic from the feed screw.



### 9.23.4 Install the Feed Screw

1. Insert the feed screw into barrel.



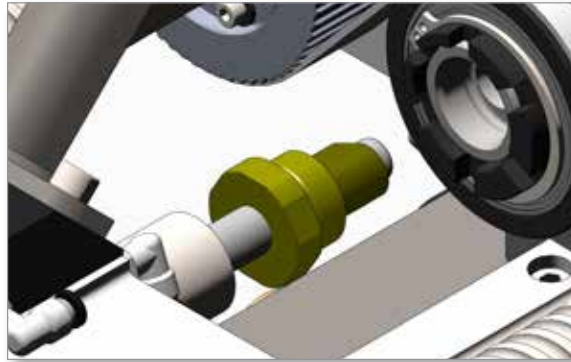
**NOTE**

Step 2 is different for EM1 / EM2 units and for EM3 / EM4 units. Refer to the correct step 2 for your system. The remaining steps are the same for all units.

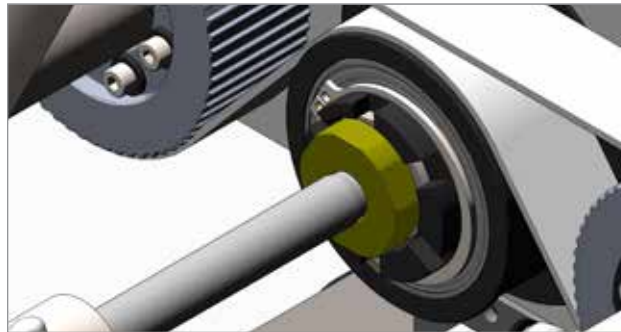
**EM1 / EM2 Units**

2. Secure the feed screw to the drive shaft.
  - a) Apply anti-seize compound to screw threads and screw nut outer surface.
  - b) Install the collet onto the screw end.

- c) Install the retaining nut onto the screw end so that the end of the screw is protruding 1-2 mm (0.04-0.08 in.) from the surface of the nut.

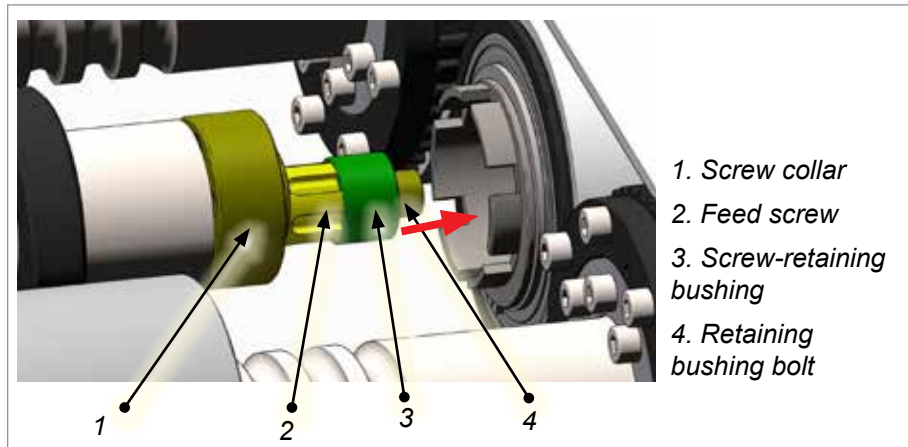


- d) Apply anti-seize compound. Tighten the collet securing the feed screw to drive.



**EM3 / EM4 Units**

- a) Insert the feed screw into the barrel. Once the end protrudes past the barrel end far enough to install the screw collar, install the splined ring.
- b) Install the screw collar, retaining bushing and bolt. Torque to 58 Nm (43 ft-lbs).
- c) Push the feed screw into the feed drive hub.



- d) In a cross pattern, torque the collar screws in steps, ensuring that the gap between the contact surfaces remains constant as the screws are tightened. See “Table 9-2 Screw Torque Specifications” on page 9-1 for torque specifications.



### All Units

3. Reinstall the front and rear guards. Ensure the gap between the guards and the injection housing is the same all around the housing. Also make sure there is no interference with heater and thermocouple wires.

## 9.24 Barrel Removal and Installation



### WARNING

Contact with the barrel can cause severe burns. Exercise caution and wear appropriate PPE when working on or around a hot barrel.



### CAUTION

Thermocouple connections on the barrel are easily damaged. Do not allow the weight of the barrel to rest on the thermocouples.



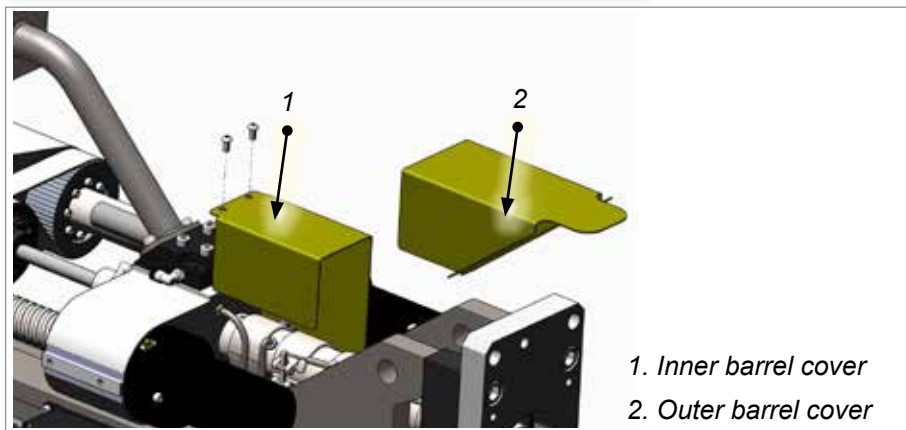
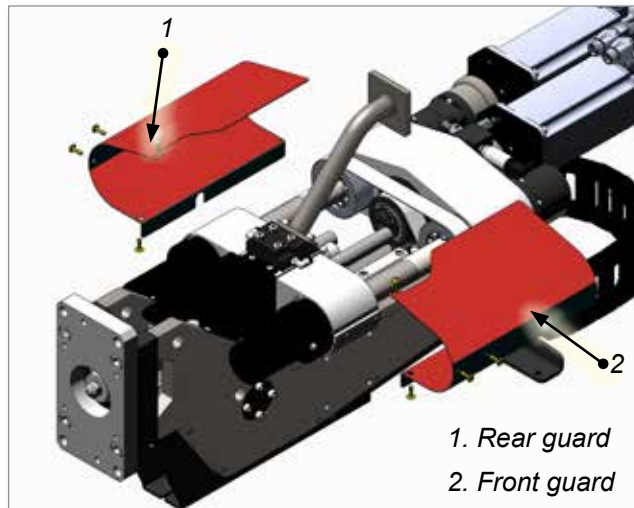
### IMPORTANT

This procedure assumes the replacement barrel is clean and the feed screw can be moved by hand. This is required so that the screw can be reattached to the injection housing without having to move the housings.

If the screw is to be separated from the barrel, follow instructions to remove the screw first. See “Feed Screw Cleaning and Replacement” on page 10-4.

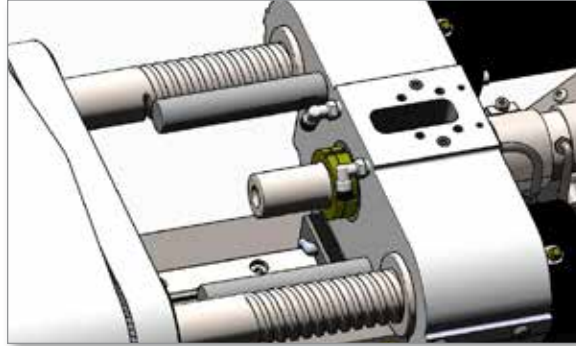
### 9.24.1 Remove the Barrel Assembly

1. Move the machine to a work surface. See “Move the E-Multi Injection Unit for Maintenance” on page 9-9.
2. Remove front and rear guards. Remove barrel cover and inner barrel cover.

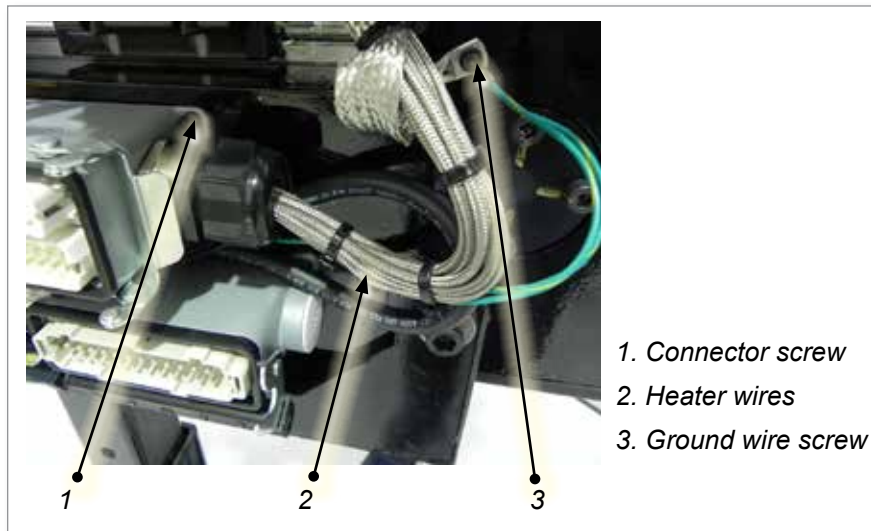


### Remove the Barrel Assembly - continued

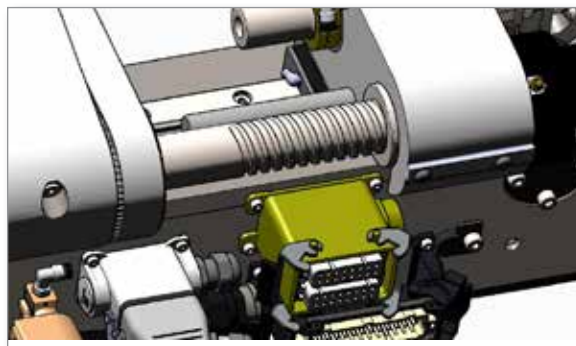
3. Remove the feed block. See “Feed Assembly Removal and Replacement” on page 9-27.
4. Remove the feed screw. See “Feed Screw Cleaning and Replacement” on page 9-30.
5. Remove the large barrel nuts securing the barrel to the barrel housing.



6. Remove the ground wire screw and wire ties required to remove the heater and the thermocouple cables from the support beam.

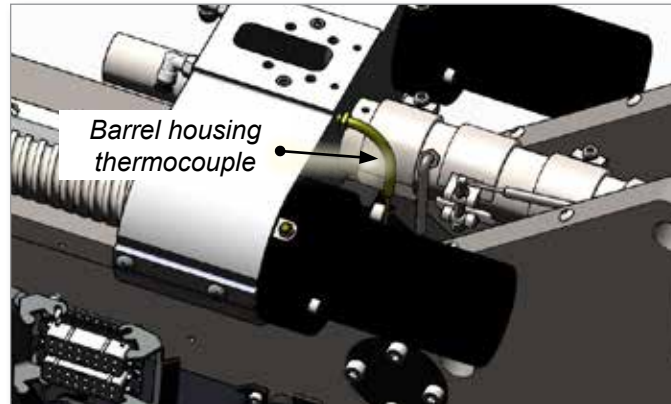


7. Remove the heater connector from the support beam.

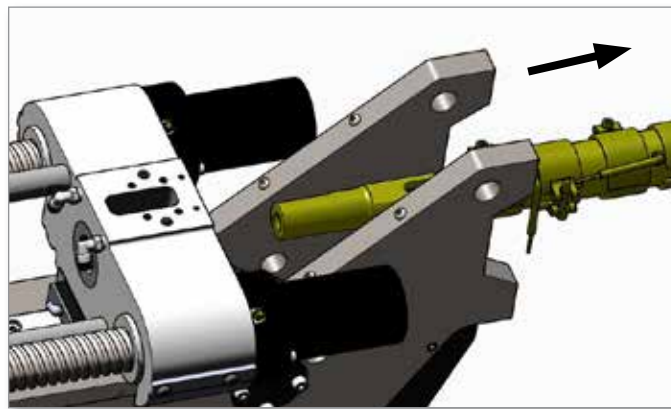




8. Disconnect the barrel housing thermocouple.



9. Slide the barrel out of the barrel housing.

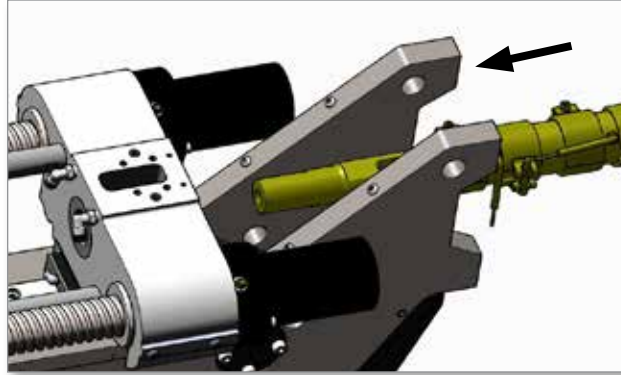


### 9.24.2 Transfer Heaters and Thermocouples to a New Barrel

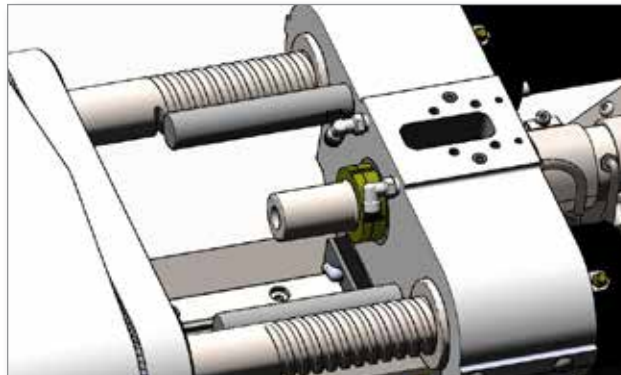
See "Heater Replacement" on page 9-23.

### 9.24.3 Install the Barrel Assembly

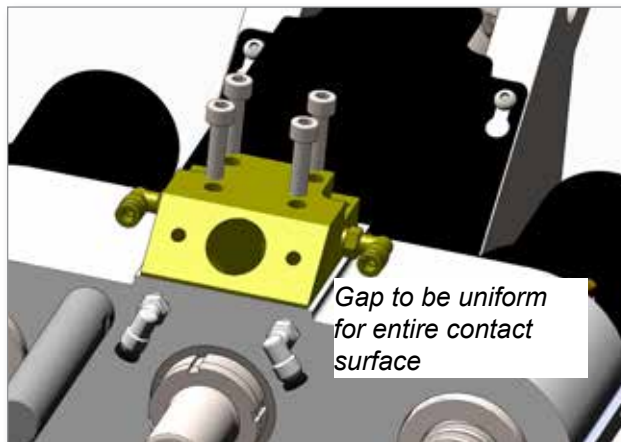
1. Apply anti-seize compound to load surfaces and thread. Lift the barrel into position and slide it into the barrel housing with the flat face facing up.



2. Install the large barrel nuts onto the end of the barrel and tighten finger tight.



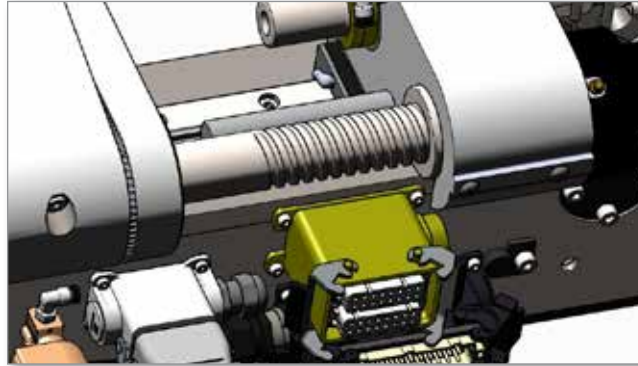
3. Install the feed block onto the barrel housing. See "Install the Feed Block" on page 9-29.



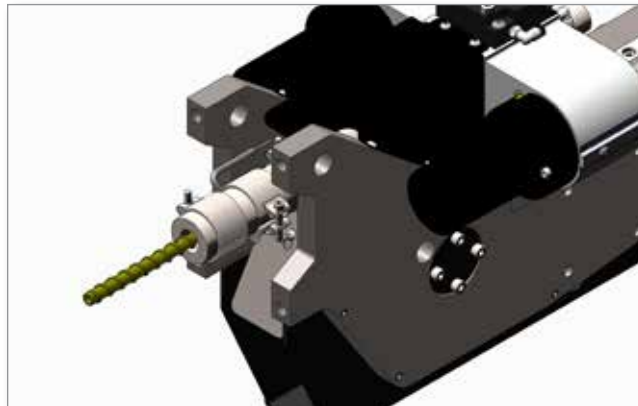
4. Tighten the barrel nut.

### Install the Barrel Assembly - continued

5. In a cross pattern, reinstall the heater connector screws. See “Screw Torque Specifications” on page 9-1.



6. Secure the feed screw to the drive shaft. See “Feed Screw Cleaning and Replacement” on page 9-30.



7. Reinstall the front and rear guards. Make sure the gap between the guards and the injection housing is the same all around the housing. Also make sure there is no interference with heater and thermocouple wires.

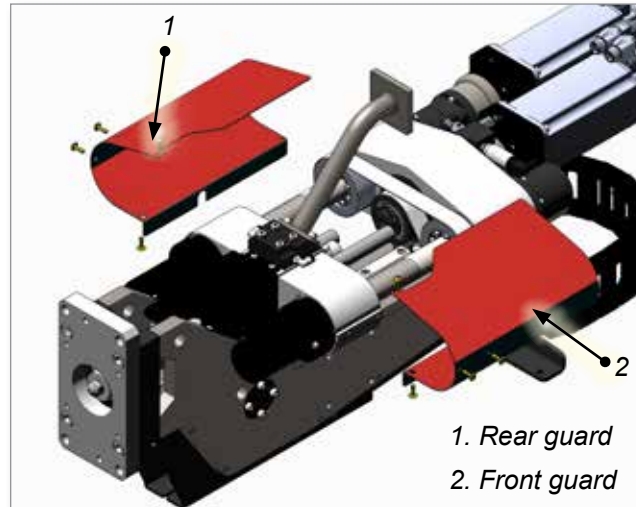
## 9.25 Belt Tension Adjustment



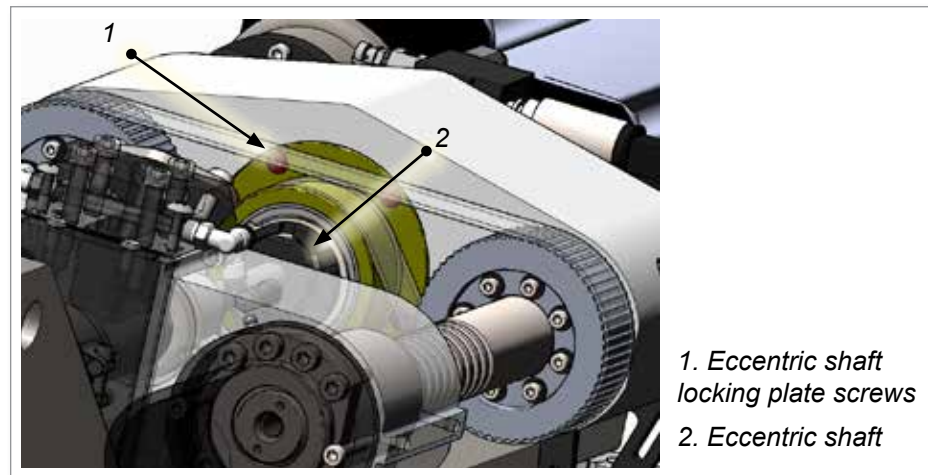
### WARNING

Lockout / tagout machine before performing a belt tension adjustment.

1. Remove front and rear guards.



2. Loosen, but do not remove, the screws securing the eccentric shaft locking plate.



3. Rotate the eccentric shaft until correct belt tension is achieved. See “Belt Tension Specifications” on page 9-2.
4. In a cross-pattern, tighten the eccentric shaft locking plate screws and torque. See “Screw Torque Specifications” on page 9-1.
5. Check belt tension again to ensure it is within specification. Repeat steps 2 to 4 if necessary.
6. Reinstall the front and rear guards. Make sure the gap between the guards and the injection housing is the same all around the housing. Also make sure there is no interference with heater and thermocouple wires.

## 9.26 Belt Removal and Installation



### CAUTION

Do not rotate the ball screws with the belt removed, otherwise realignment will be necessary.

### EM1 / EM2 Models:

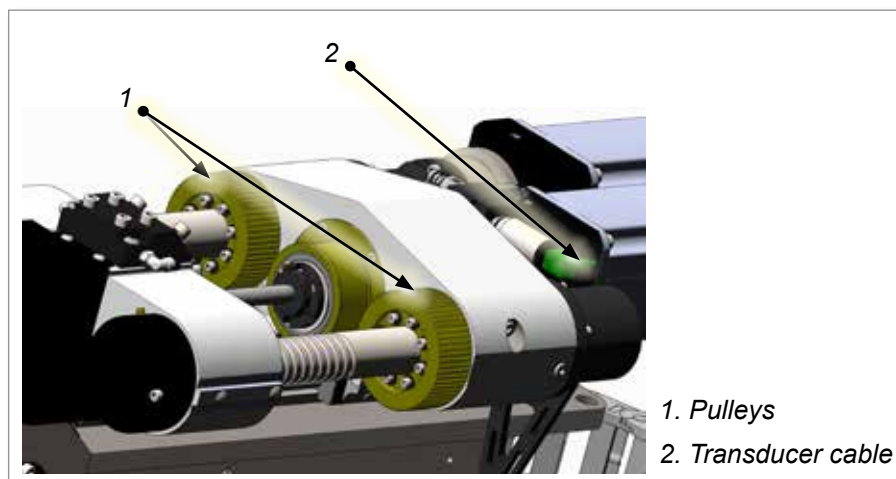
1. Purge plastic from the machine. See “Purge Plastic from System” on page 9-8.
2. Move the injection housing to the fully back position.
3. Remove front and rear guards.
4. With the drive power on, loosen the feed screw from the drive shaft. See “Remove the Feed Screw” on page 9-31.
5. Turn off the drive power, but keep the heaters on.
6. Disconnect the feed screw and push as far as possible into the barrel.
7. Turn the controller off.
8. Purge the water lines. See “Purge Cooling Water from System” on page 9-8.
9. Remove the screws securing the eccentric shaft locking plate.
10. Rotate the eccentric shaft to release the tension on the belt.
11. Slide belt forward on the pulleys but do not remove.
12. Mark pulleys relative to the housing.
13. Remove the belt from the pulleys. Take care that the pulleys do not change orientation relative to one another.



### NOTE

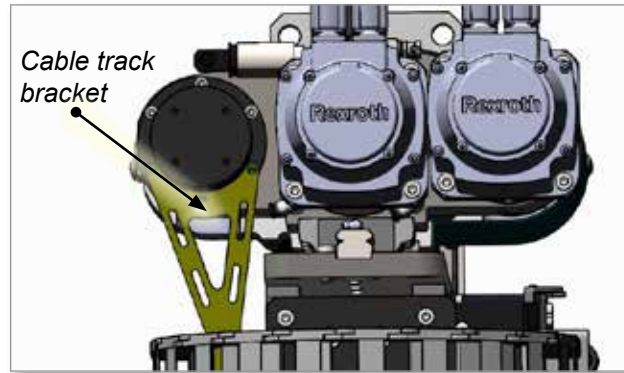
For the EM1 model, it is easier to slide the idler pulley off with the belt.

14. Disconnect the motor connectors, transducer cable and water lines.



**Belt Removal and Installation - continued**

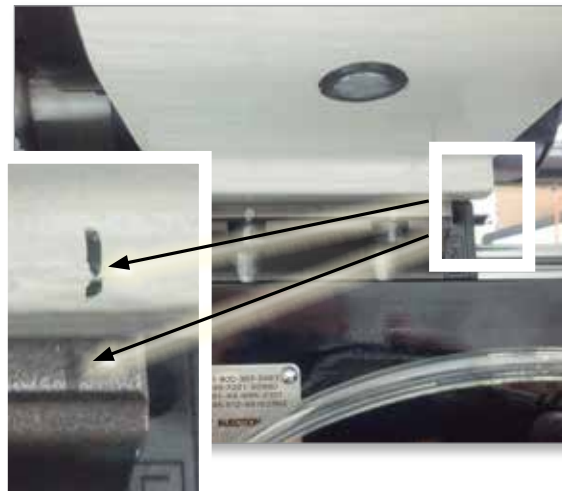
15. Remove the screws securing the cable track bracket to the shaft cover on the injection housing.



16. Unfold the cable track.
17. Position the new belt as shown below.



18. Mark the position of the linear guide relative to the injection housing. See Figure 9-5.



*Figure 9-5 Linear guide position*

19. Loosen the linear guide screws.

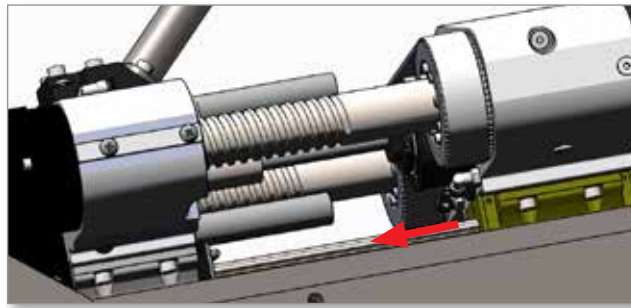
**Belt Removal and Installation - continued**

20. Slide the linear guide out from under the injection housing (you may need to lift the motor slightly to release tension on the guide).

**NOTE**

For EM1 models, slide the guide towards the motors. For other models, slide the guide towards the barrel.

21. Move the old belt over the injection housing, all the way to the barrel housing and remove it.
22. Clean the pulleys and the idler surface with solvent and a clean cloth.
23. Move the new belt over the injection housing and pulleys.
24. Move the linear guide back into place using marks. Torque the linear guide screws. See “Screw Torque Specifications” on page 9-1.



25. Reinstall the cable track bracket. Torque the screws in a cross pattern, see “Table 9-2 Screw Torque Specifications” on page 9-1.
26. Reconnect the transducer cable and the water lines.
27. Reconnect the motor connectors. See “Route and Connect Servo Cables” on page 7-1.
28. Install the belt over the idler and the toothed pulleys. Take care that the pulleys do not change orientation relative to one another.
29. Slide the belt onto the pulleys.

**NOTE**

For EM1 models it is easier to slide the belt on with the idler pulley.

30. Verify that the belt is centred on the idler pulley.
31. Adjust the belt to the correct tension. See “Belt Tension Adjustment” on page 9-41.
32. Move the pulleys back and forth to check for proper movement of the belt.
33. Reconnect the feed screw. See “Feed Screw Cleaning and Replacement” on page 9-30.
34. Reinstall the front and rear guards. Ensure the gap between the guards and the injection housing is the same all around the housing. Also make sure there is no interference with heater and thermocouple wires.

**9.27 Servicing and Repairing your Controller**

Refer E-Multi Controller User Manual for servicing, repair and software updates.

# Section 10 - Component Tests and System Alarms



## WARNING

Ensure that you have fully read “Section 3 - Safety” before performing any of the tests in this section.

The user is responsible to ensure protection against shock by indirect contact, by protective earth conductors and automatic disconnection of supply. *Mold-Masters* components and systems are either equipped with a protective earth conductor or there is a connector for this purpose.

## 10.1 Thermocouple Electrical Test

The controller system has functionality to monitor thermocouple performance. A working thermocouple will show a realistic temperature based on the environment it is in. Defective thermocouples will read -100°C (-148°F) on the controller.

- If a thermocouple shows as defective, test the thermocouple at the support beam or hot runner connector.
- Thermocouples should show output similar to those in the same area. If the output is significantly different, replace the thermocouple.
- If the new thermocouple shows -100°C (-148°F) there is probably a wiring problem. Check the wiring and connections.

## 10.2 Heater Continuity Test



### WARNING

This procedure requires access to the heater connector. Power down the machine before disconnecting heater cable.

Testing of the heaters is done with a multimeter set to measure resistance. The heaters are wired to the connector in pairs according to the wiring schematic.

- Check the resistance across the pins. The multimeter should show around 48 ohms for a 1000 W heater and 96 ohms for a 500 W heater.
- A reading of 0 ohms indicates a shorted heater and a reading of infinity indicates an open heater.

## 10.3 Transducer Output Alarm

Transducer function is checked automatically every cycle. If the transducer is defective, an alarm will be shown on the controller.



## 10.4 Vibrator Valve Test

The vibrator runs on every cycle when the feed screw is turning. If the vibrator is not moving, first check the air pressure to the vibrator.

1. Close the air needle valve and disconnect the air line from the supply side of the valve.
2. Open the needle valve slowly and check for air pressure on the supply line.
  - If there is no pressure, check the pneumatic connection to the machine.
  - If there is pressure, close the valve, reconnect the air line to the valve and open the valve.

Then check the mechanical function.

1. Disconnect the air supply tube from the solenoid valve on the support beam and apply compressed air to the tube.
  - If the vibrator is working properly, it should start to vibrate when compressed air is applied.
2. If the vibrator is working, reconnect the air line to the valve and disconnect the valve cable. Apply 24 VDC to pin 1 and 0 VDC to pin 2.
  - The valve should open and the vibrator should start to vibrate.
  - If the valve does not move, replace the valve with a known good one.

## 10.5 Control System Alarms

The control system has several features, which provide an early diagnosis of faults in the control system.

- If the system detects any malfunctions, it displays an **error** message on the Alarm screen.
- If the system detects any abnormal condition it displays a **warning** message on the Alarm screen.

See E-Multi Controller User Manual for details.

## 10.6 Servo Motor Temperature Alarms

The motor warning and alarm temperatures are factory settings that can only be changed by a *Mold-Masters* technician. The default values are:

- warning temperature: 75°C (167°F)
- alarm temperature: 80°C (176°F)

The E-Multi controller automatically disables the motors when the alarm temperature is reached. The motor temperature can be monitored in real time on the E-Multi controller.

For more information about motor temperature alarms, please refer to the E-Multi Controller User Manual.

















State	Time	Class	Description
	5/29/14 7:56:02 PM		Inject B Motor Temperature is within alarm limits. Servos will be shut off. Check motor.
	5/29/14 7:47:34 PM		Drive Injection not referenced
	5/29/14 7:47:24 PM		Carriage not referenced. Carriage must be referenced before turning Servo On.
	5/29/14 7:47:24 PM		Emergency stop 1 pressed
	5/29/14 7:47:23 PM		Servo motor off
	5/29/14 7:47:23 PM		Hot Runner is not up to Temperature. Check Hot Runner Settings.
	5/29/14 7:47:23 PM		Gate is Opened! Close Gate to operate EMulti.
	5/29/14 7:47:23 PM		EMulti Emergency Stop is Pressed!
Inject B Motor Temperature is within alarm limits. Servos will be shut off. Check motor.			
Confirm	Confirm all	Alarm history	Help

Figure 10-1 Motor temperature alarm - Alarms screen on E-Multi controller



# Section 11 - E-Multi Radial Option



## WARNING

Ensure you have fully read “Section 3 - Safety” before unpacking, assembling or installing the E-Multi Radial Option.

## 11.1 Introduction

This section provides information that is special to the E-Multi Radial machine-mounted solution for E-Multi injection units.

The E-Multi Radial is designed to be mounted to the top of the stationary platen of an injection molding machine, where it can conveniently swing out of the way of the mold mounting face. This speeds up mold changes, as there is no need to remove the E-Multi injection unit when changing a mold. An additional benefit is that the full weight of the E-Multi injection unit is supported by the injection molding machine, rather than the mold.

The E-Multi Radial has a servo controlled carriage axis which allows the system to be operated in sprue-break mode or in continuous nozzle contact mode.

In sprue break mode, the nozzle retracts and extends with each injection cycle, as required for parting line injection application.

## 11.2 E-Multi Radial Specifications

Table 11-1 E-Multi Radial Specifications							
E-Multi Model	Typical Clamp Size	Vertical (Carriage) Stroke (z-axis)	Mold Face Reach (x-axis)	Rotation (Injection Molding Machine Center)	Nozzle Contact Force	Sprue Break (Carriage Stroke)	Sprue Break (Average Velocity)
ER1-15 ER1-30	100 - 450 ton	0 - 415 mm	50 - 350 mm	-120° CCW +120° CW	10 kN	≤ 50 mm	50 mm/sec
ER2-50 ER2-80	90 - 400 tonne				17 kN		
ER3-100 ER3-200	300-2000 ton 275 - 1800 tonnes	0 - 825 mm	60 - 500 mm		40 kN		
ER4-350 ER4-550	400 - 4000 ton 365 - 3600 tonnes		70 - 500 mm				

### 11.3 E-Multi Radial Components



Figure 11-1 Main components of the E-Multi Radial

## 11.4 Unpacking



### WARNING

When doing any work that requires lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death. See “E-Multi Weight Specifications” on page 3-20 for weight, dimensions and safe lifting instructions.

The crate should be moved using a forklift or pallet truck. If using a crane, the crate must be slung from underneath. Never lift from the top of the crate.

1. Remove the lid and the plastic wrap as necessary.
2. Inspect the unit prior to removing any of the crate walls or bracing. See “11.5 Inspection” on page 11-4.
3. Attach the slings to the unit as shown in Figure 11-2, Figure 11-3 and Figure 11-4. Use the slings provided in the crate. Note the approximate point of the center of gravity.
4. Raise the lifting machine just enough to reduce the slack in the slings. Ensure that the lifting point is positioned above the center of gravity and the unit will not swing when lifted.
5. Remove the remaining crate sides and bracing, leaving the crate floor and all floor bracing around the adapter plate.
6. Remove the accessory boxes and anything other than the E-Multi Radial.

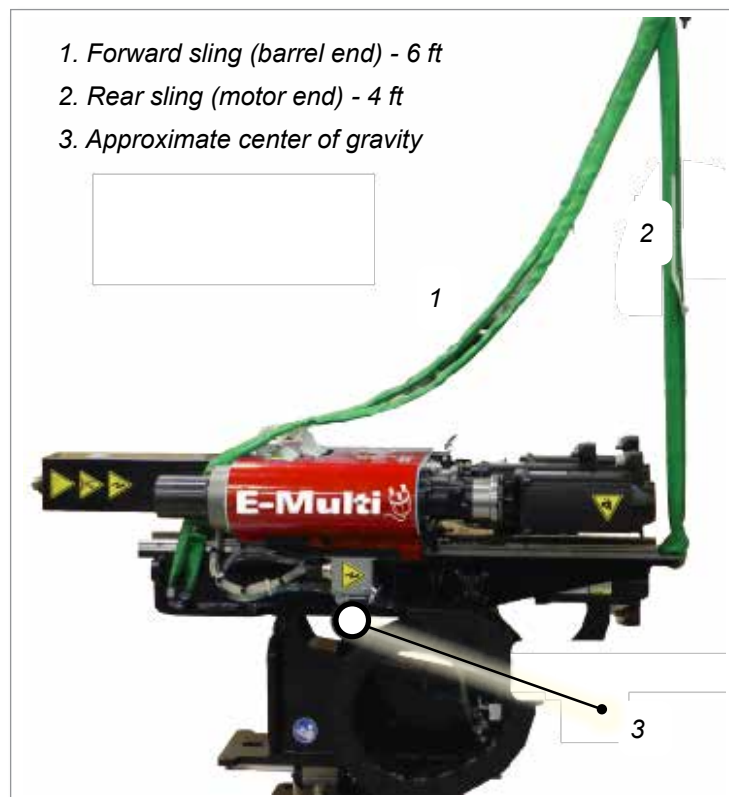


Figure 11-2 Sling positions of the E-Multi Radial vertical beam (in horizontal orientation) and the approximate location of the center of gravity.

## Unpacking - continued

7. Remove any rust inhibiting material that may be on the four machined surfaces of the horizontal and vertical beam interface. Apply a light coating of oil on these four surfaces.

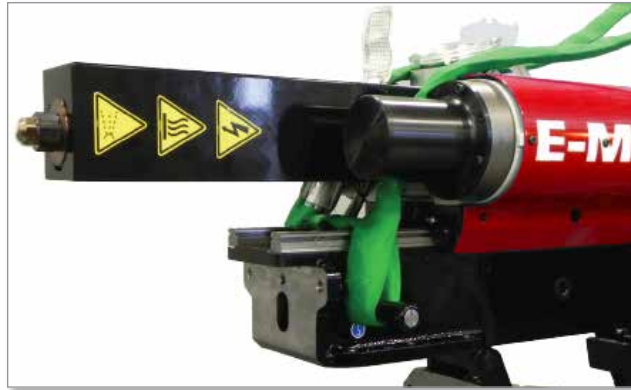


Figure 11-3 Forward sling attachment



Figure 11-4 Rear sling attachment

## 11.5 Inspection

1. Check that the E-Multi injection unit and the E-Multi Radial have not been damaged in transit.
2. Check all wires and cables. Ensure they are not kinked or damaged and are still connected properly.
3. Check for oil leaks on the machine. If visible, find the source of the leak and correct. Check oil level. See “Check the Oil Bath Level” on page 9-7.



Figure 11-5 Oil fill kit (optional)

## 11.6 E-Multi Radial Installation (EM1 and EM2 Models)



### WARNING

See “Safety” on page 3-1.

It is the responsibility of the integrator to understand and follow international and local standards for safety of machinery when integrating the E-Multi Radial system into the molding system. This includes providing necessary e-stop connections, safety interlocks and guarding modifications to protect operators.

Ensure E-Multi Radial placement will not interfere with electrical cables on top of the mold or injection molding machine movement. Check that all coolant, hydraulic and air lines as well as electrical cables will not interfere with the moving parts of the mold, machine or robot. The lines must be of sufficient length so that they will not strain or pinch when the mold halves separate.

When installing, check the E-Multi highest position does not interfere with other moving equipment in the molding area (robots, cranes, etc.).

The E-Multi Radial has a high center of gravity which can shift during installation. Read all instructions prior to starting the installation procedure.

The center of gravity will move forward as the vertical beam is rotated, and the lifting point must be moved forward to remain above the center of gravity. However if the lifting point is moved too much the crate and E-Multi Radial can slide or lift off the floor.



### WARNING - LOCKOUT

Ensure that all energies are properly locked out in the controller and injection molding machine before installation of the E-Multi injection unit into the system.



### WARNING - LIFT POINTS

When doing any work on the machine that requires moving and lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death. See “E-Multi Weight Specifications” on page 3-20.



### NOTE

Please reference the installation drawing supplied with the unit for complete information on services and connections.



## E-Multi Radial Installation (EM1 and EM2 models) - continued

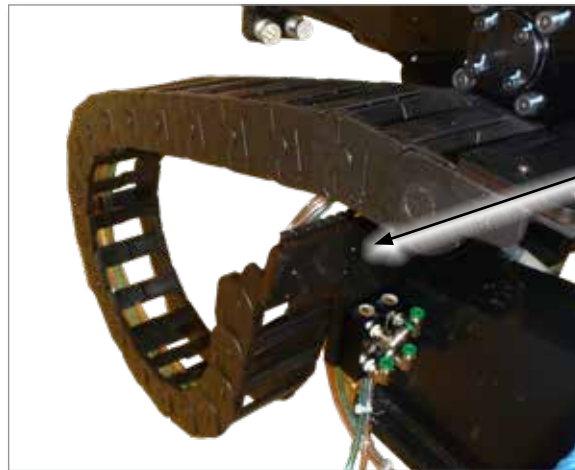
1. In preparation for mounting the E-Multi Radial to the injection molding machine, clean the stationary platen surface where the E-Multi Radial will be mounted.



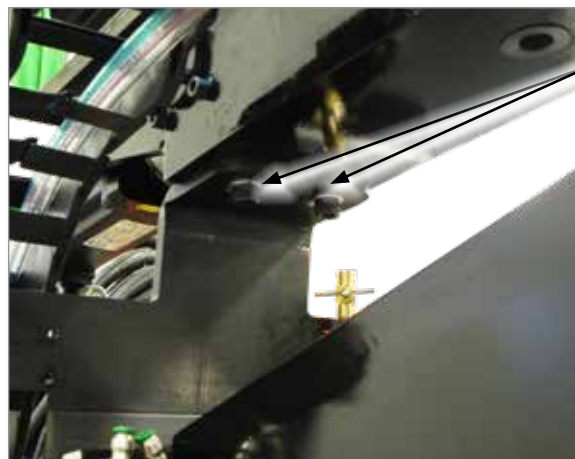
### NOTE

The E-Multi Radial is shipped with the injection unit in the horizontal position.

2. To move the unit to the vertical orientation, remove the screws mounting the cable tracks to the lower cable track bracket, and remove the two M10 shipping screws.



Remove screws from both sides



Remove two M10 shipping screws

3. Slowly start raising the lifting machine, causing the upper “vertical beam” to rotate around the pivot pin, without lifting the entire E-Multi Radial off of the crate floor. Continue this process until the vertical beam is vertical, and the 2 machined faces are in contact.

**E-Multi Radial Installation (EM1 and EM2 Models) - continued**

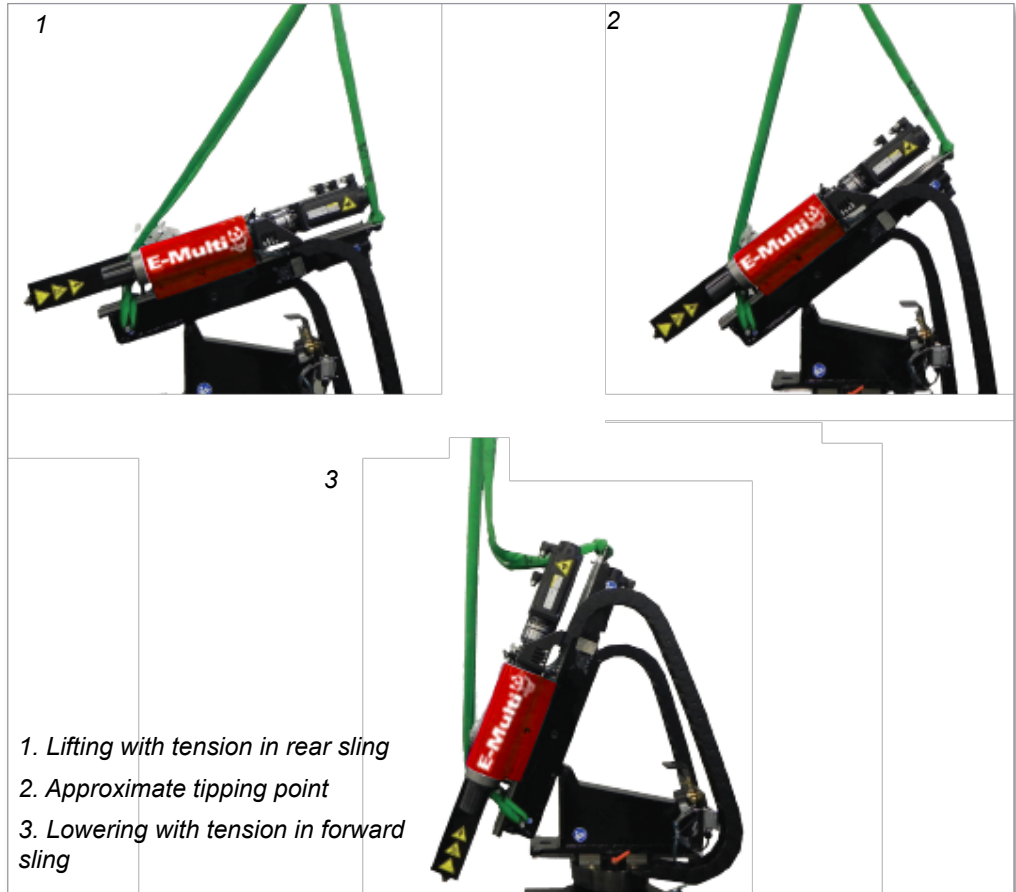
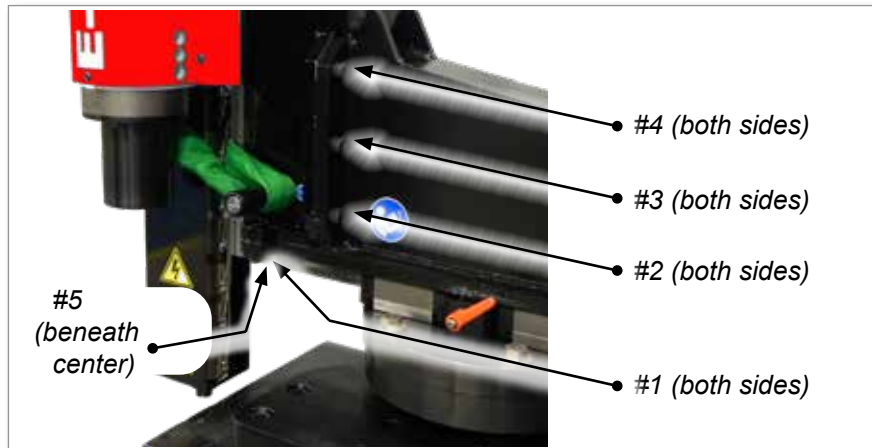


Figure 11-6 Tilting the E-Multi Radial from the horizontal to vertical position

4. Install two previously removed M10 shipping screws back into the vertical beam and tighten.
5. Carefully insert, and thread, all nine M12x35 socket head caps screws (SHCS) bolting the upper and lower beam together.
  - a) Loosely tighten the SHCS in the order shown. This order is important to draw the vertical beam squarely into position.



- b) Torque to half the recommended torque setting, following the same order as shown. See “Screw Torque Specifications” on page 9-1.

**E-Multi Radial Installation (EM1 and EM2 Models) - continued**

- c) Torque to the full recommended torque setting, following the same order as shown. See “9.2 Screw Torque Specifications” on page 9-1.
- 6. Install the lower end of both cable tracks and connect the water and air lines.



- 7. Release the orange X-Axis brake and slide the unit back until it is balanced and stable.



- 8. Remove the lifting slings. Attach the appropriate lifting devices to the hole at the top of the E-Multi Radial vertical beam.



### 11.6.1 Install onto an Injection Molding Machine

1. Lift the assembly into place above the injection molding machine's stationary platen. Install all adapter plate mounting screws and torque in a crosswise pattern. See "Screw Torque Specifications" on page 9-1.
2. Install the controller and complete all system connections.



#### NOTE

The E-Multi Radial controller and systems connection procedure is very similar the standard E-Multi controller connection procedure. See "Controller Installation" on page 6-3 and "System Setup" on page 7-1. Note that the E-Multi Radial has an additional set of cables for the carriage axis servo motor, and the cables are routed through two cable tracks.

3. Install the barrel heats connector. Route the cables through the cable track as shown in Figure 11-7.



Figure 11-7 Install the barrel heats connector

4. Attach the servo motor cables. Route the cables through the cable track as shown in Figure 11-8.



Figure 11-8 Attach the servo motor cables

## Install onto an Injection Molding Machine - continued

5. Install the I/O connector as shown in



Figure 11-9 Install the I/O connector

### 11.7 Manual Position Adjustment



#### WARNING

Keep a firm hold on the assembly and use a slow, controlled motion when manually positioning the E-Multi Radial.

Manually use the E-Multi Radial range of movement to roughly align the E-Multi nozzle with the hot runner inlet. The controller will be used to fine tune the alignment and calibrate the carriage position in preparation for molding.

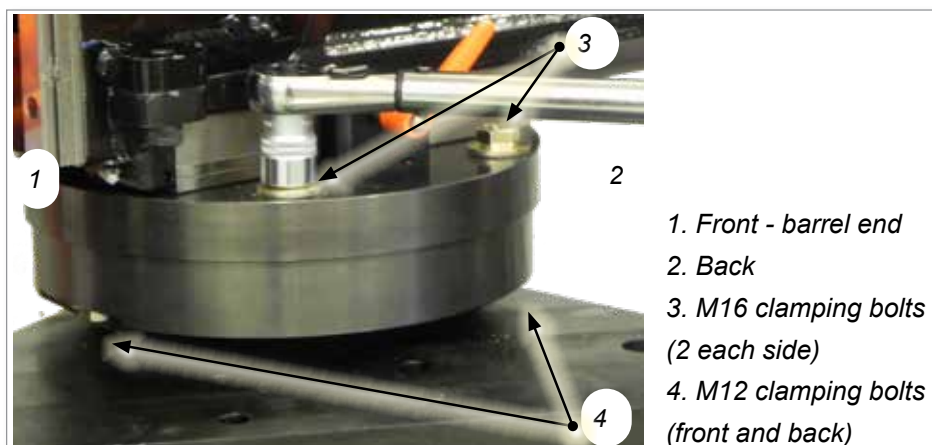


#### NOTE

The E-Multi Radial is designed to work with a spherical nozzle tip and a spherical hot runner inlet. A flat nozzle / inlet design is not recommended as leakage of molten plastic is likely. Contact an E-Multi representative for recommended design guidelines for the spherical nozzle tip / inlet geometry.

The clamping bolts are special hex flange bolts (yellow zinc in color) and differ from standard screws, as described in the “Table 9-2 Screw Torque Specifications” on page 9-1.” However, the clamping bolts are still to be torqued to the same torque values.

1. Loosen the two M12 clamping bolts (front and back).



**Manual Position Adjustment - continued**

- Loosen the four M16 clamping bolts until a small gap is visible between the locking and the rotating plate at approximately 0.1 to 0.3 mm (0.004 to 0.01 in.).

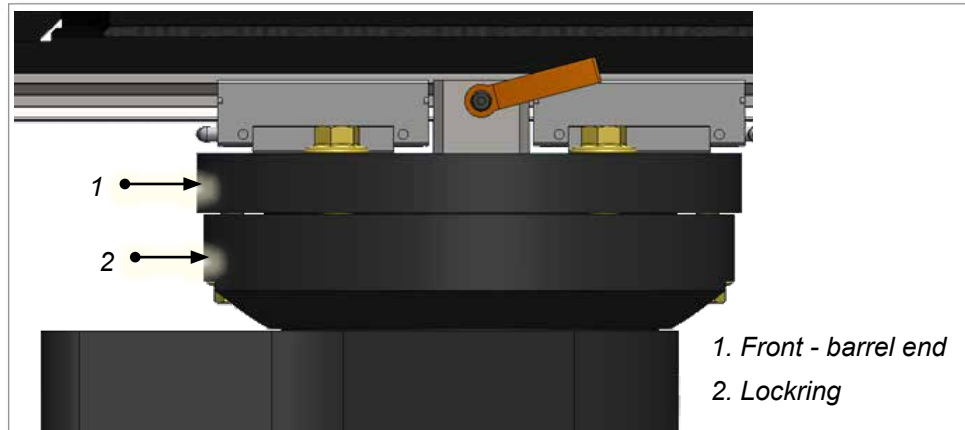


Figure 11-10 Gap between the rotating plate and lockring

- Release the rotary stopper - a white band will show on the plunger when released. Rotate the E-Multi Radial to the approximate angle required.



**NOTE**

The rotary stopper can be depressed to prevent further rotation. It can be depressed in rotational increments of 15°. It may not depress at the exact rotation position required for final nozzle concentricity.



- Loosen the X-Axis brake. Use the handles to position the E-Multi Radial to the correct X-Axis position. Tighten the X-Axis brake.
- Clean all plastic and debris from the nozzle tip and hot runner inlet contact surfaces. Use a wire brush or similar tool.
- With the controller in Setup mode, move the E-Multi downwards (forwards) until the nozzle is approximately 10 mm (0.4 in.) away from the hot runner inlet. If necessary, manually adjust the E-Multi Radial to improve the rough nozzle alignment.



**NOTE**

The rotary stopper may need to be released.

**Manual Position Adjustment - continued**

7. Lightly tighten the four M16 clamping bolts, until there is no visible gap between the lockring and the rotating plate as viewed from the side. See Figure 11-10 on page 11-11.

**NOTE**

Do not overtighten the bolts. The unit should be able to rotate slightly by hand.

8. Loosen the X-Axis brake.
9. With the controller in Setup mode, move the E-Multi downwards (forwards) until it contacts the hot runner inlet. Continue to hold the Forward button for 2 more seconds after contact. The E-Multi Radial will self-align with the spherical inlet as it makes contact and will stay in contact for the following step.
10. Follow these steps to start to lock the Radial into position:
  - a) Torque the two, rear-most M16 clamping bolts to 160 Nm (118 ft-lbs)
  - b) Torque the two, forward-most M16 clamping bolts to 160 Nm (118 ft-lbs)
  - c) Finger tighten the two M12 clamping bolts
  - d) Tighten the X-Axis brake
11. Move the unit upwards (backwards) approximately 50 mm (2 in.) away from the inlet, or further if the nozzle and inlet need to be cleaned again.
12. Perform a carriage calibration following the procedure “Calibrate the Carriage Home Position” on page 9-17.
13. Loosen the X-Axis brake.
14. With the controller in Manual mode, move the unit downwards (forwards) until the nozzle contacts the inlet. Continue to hold the Forward button until the carriage Servo Brake Status indicator comes on. See the E-Multi Controller User Manual for more information.

**NOTE**

The nozzle will stay in contact with the inlet.

15. Follow these steps to lock the Radial into position:
  - a) Torque the two, rear-most M16 clamping bolts to the recommended torque of 248 Nm (183 ft-lbs)
  - b) Torque the two, forward-most M16 clamping bolts to the recommended torque of 248 Nm (183 ft-lbs)
  - c) Using a box wrench, tighten the two M12 clamping bolts (tight, plus a quarter turn)
  - d) Tighten the X-Axis brake to approximately 30 Nm (22 ft-lbf)
16. Move the unit upwards (backwards) 50 mm (2 in.).
17. Perform a carriage calibration following the procedure “Calibrate Home Position” on page 12-2.

The nozzle is now aligned and ready to be run in Automatic mode.

## 11.8 Home Position Calibration



### NOTE

Calibrate the carriage home position when you install the E-Multi for the first time and when you use the E-Multi with a newly installed mold. Mold must be closed and clamped and barrel must be at operating temperature before calibrating the home position.

Set up the controller before you use the E-Multi Radial.

1. Make sure that the E-Multi is in Setup mode and the servo motors are turned on [F10].
2. Open the Carriage screen. See E-Multi Controller User Manual for more detailed instructions.
3. Push the calibrate button. See the “Carriage calibration settings” in E-Multi Controller User Manual.

The carriage touches the mold with a known force and sets the mold touch position to the 0.0 mm in the setup profile screen. The carriage then moves to 10 mm (0.4 in.) position. At this position the E-Multi is ready to be switched to Auto mode.



### NOTE

You may see a deflection of the E-Multi Radial system when the nozzle contact force is applied. This deflection is normal and expected.

## 11.9 Auto Purge



### WARNING

Use protective clothing, goggles and gloves.

Ensure that the protective guards are placed around the nozzle to prevent the molten plastic from splashing or drooling.

Material purged from the machine will be extremely hot.

The Auto Purge screen is used to adjust the settings and perform the Auto Purge. Push the [Start] and [Stop] buttons. Refer E-Multi Controller User Manual for the operation.

For details, see E-Multi Controller User Manual.



## 11.10 E-Multi Radial Maintenance

Follow the recommended maintenance in “Section 9 - Maintenance” on page 9-1. Additional E-Multi Radial maintenance instructions are listed here.

The E-Multi Radial has linear guides attaching the upper assembly to the lower assembly and also has additional linear guides supporting the E-Multi barrel housing and injections housings. Lubricate these linear guides according to the maintenance schedule found in Table 9-1 on page 9-1.

### 11.10.1 Lubricate the E-Multi Radial Carriage Ball Screw and Linear Guides



#### WARNING

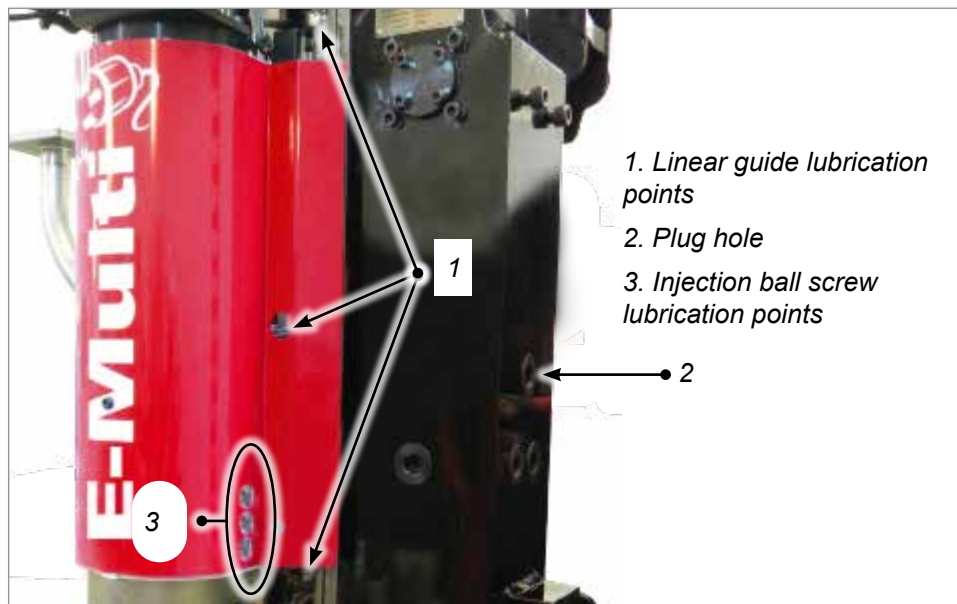
Do not put fingers into the lubrication access hole. There is a shearing hazard if the carriage moves and serious injury can occur.

The E-Multi Radial carriage assembly requires periodic maintenance of the ball screw nut. See Table 11-2 for lubrication specification.

Model	Mass (g)
ER1	3.6
ER2	
ER3	27
ER4	
EM1	50
EM2	
EM3	XX
EM4	

#### 11.10.1.1 EM1 and EM2 Models

1. Move the carriage to line up the grease nipple with the plug hole to allow access to the grease fitting. This position is approximately 75 mm (3 in.) from the uppermost carriage position.



**EM1 and EM2 Models - continued**

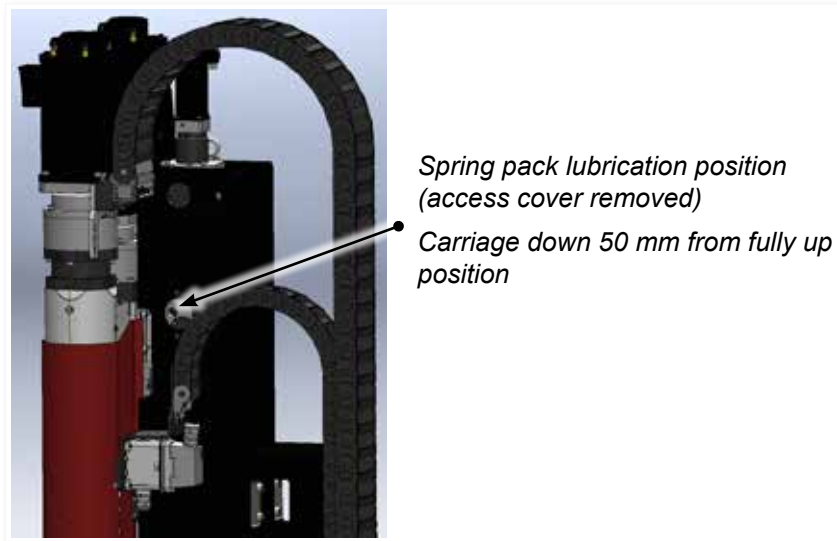
2. Remove the plug. Ensure the fitting is lined up with the hole.



3. Press the E-Stop on the controller. Lockout / tagout the E-Multi system by following the procedures in “3.6.1 Electrical Lockout” on page 3-10.
4. Ensure the grease fitting is clean.
5. Apply adequate grease for relubrication using a grease gun. See Table 11-2 for lubrication specification.
6. Reinstall the plug.

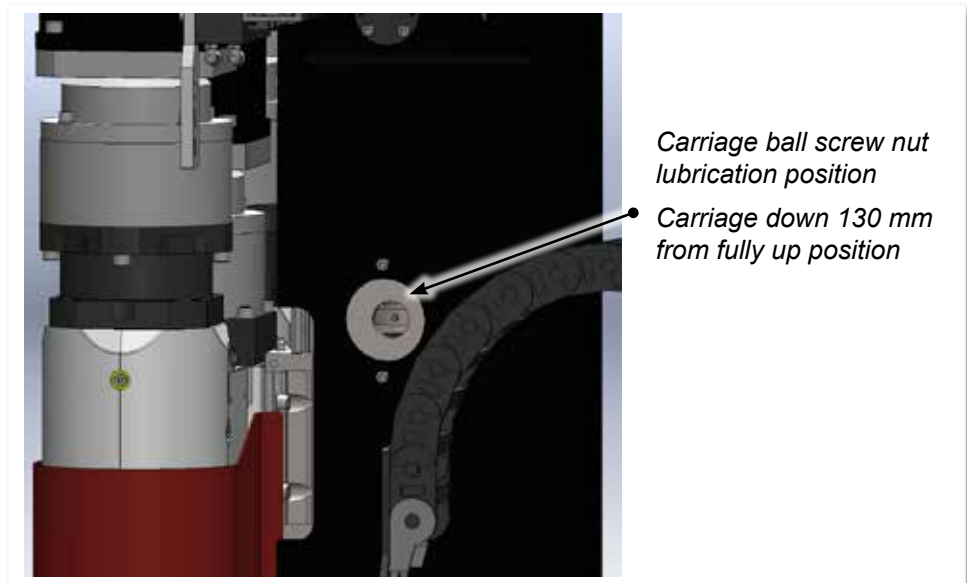
**11.10.1.2 EM3 and EM4 Models**

1. Move the carriage to the fully up position.
2. Remove the access cover.
3. Bring the carriage down approximately 50 mm (2 in.) to access the grease nipple for the spring pack assembly. Apply E-Stop on the controller.
4. Apply adequate grease for lubrication using a grease gun. See Table 11-2 for lubrication specification.

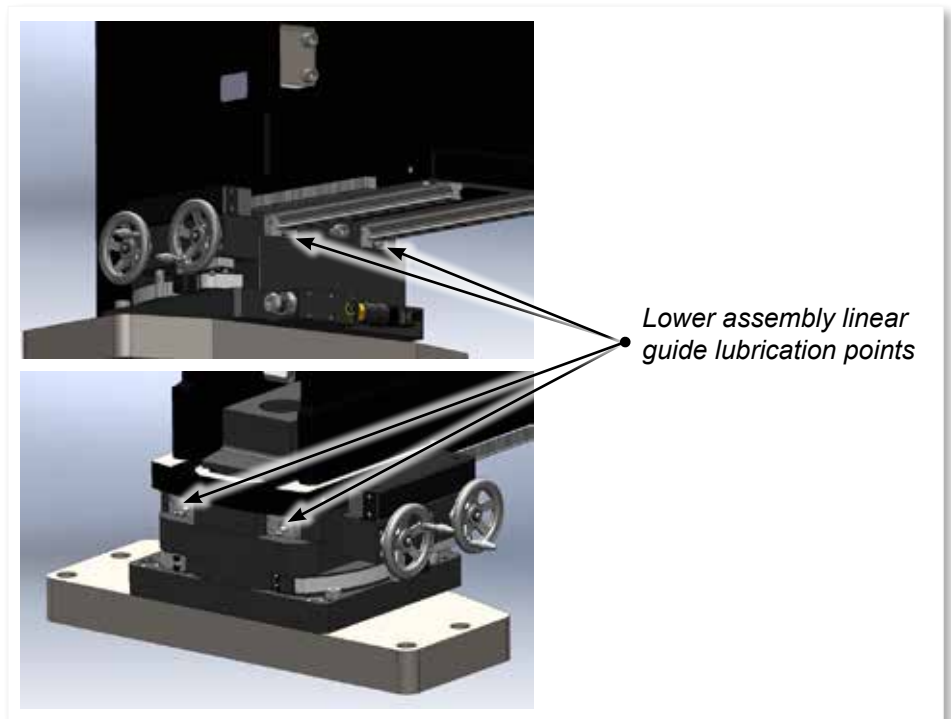


**EM3 and EM4 Models - continued**

- Bring the carriage down approximately 130 mm (5 in.) from fully up to access the grease nipple for the ball screw nut. Apply the E-Stop on the controller. See Table 11-2 for lubrication specification.

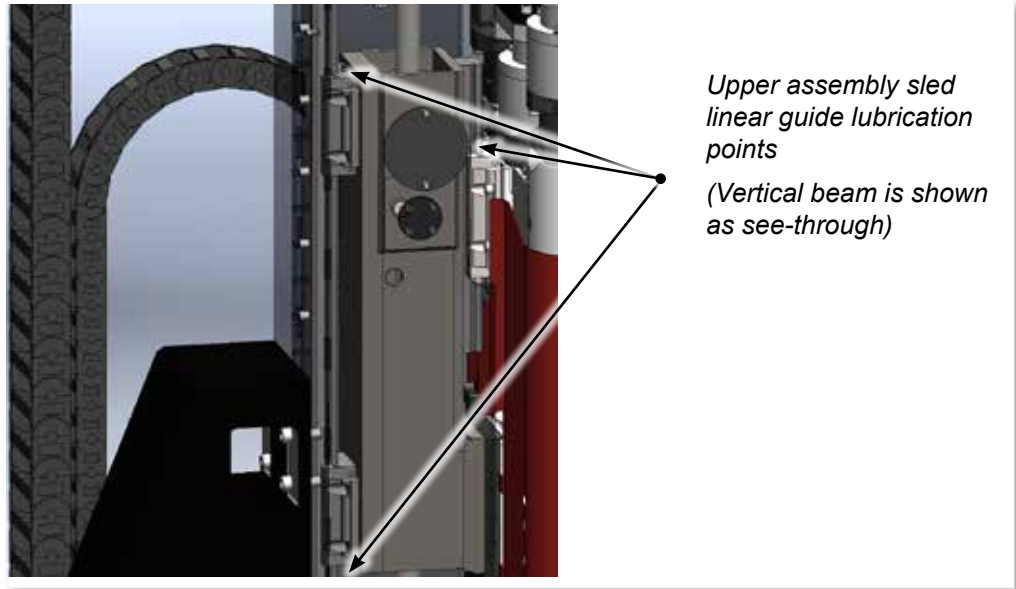


- Lubricate the four linear guides on the lower assembly.



### EM3 and EM4 Models - continued

7. Lubricate the three linear guides on the upper assembly sled.



## 11.11 Service of the E-Multi Radial Carriage Assembly and Servo Motor



### **WARNING**

The carriage assembly and specifically the servo motor should never be removed for maintenance. If the carriage assembly or the servo motor must be removed, please contact your *Mold-Masters* representative for instructions.

Removal of any of the carriage assembly, including the servo motor, any of the servo motor components, the gear box, or any of the mounting screws associated with this assembly, may cause the E-Multi unit to move down (forward) unexpectedly and may create a crushing or shearing hazard.

## 11.12 ER3 / ER4 Installation



### WARNING

Do not place any body parts between the two mating parts. Serious injury may result from having fingers or hands crushed between moving parts.



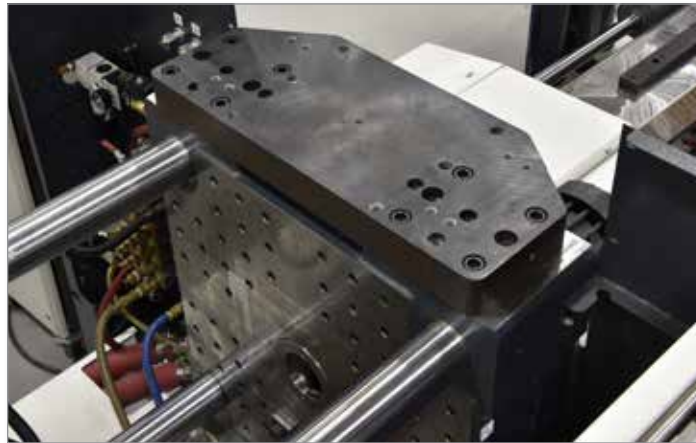
### CAUTION

Do not tighten the clamping screw so much that the unit locks as this will prevent proper alignment of the nozzle to the inlet.

1. Remove adapter plate from shipping crate.



2. Place the adapter plate on the stationary platen. Install the bolts (M20X90) in a cross pattern and torque it to 339 Nm (250 ft-lbs).

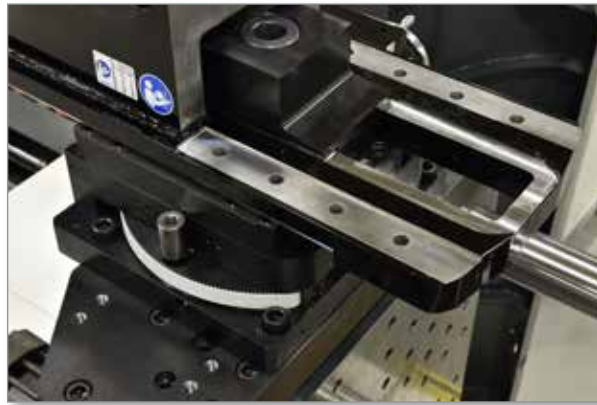


**ER3 / ER4 Installation - continued**

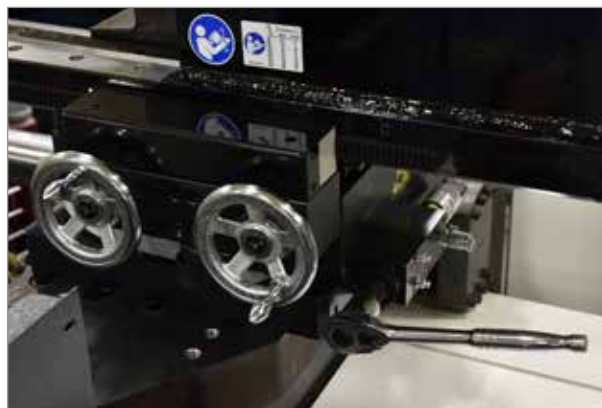
3. Remove the horizontal beam from the shipping crate. Rotate the horizontal beam so that the turret faces the ground.



4. Install the horizontal beam on the adapter plate. Insert and hand tighten the 4 bolts (M20X90) in the accessible holes.

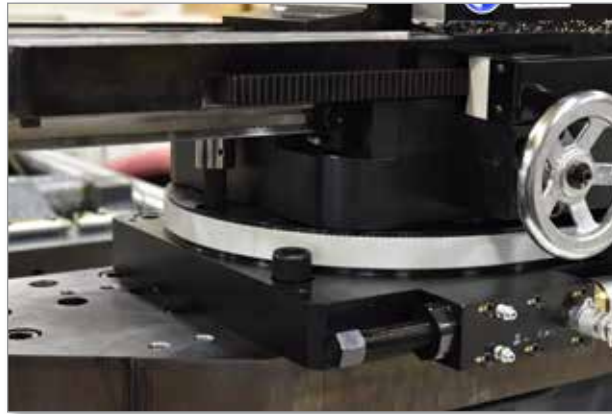


5. Unclamp the horizontal beam assembly with the clamping screw. Rotate the screw counterclockwise until the end of the head is flush with the support plate.

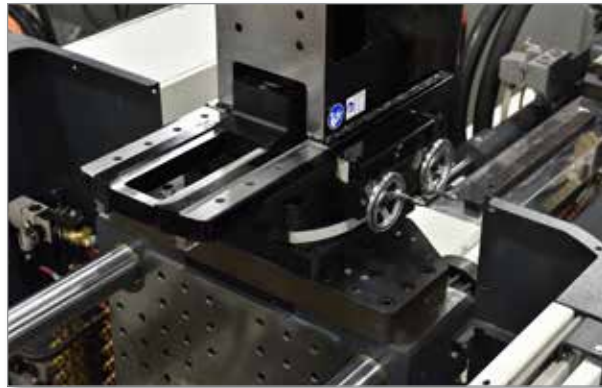


### ER3 / ER4 Installation - continued

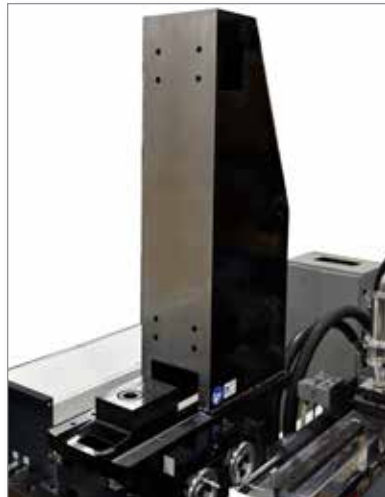
6. Use the rear hand crank and rotate the horizontal beam assembly 90° counter clockwise so that the other 2 bolt (M20X90) holes are accessible. Torque all accessible bolts in a cross pattern to 339 Nm (250 ft-lbs).



7. Use the rear hand crank and rotate the horizontal beam assembly so that it is in the home position (x-axis is parallel to tiebars). Torque the other two bolts to 339 Nm (250 ft-lbs).



8. Use front hand crank and move the x-axis so that the vertical beam mounting flange is above the turret.



9. Lock horizontal beam assembly by turning clamping screw clockwise until there is about 10 mm (0.4 in.) between the head of the clamping screw and the screw collar on the manifold.

**ER3 / ER4 Installation - continued**

10. Install two M12 swivel hoist rings into the screw gearbox adapter ring.
11. Remove the vertical beam from the crate. Remove the swivel hoist rings.



12. Attach lifting bar to vertical beam. Attach a 4 in. web sling (supplied) to each end of the lifting bar with a choker configuration.



13. Lift the vertical beam with two lifting devices. If a crane and forklift are used, the crane should lift the lifting bar end.



14. Change the beam orientation so that the beam is vertical with the lifting bar at the top.



**IMPORTANT**

Take care that the nozzle does not touch the ground.

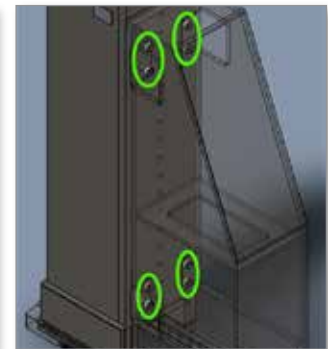


### ER3 / ER4 Installation - continued

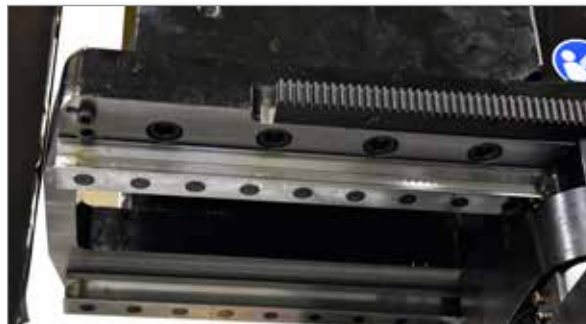
15. Coat the mating faces of horizontal and vertical beam with grease, oil or rust preventive material to prevent corrosion. Move vertical beam to horizontal beam and mate together.



16. Install the 8 screws (M16X50) and secure the vertical beam to the horizontal beam and hand tighten.



17. Install the 8 screws (M16X55) into the bottom of the horizontal beam and hand tighten.



18. Torque the lower four bolts (M16X50) into the vertical beam to 122 Nm (90 ft-lbs) in a cross pattern and repeat for the upper four bolts into the vertical beam.
19. Torque the 8 bolts from the horizontal beam to 240 Nm (180 ft-lbs) in a cross pattern.
20. Torque the four lower bolts into the vertical beam to 240 Nm (180 ft-lbs) in a cross pattern and repeat for the upper four bolts.

### ER3 / ER4 Installation - continued

21. Remove the lifting bar.
22. Use a crane and lift the cable track assembly into position with a sling.
23. Install the large cable track bracket to the lower section of the horizontal beam with 3 screws (M10 X 35 SHCS).
24. Install large cable track to the bracket on the injection housing with 2 flat head screws (M6X16). Torque the screws to 10 Nm (7.4 ft-lbs).



25. Cut the cable ties which secures the small cable track to large cable track.
26. Install the small cable track to the barrel housing bracket with 2 flat head screws (M6x16). Torque the screws to 10 Nm (7.4 ft-lbs).



27. Connect the barrel heat cable.
28. Connect the cooling lines to quick connects.

### ER3 / ER4 Installation - continued

29. Connect the motor cables to screw and injection motors. Motors and cables are clearly marked. Make sure that you connect the correct cables to the correct motors.



30. Secure the motor cables to the upper cable track bracket with cable ties. Make sure that the cables do not contact the injection housing when the injection housing moves.
31. Connect the pressure transducer cable to the pressure transducer on the injection housing.
32. Connect cooling lines to the manifold on the injection housing.
33. Connect carriage motor cables to carriage motor. Make sure that the cables do not interfere with the cable track and do not bind against the support beam. Verify once again when the system operates.
34. Remove the maintenance pin from the shipping position in support beam and install in storage position. Make sure that the pin does not interfere with cable track.



### ER3 / ER4 Installation - continued

35. Connect the lower base pressure transducer cable.



36. Connect the 24 pin I/O cable to connector on lower cable track bracket.



37. Install cooling line fittings into the manifold on the support beam cable track bracket. Test cooling system for leaks.

38. Turn on the controller and the barrel heats.

39. Rotate the clamping screw counterclockwise until the unit can be moved using the hand wheels. Check the color of the LED on the transducer connector. It should be red.

40. After the system reaches its temperature, use the hand wheels on the lower base to position the E-Multi nozzle as close as possible to the manifold inlet.

41. Press the **[F1]** button. It puts the controller in setup mode. The **[F1]** LED should flash.

42. Press and hold **[F4]** until the carriage moves down to 10 mm (0.4 in.).

43. Tap the gears icon to navigate to the service overview screen on the bottom button bar.

44. Tap the drive information button to navigate to the drive information screen.

45. Navigate to the carriage drive tab.

46. Press and hold **[F3]** until the carriage moves up to its end. Reference the carriage.

### ER3 / ER4 installation - continued

47. Tap the reference button. Wait until the status message says referenced.
48. Press and hold [F4] to move the carriage down until the nozzle is approximately 25 mm (1 in.) above the manifold inlet.
49. Use the hand wheels to align the barrel as close as possible to the manifold inlet.
50. Turn the clamping screw clockwise until slight resistance is felt in the hand wheels.
51. Press the [F4] button to move the nozzle towards the inlet. Use the hand wheels to keep the nozzle centered on the inlet.
52. Move the nozzle up and down, adjusting the position as necessary, until there is no visible deflection when it makes contact with the inlet.
53. Tighten the clamping screw until the lamp on the transducer connector turns green.
54. Move the carriage up and down again to verify there is still no deflection in the nozzle with the system clamped.
55. Calibrate the carriage from the screw settings page. Verify that the barrel does not deflect when the nozzle makes contact.
56. Navigate to the carriage setup page and set the nozzle movement mode.

**Maintain forward:** Nozzle moves to the mold and builds contact force on first cycle and stays in contact at the specified force until the cycle is stopped and the nozzle is moved back manually.

**After injection:** Nozzle moves to the mold and build contact force on the first cycle. After E-Multi injection completes, the nozzle moves back to the specified position and waits for the next cycle.

**After hold:** Same as after injection, except that the nozzle moves back after E-Multi hold completes.

### 11.13 Spare Parts for the E-Multi Radial

Contact your *Mold-Masters* representative if you need any spare parts for the E-Multi Radial system.

# Section 12 - Servo Carriage Option



## WARNING

Ensure that you have fully read “Section 3 - Safety” before installing, calibrating, maintaining or operating the E-Multi Servo Carriage Option.

## 12.1 Introduction

This section provides information that is special to the E-Multi Servo Carriage Option “EMSC” for E-Multi injection units.

The E-Multi Servo Carriage has a servo controlled carriage axis which allows the system to be operated in sprue-break mode or in continuous nozzle contact mode.

When injection occurs in sprue-break mode, the nozzle retracts automatically from the sprue bushing. The nozzle retracts and extends with each injection cycle as required for parting line injection applications.

## 12.2 E-Multi Servo Carriage Specifications

E-Multi Model	Typical Clamp Size	Carriage Stroke mm (in.)	Nozzle Protrusion Max mm (in.)	Nozzle Contact Force kN (lbf)	Sprue Break Stroke mm (in.)
EM1 - 15SC	100 - 450 ton, 90 - 400 tonne	181 (7.1)	6 (0.24)	10 (2248)	≤ 50 (2)
EM1 - 30SC		231 (9.1)	56 (2.2)		
EM2 - 50SC		281 (11.1)	163 (6.42)	17 (3822)	
EM2 - 80SC		331 (13)	208 (8.19)		
EM3 - SC	Not available at this time				
EM4 - SC	Not available at this time				

## 12.3 Material Handling

### 12.3.1 Preparation

Refer to “Section 5 - Preparation” on page 5-1 for the preparation procedure.

### 12.3.2 Unpacking

Refer to “5.2 Unpacking” on page 5-2 for the unpacking procedure.

### 12.3.3 Inspection

Refer to “5.3 Inspection” on page 5-2 for the inspection procedure.

### 12.3.4 Installation

Refer to “Section 6 - Installation” on page 6-1 for the installation procedure.

## 12.4 Calibrate Home Position



### NOTE

Calibrate the carriage home position when you install the E-Multi for the first time and when you use the E-Multi with a newly installed mold.

Set up the controller before you use the E-Multi Servo Carriage.

Set up the controller before you use the E-Multi Radial.

1. Make sure that the E-Multi is in Setup mode and the servo motors are turned on [F10].
2. Open the Carriage screen. See E-Multi Controller User Manual for more detailed instructions.
3. Push the calibrate button. See the “Carriage calibration settings” in E-Multi Controller User Manual.

The carriage touches the mold with a known force and sets the mold touch position to the 0.0 mm (0 in.) in the setup profile screen. The carriage then moves to 10.0 mm (0.4 in.) position. At this position the E-Multi is ready to be switched to Auto mode.





## 12.5 Auto Purge

### WARNING

Use protective clothing, goggles and gloves.

Ensure that the protective guards are placed around the nozzle to prevent the molten plastic from splashing or drooling.

Material purged from the machine will be extremely hot.

The Auto Purge screen is used to adjust the settings and perform the Auto Purge. Push the Start and Stop buttons for the operation. See the E-Multi Controller User Manual for more information.

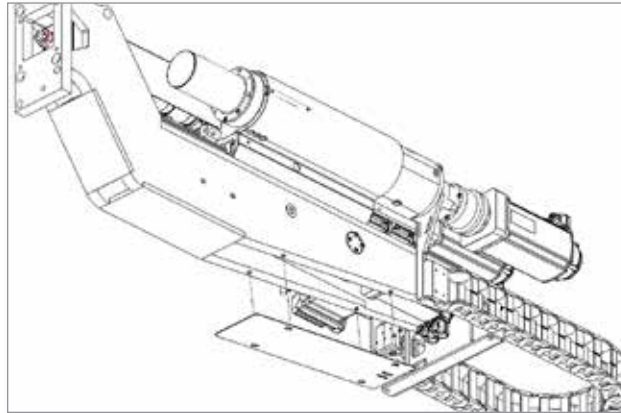
## 12.6 Maintenance

Follow the recommended maintenance in “Section 9 - Maintenance” on page 9-1. Additional E-Multi Servo Carriage maintenance instructions are listed in this section.

### 12.6.1 Check the Lubrication of the Ball Screw

The E-Multi Servo Carriage assembly requires periodic maintenance of the ball screw nut.

1. Move the carriage back to the rear hardstop.
2. Remove the support beam cover. Unscrew 4x button head screws with 5 mm (0.2 in.) hex key.



3. Press the E-Stop on the controller.
4. Follow the procedures in “3.6.1 Electrical Lockout” on page 3-10 and lockout / tagout the E-Multi system.
5. Ensure that the grease fitting is clean.
6. Use a grease gun and apply sufficient grease for relubrication. See “Table 11-2 Grease Lubrication Volume - Ball Screw Nut” on page 11-14 for lubrication specification.
7. Reinstall the support beam cover.

## 12.7 Spare Parts

Contact your *Mold-Masters* representative if you need any spare parts for the E-Multi Servo Carriage system.





# Section 13 - Servo Cooling Option



## WARNING

Ensure you have fully read “Section 3 - Safety” before doing maintenance procedures or troubleshooting any issues with the E-Multi Servo Cooling Option.

## 13.1 Operation and Specifications

The cooling unit’s pump powers up with the controller and continuously circulates fluid through the motors.

The E-Multi controller automatically switches the flow rate of coolant between high and low settings to maintain the motor temperatures in a safe range.

If there is insufficient cooling due to a failure of the system or external coolant flow, the controller will automatically shutdown the motor drives when the motor temperature reaches 85°C (185°F).

### 13.1.1 Closed Loop Specification

- Pump high flow rate: 3.6 LPM (1 gal/min)
- Pump low flow rate: 1.6 LPM (0.42 gal/min)
- Pump pressure bypass: opens at 4.1 bar (60 psi)
- Heat dissipation: 2.5 kW max

### 13.1.2 External Loop Specification

- Max temp: 30°C (86°F)
- Flow rate: 8-10 LPM (2.1 to 2.6 gal/min)
- Pressure drop: 0.6 bar at 10 LPM (8.7 PSI at 2.6 gal/min)
- Max pressure: 28 bar (406 PSI)

### 13.1.3 Materials in Contact with Coolant

Table 13-1 Materials in Contact with Coolant	
Unit	Materials
Servo Motors	Al Mg 5 F32, Al Mg Si 0.5 F22
Seals	EPDM, Viton, Cork
Fittings	Brass, Polypropylene, Steel, Zinc
Reservoir	Polycarbonate
Lines	Polyurethane, Rubber
Heat exchanger	Copper, Tin
Pump	Stainless Steel, Graphite

## 13.2 Maintenance



### WARNING

Disconnect the 4 pin pump connector from the cabinet when servicing or whenever the cooling circuit is opened to prevent accidental power-up of the pump with the controller.

Make sure that the controller cabinet is powered off and unplugged from the power source. Follow lockout / tagout procedures.

### 13.2.1 Drain the Coolant



### CAUTION

Make sure that the E-Multi injection unit is flushed and completely purged of water.

Disconnect the pump before you empty the reservoir. Failure to do so will damage the pump if it runs dry.

1. Blow the compressed air into the supply hose of the E-Multi and drain the coolant into the reservoir.
2. Unscrew the drain plug as shown in the figure below and drain the coolant from the reservoir.

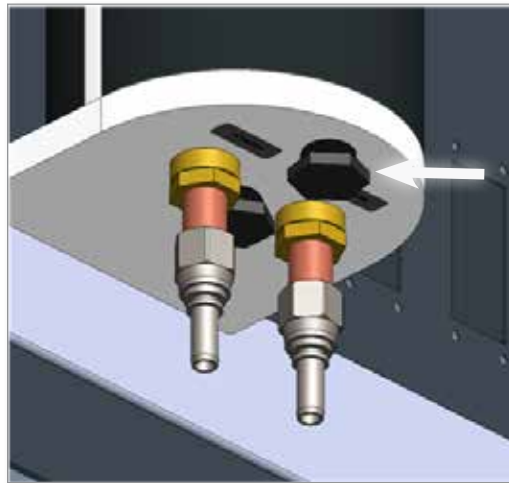


Figure 13-1 Bottom side of the cooling unit showing the drain plug

### 13.2.2 Clean / Replace the Heat Exchanger



#### WARNING

Drain the reservoir before the disassembly of the cooling unit. See 13.2.3.

#### Clean the Heat Exchanger:

Use a diluted solution of 5% acetic acid or any copper-safe aqueous acidic cleaning solution and flush the heat exchanger periodically depending on the mineral concentration in the cooling water. There is no need to remove the unit for cleaning.

#### Replace the Heat Exchanger:

1. Switch off the power of the controller and follow lockout / tagout procedures.
2. Unplug all coolant and electrical connections from the cooling unit.
3. With assistance, unscrew the four M10 mounting screws from inside the cabinet and place the cooler on a work bench.
4. Unscrew the plastic pipe plug which is between the inlet and outlet ports on the bottom of the unit.
5. Unscrew the M10 nut which is seen below the plug.
6. Remove the lower reservoir plug.
  - a) Tap the plug with a rubber mallet to overcome seal friction.
7. Unscrew the hose fittings from the ports of the heat exchangers.
8. Unscrew and remove the heat exchanger coil from the reservoir plug.



#### NOTE

Installation is the reverse of disassembly.

### 13.2.3 Troubleshooting

Table 13-2 Troubleshooting	
Symptom	Resolution
Water leak emerging from between pump enclosure and upper plug.	Remove the pump enclosure by undoing the four acorn nuts on top. Inspect threaded fitting connections. Inspect pump inlet tubing for damage. Repair or replace as required.
Water leaking at connections on closed or open circuit sides.	Tighten threaded connections or replace. Inspect tubing and hoses for damage. Repair or replace as required.
Low flow through heat exchanger (open loop side connections).	Follow instructions in section "13.2.2 Clean / Replace the Heat Exchanger"
Pump does not turn on when cabinet is powered up.	Check that the cabinet exhaust fans are running, if they are not, reset the 5A breaker that they share with the pump. The breaker is located in the high voltage side of the controller. Turn controller off before opening door.



# Section 14 - E-Multi Stands



**WARNING**

Ensure you have fully read “Section 3 - Safety” before using or maintaining the E-Multi stand.



**WARNING - TIP OVER HAZARD**

The stands are intended for supporting E-Multi injection units at the machine when used in the horizontal position. They are not for transporting the E-Multi injection unit and would be top heavy and present a tip hazard. The E-Multi injection unit and stand assembly should be moved together by crane using the proper E-Multi injection unit lift points. See “E-Multi Weight Specifications” on page 3-20 for lift points.

Do not modify stands to reduce or add height, for example, adding additional holes or not bolting the upper and lower columns together. Such changes would impact the stand stability and could result in serious injury as well as damage to the machine.

## 14.1 Introduction

E-Multi stands are designed to support the E-Multi injection machines when used in a horizontal feed orientation.

## 14.2 Stand Options

E-Multi stands come in two main designs: compact and heavy duty. See the “Table 14-1 E-Multi Stand Options” on page 14-1 to determine which stand design can be used for each E-Multi model.

Each design is manufactured in a number of top column, base column and frame base options to provide a range of minimum and maximum heights. Your order documentation will indicate your stand type. If you require spare parts, or to find out more about other stand options, please contact your *Mold-Masters* representative.

Table 14-1 E-Multi Stand Options				
E-Multi Model	EM1	EM2	EM3	EM4
Compact Stand	Yes	Yes	Yes	No
Heavy Duty Stand	No	No	Yes	Yes



Figure 14-1 Compact stand



Figure 14-2 Heavy duty stand

## 14.3 Compact Stand

### 14.3.1 Main Components

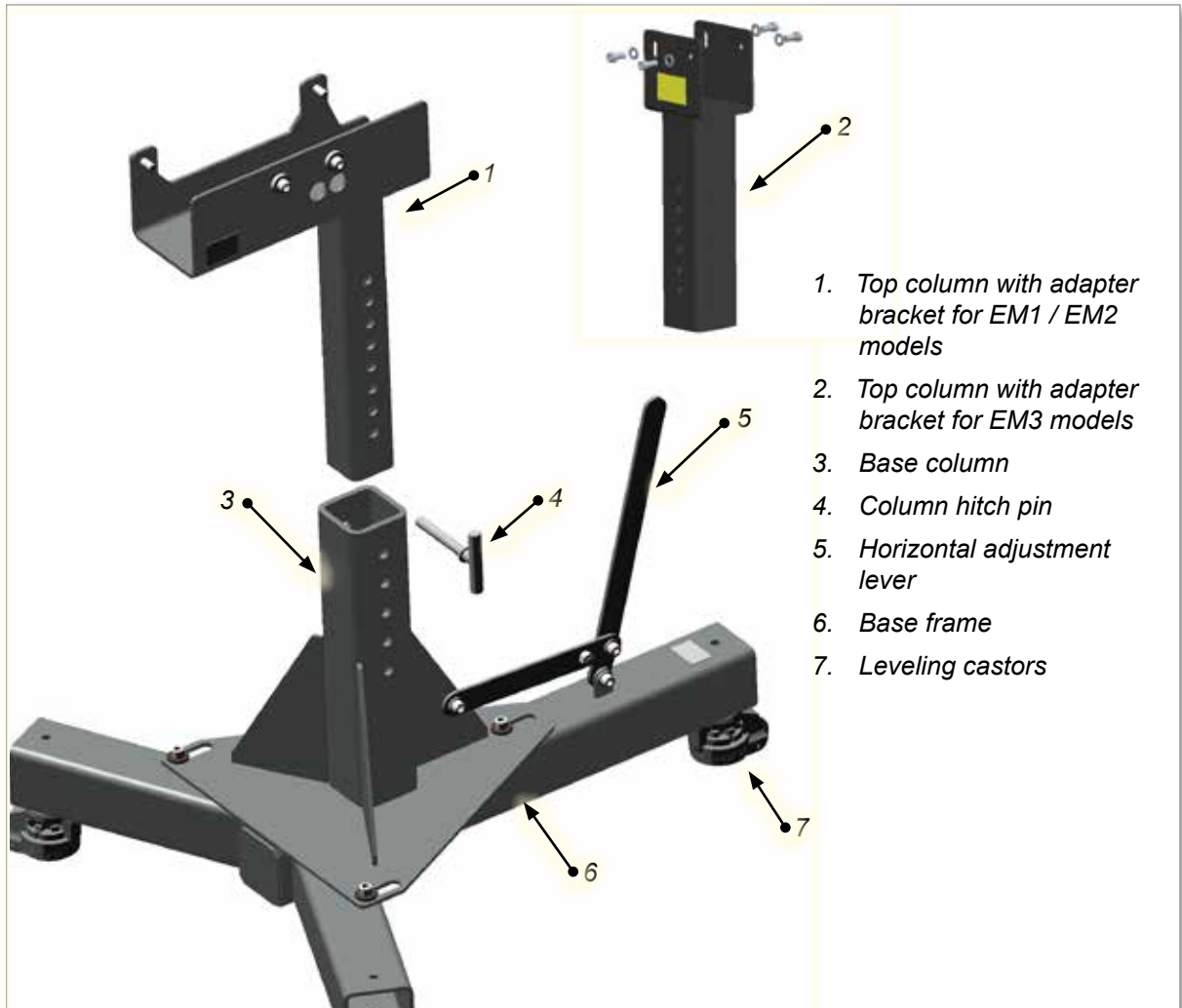


Figure 14-3 Compact stand main components

### 14.3.2 Horizontal Position Adjustment

The compact stand lever is used to move the E-Multi adapter plate position toward or away from the mold to aid installation and removal from the mold. The compact stand range of horizontal position adjustment is 50-75 mm (2 to 3 in.).

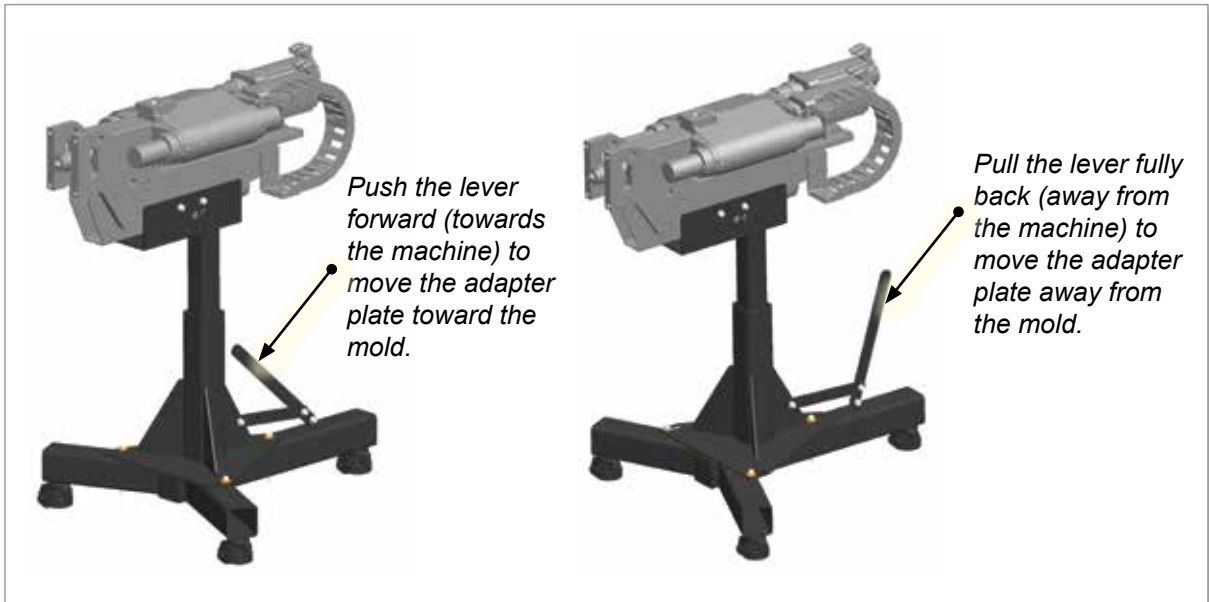


Figure 14-4 Compact stand horizontal position adjustment

### 14.3.3 Assembly

The compact stand is shipped with the base column assembled to the base frame.

1. Install the top column into the base column and secure with the column hitch pin.

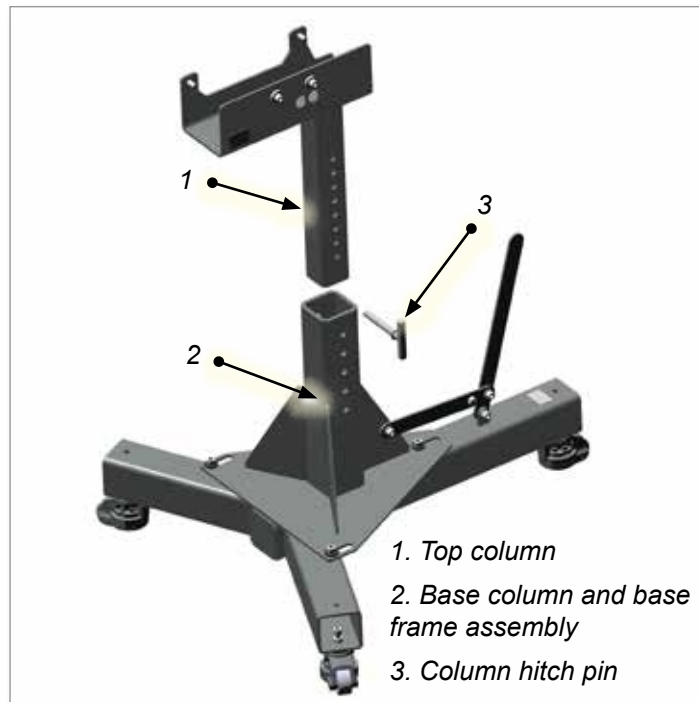


Figure 14-5 Compact stand assembly



## 14.4 Heavy Duty Stand

### 14.4.1 Main Components

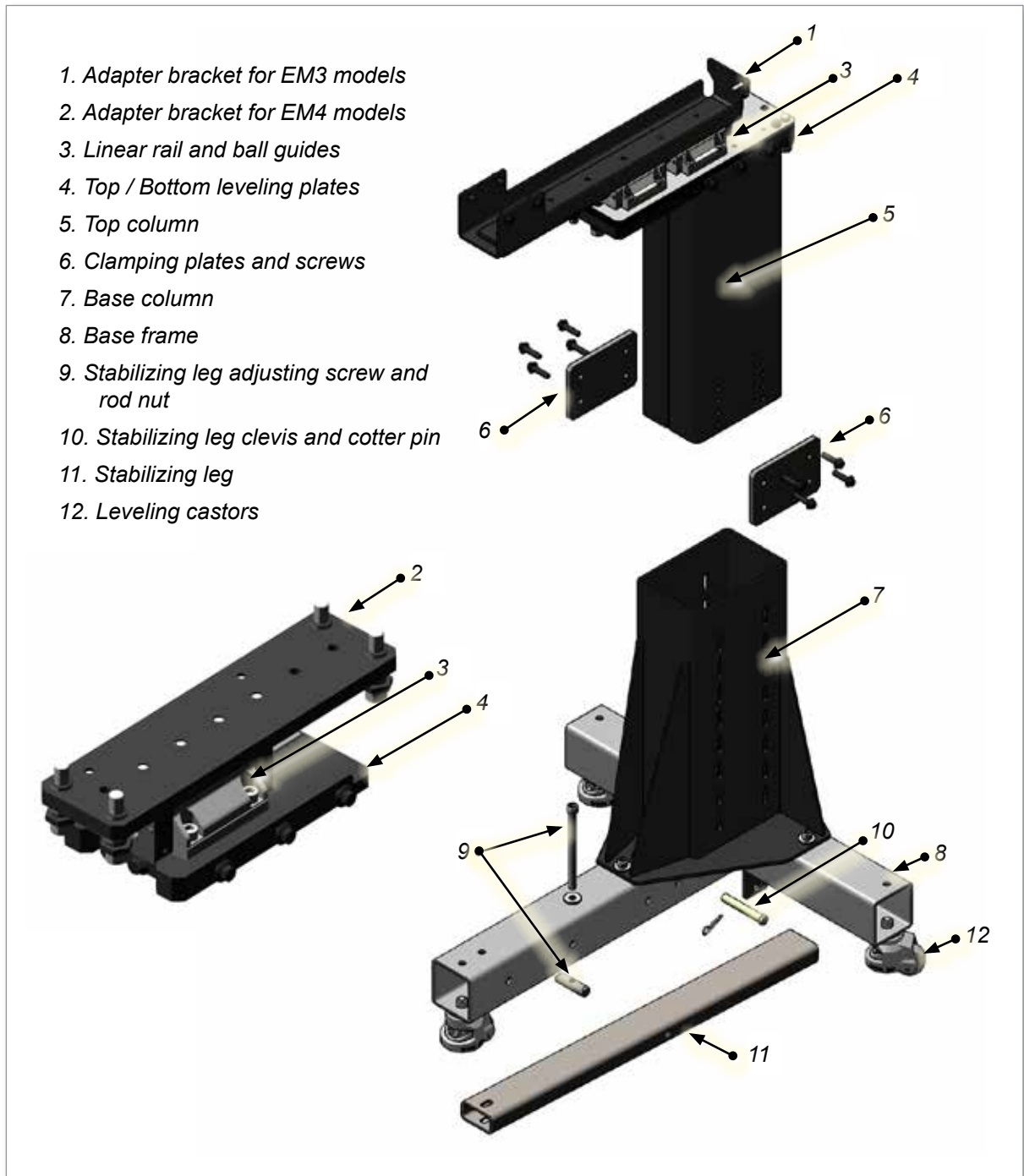


Figure 14-6 Heavy duty stand main components

### 14.4.2 Horizontal Position Adjustment

The heavy duty stand linear rail / ball guide assembly is used to move the E-Multi adapter plate position toward or away from the mold, to aid installation and removal from the mold.

- EM3 stand range of horizontal position adjustment is 0-125 mm (0-4.92 in.)
- EM4 stand range of horizontal position adjustment is 0-30 mm (0-1.18 in.)

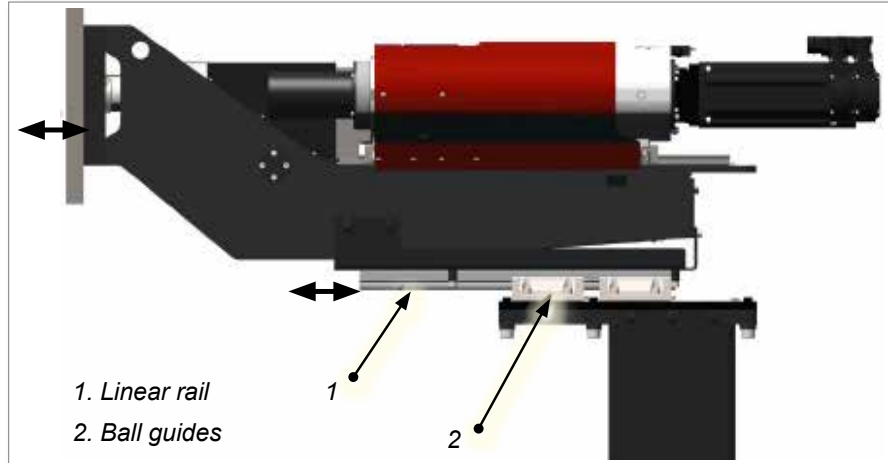


Figure 14-7 Heavy duty stand horizontal position adjustment

### 14.4.3 Front or Back Leg Position



#### WARNING

In either orientation, the stabilizing leg must be in contact with the floor to prevent the assembly tipping.

The stand can be placed with the lead leg of the base frame under the front or the rear of the E-Multi injection unit. The most stable configuration is with the lead leg under the front of the E-Multi injection unit, but it can be reversed if the injection molding machine set up does not have enough space for the lead leg to be forward.

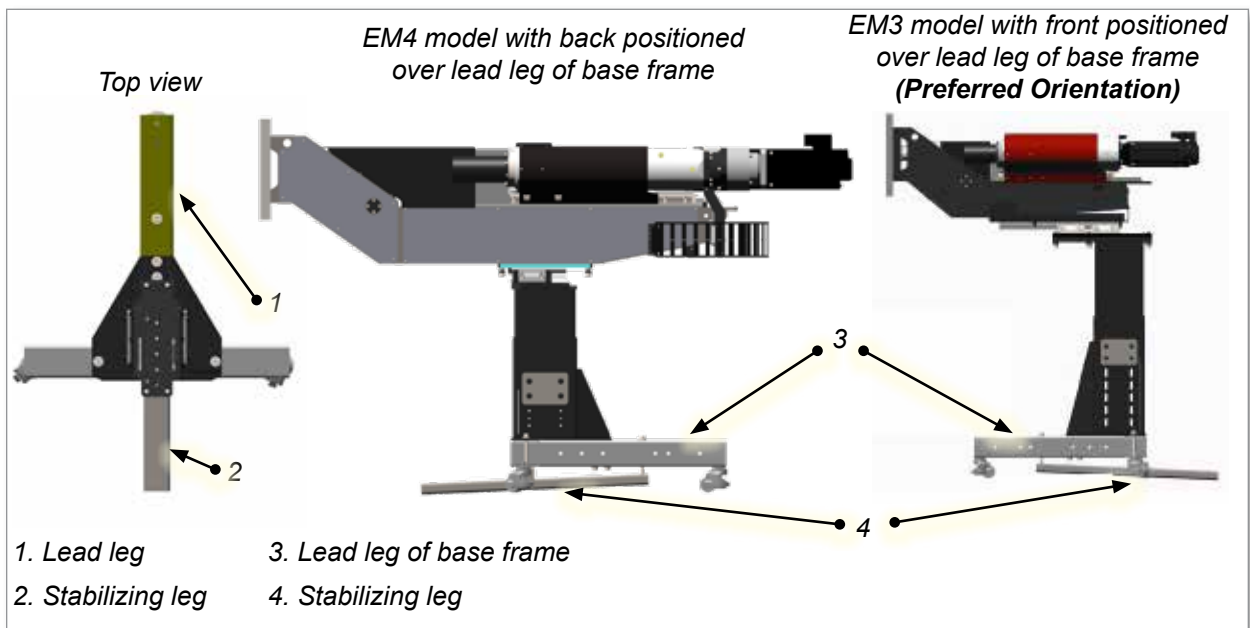


Figure 14-8 Heavy duty stand - front or back leg position

#### 14.4.4 Counter Weight Kit (Optional)

**WARNING - TIP OVER HAZARD**

Do not remove the counter weights while the injection unit is supported by the stand. This will create a tip hazard.

Counter weight kits for heavy duty stands can be purchased to add further stability to the E-Multi injection unit / stand assembly or in cases where the stabilizing leg will not fit under the injection molding machine. The counter weight brackets are installed onto the lead leg of the base frame and the weights assembled onto the bracket posts.

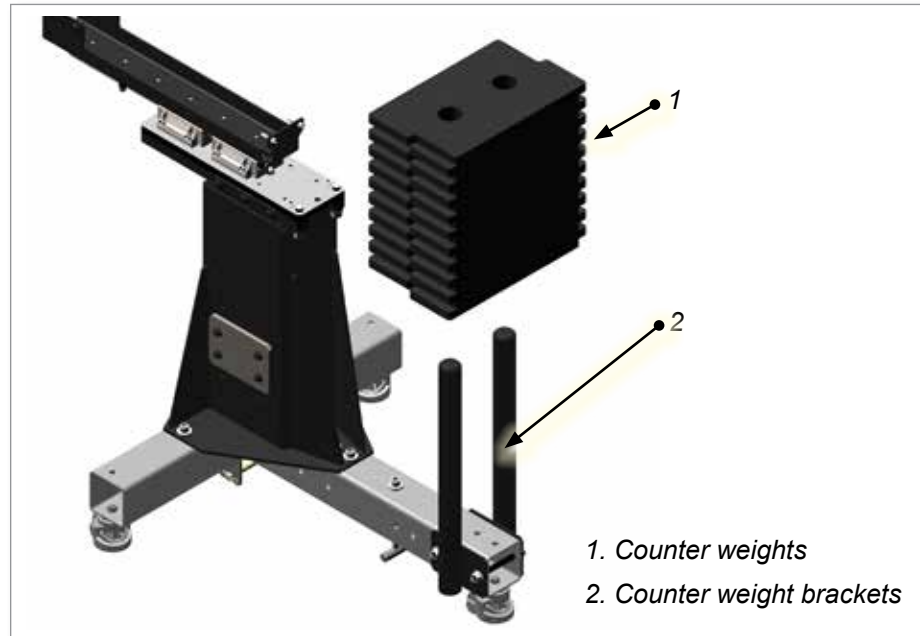
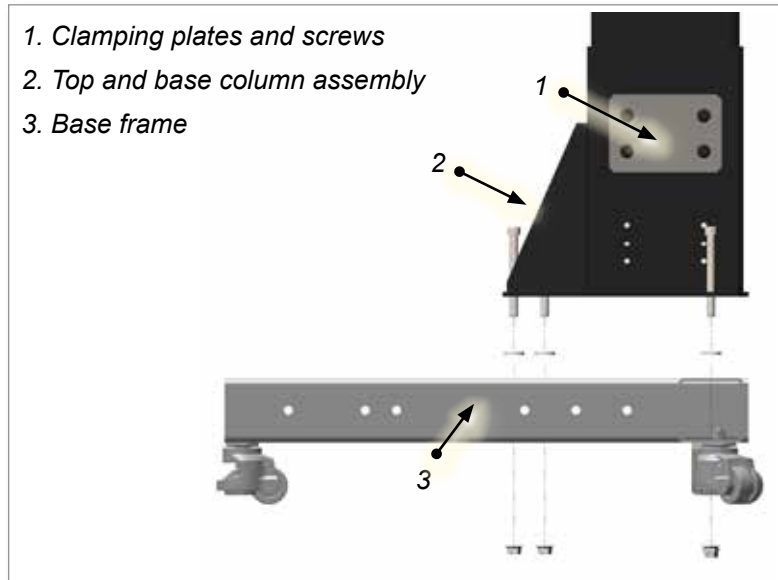


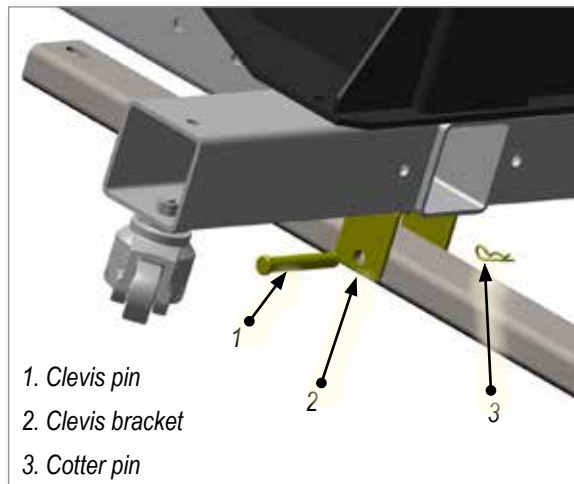
Figure 14-9 Heavy duty stand counter weight kit

### 14.4.5 Assembly

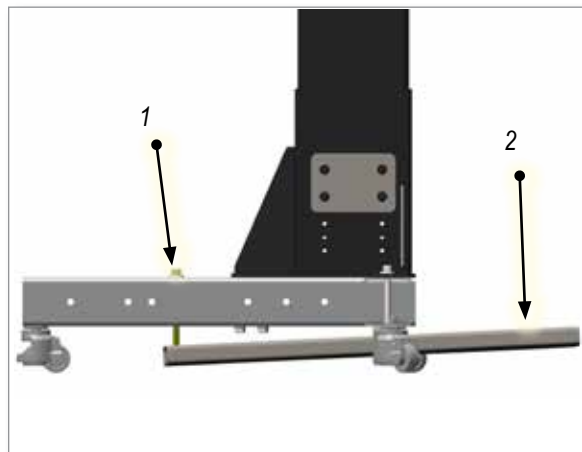
1. Assemble stand in the lowest position (the clamp plates can be loose).



2. Place the stabilizing leg under the base frame and install onto the clevis bracket with the clevis pin. Secure the clevis pin with the cotter pin.



3. Install the stabilizing leg adjusting screw into the screw nut in the end of the stabilizing leg. Adjust the stabilizing leg is not touching the floor when moving the stand into position.



1. Stabilizing leg adjusting screw  
2. Stabilizing leg position up and not touching the floor

## 14.5 Leveling Castors



### WARNING

The E-Multi injection unit must be operated with the leveling castor pads bearing the weight of the unit. Failure to use the leveling pads may cause the castor wheels to fail and lead to unexpected and dangerous unbalancing of the E-Multi injection unit.

Once the E-Multi injection unit is in position at the machine, the leveling castor pads are extended equally until the stand is resting on the pads and the wheels are not touching the ground. With the wheels off the ground, the leveling pads can be used to provide additional height adjustment to align the adapter plate with the mold. The leveling castors also provide a height fine adjustment of 12-15 mm (0.47-0.59 in.) depending on the stand.

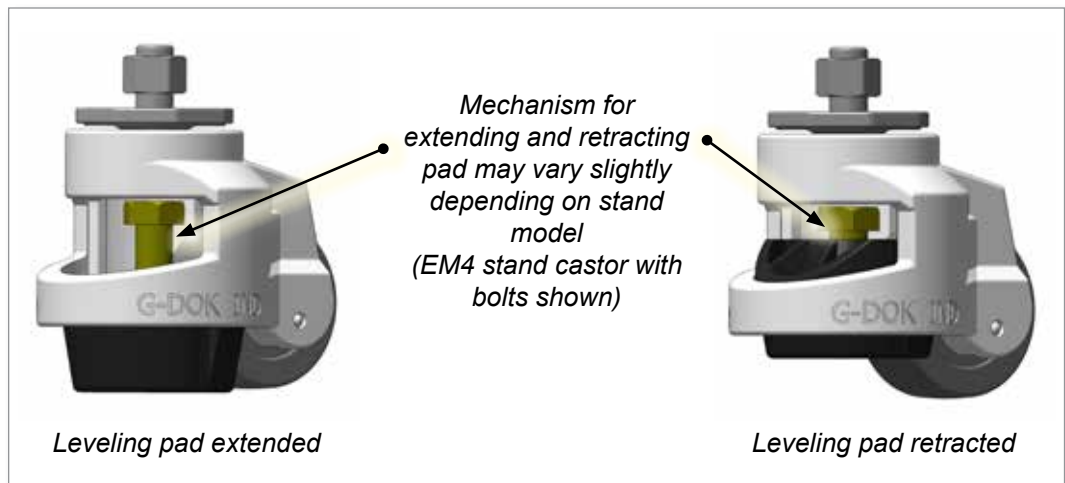


Figure 14-10 E-Multi stand leveling castors

## 14.6 Mold Installation



### CAUTION

Do not move the stand with the unit installed without crane support.

1. Roll the assembled (empty) stand close to the injection molding machine, i.e. within 3 m (9.84 ft).
2. Install adapter plate onto E-Multi machine. See “Adapter Plate Removal and Installation” on page 9-10.
3. Attach lifting devices and crane to the E-Multi injection unit as outlined in “E-Multi Weight Specifications” on page 3-20. Using the crane, install the E-Multi injection unit into the stand adapter bracket. Secure using correct screws. Torque according to “Screw Torque Specifications” on page 9-1.
4. With the crane still supporting the E-Multi injection unit and stand assembly, move the assembly into position near the mold.
5. Remove the column hitch pin (compact stand) or clamping plates (heavy duty stand). Using the crane, slowly lift the E-Multi injection unit until the center line height is approximately 3-6 mm (0.12 to 0.24 in.) below the center height of the mold inlet for the E-Multi injection unit. This will allow the fine height adjustment to be completed using the leveling castors.

**Mold Installation - continued**

6. Install the column hitch pin (compact stand) or clamping plates (heavy duty stand). Torque the clamping plate screws as specified in Table 9-2 on page 9-1.
7. Slowly lower the crane until the E-Multi injection unit is supported by the stand, but do not remove the attachment to the crane.
8. Adjust the 3 leveling castors to raise the stand until the E-Multi injection unit center line is aligned to the mold center line.
9. Use the stand horizontal adjustment to slowly move the E-Multi adapter plate forward to contact the mold.
10. Fasten the adapter plate to the mold. Torque adapter plate screws to specified torque. See “Screw Torque Specifications” on page 9-1. The tightening of these screws will move the E-Multi injection unit and stand slightly so that the nozzle and mold inlet are properly aligned.
11. Move the stand as far towards the injection molding machine possible. This will ensure the largest possible clearance when moving the injection unit away from the mold using the horizontal adjustment.
12. Verify that the 3 leveling castor pads are in full contact with the floor. Raise one leveling castor pad until it is not in contact with the floor. Then slowly lower the same castor pad until it makes contact with the floor (i.e. finger tight). Using a wrench, tighten a further 1/4 turn, but do not over-tighten. Repeat for the other leveling castors.

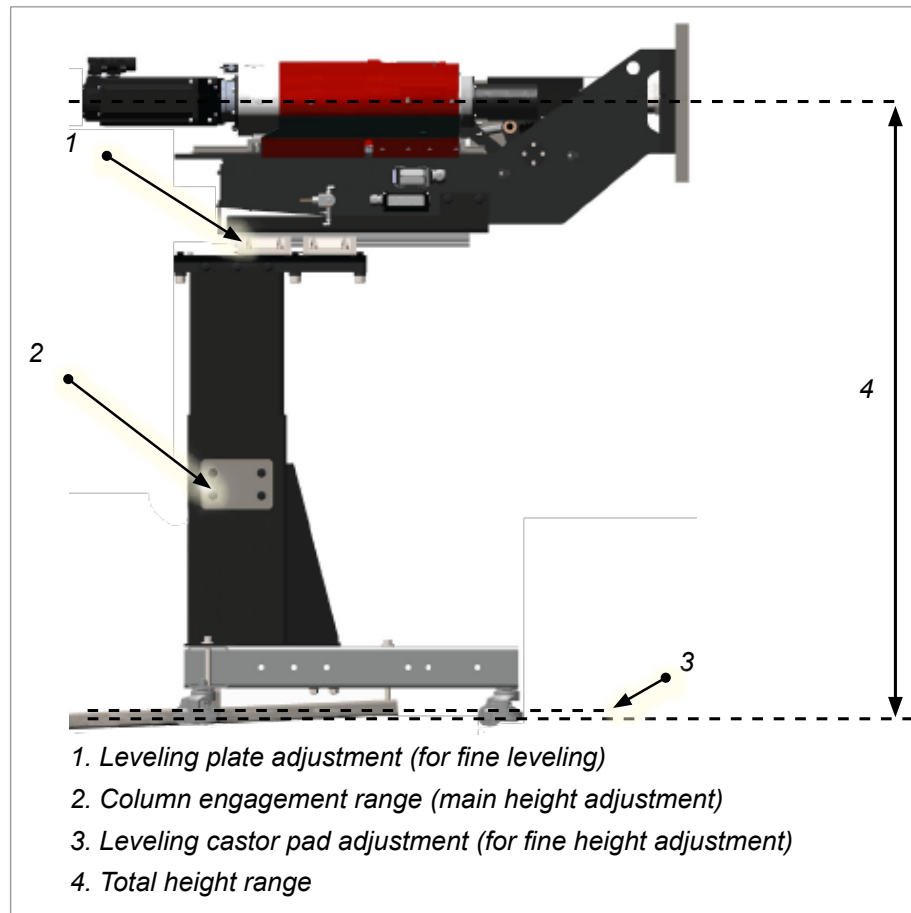
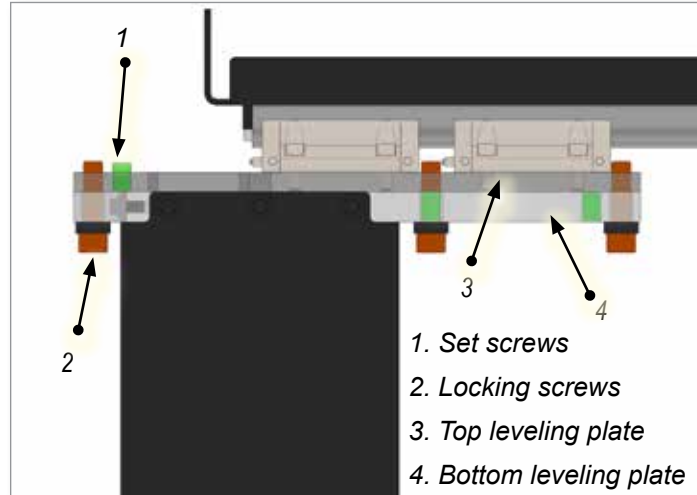


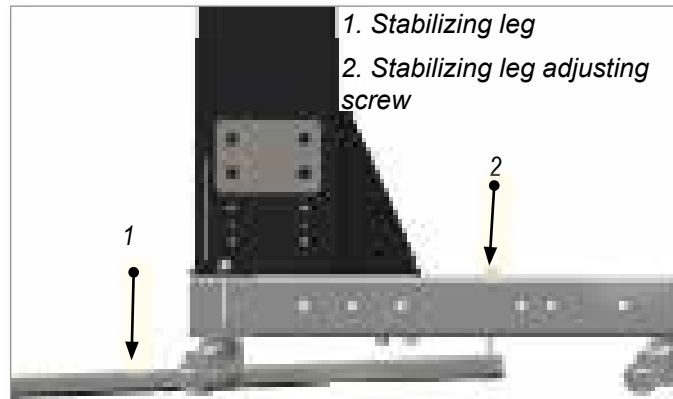
Figure 14-11 E-Multi injection unit stand-to-mold installation

**Mold Installation - continued**

**13. Heavy Duty Stand** - If necessary, the top leveling plate may be adjusted in order to obtain fine leveling alignment. The SHCS should be loosened only enough to allow the plate to be raised and leveled by the set screws. After final leveling, the locking screws must be torqued to the levels found in Table 9-2 on page 9-1.



**14. Heavy Duty Stand** - Slowly lower the stabilizing leg until it makes light contact with the floor, then tighten the adjusting screw by a 1/2 turn more. Do not overtighten this screw or it will raise the leveling castors off the floor. Verify that each castor is in full contact with the floor.



**15.** Verify that the load is stable, and fully supported by the stand and the mold. Once this is verified, the attachment to the crane may be removed.

## 14.7 Mold Removal

1. Remove the bolts fastening the adapter plate to the mold.
2. Move stand horizontal adjustment fully back:
  - **Compact stand** - pull lever away from the injection molding machine
  - **Heavy duty stand** - move the linear rail fully back on the ball guides and lock
3. Remove mold.

## 14.8 Disassembly



### CAUTION

Do not move the stand with the unit installed without crane support.

1. Remove the screws fastening the adapter plate to the mold.
2. Move the stand horizontal adjustment fully back:
  - **Compact stand** - push lever away from the injection molding machine
  - **Heavy duty stand** - move the linear rail fully back on the ball guides and lock
3. Attach the lifting devices and crane to the E-Multi injection unit and stand assembly and with the crane move the assembly away from the machine.
4. Remove screws fastening the stand to the E-Multi injection unit.

*Figure 14-12 With the crane, lift the E-Multi injection unit up and away from the stand.*
5. For the heavy duty stand - adjust the stabilizing leg adjusting screw so the stabilizing leg is not touching the floor.
6. Retract the level castor pads so the stand, on its own, can be rolled to desired location on the castors.





# Section 15 - Euromap 67

## 15.1 Scope and Application

This EUROMAP 67 recommendation defines the connection between the injection molding machine and the handling device / robot. This is intended to provide interchangeability. In addition recommendations are given for signal voltage and current levels.

Please note that the risk assessment for the movements of the handling device / robot mostly require redundancy which is achieved by two channels on ZA3, ZC3 and ZA4, ZC4 on the injection molding machine. EUROMAP 12 shall therefore only be applied for replacement purposes on existing equipment.

## 15.2 Description

The signals in both the injection molding machine and the handling device / robot are given by contacts, e.g. contacts of relays or switches, semiconductors, etc. The contact making is either potential-free or related to a reference potential supplied to a contact of the plug mounted on the injection molding machine or the handling device / robot. All signals which are not optional shall be supported by all injection molding machines and handling devices / robots.

## 15.3 Plug and Socket Outlet

The connection between the injection molding machine and the handling device / robot is achieved by the plugs specified below. For the injection molding machine and the handling device / robot the plug contacts should be capable of taking a minimum of 250 V and 10 A.

Table 15-1 Plug on the Injection Molding Machine		
Signals from the Injection Molding Machine to the Handling Device / Robot		
Contact No. (Male)	Signal Designation	Description
<b>ZA1</b> <b>ZC1</b>	Emergency stop of machine channel 1	The switch contact must be open when the injection molding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
<b>ZA2</b> <b>ZC2</b>	Emergency stop of machine channel 2	The switch contact must be open when the injection molding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
<b>ZA3</b> <b>ZC3</b>	Safety devices of machine channel 1	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection molding machine are operative so that dangerous movements of the device / robot are possible. The signal is active in operation mode. The signal must be the result of limit switch contact series of mold area safety devices according to EN 201.

## Plug and Socket Outlets - continued

Table 15-1 Plug on the Injection Molding Machine		
Signals from the Injection Molding Machine to the Handling Device / Robot		
Contact No. (Male)	Signal Designation	Description
<b>ZA4 ZC4</b>	Safety devices of machine channel 2	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection molding machine are operative so that dangerous movements of the handling device / robot are possible. The signal is active in any operation mode. The signal must be the result of limit switch contact series of mold area safety devices according to EN 201.
<b>ZA5</b>	Reject	HIGH signal when the molding is a reject. HIGH signal when the mold is open and must remain HIGH at least until "Enable mold closure". Optional. See contact No A6. It is recommended to have HIGH signal already when the mold opening starts.
<b>ZA6</b>	Mold closed	HIGH signal when the mold closing is completed. Note: The signal "Enable mold closure" is then no longer required. See contact No A6.
<b>ZA7</b>	Mold open position	HIGH signal when mold opening position is equal or more than required position. Inadvertent alteration to mold opening stroke smaller than that required for the handling device / robot to approach must be impossible. The signal must remain HIGH as long as the mold is open and must not be interrupted by a change of operation mode or safety guard opening.
<b>ZA8 Optional</b>	Intermediate mold opening position	HIGH signal when mold opening reaches a set position smaller than mold opening position. See table 1: injection molding machine signals contact No ZA7. The signal remains HIGH to the end of mold opening position. Two sequences are possible with this signal: a) Mold opening stops on intermediate position and gives start signal to handling device / robot. Mold opening restarts with the signal "Enable full mold opening". See contact No A7. b) Mold opening does not stop on intermediate position, however gives the signal to handling device / robot. At this sequence the signals "Enable full mold opening". See connection A7 and "Mold area free" (See A3/C3) are not in use. LOW signal when intermediate mold opening position is not in use.
<b>ZA9</b>	Supply from handling device / robot	24 V DC (Reference potential)
<b>ZB2</b>	Enable operation with handling device / robot (Automatic)	HIGH signal when the injection molding machine is able to be operated with handling device / robot. This signal shall not be used to start the handling device / robot. If the signal turns LOW during the operation mode of the handling device / robot "operation with injection molding machine", it is recommended that the handling device / robot continues its automatic cycle until the end position.
<b>ZB3</b>	Ejector back position	HIGH signal when the ejector has been finally (e.g. after the number of its set cycles) retracted regardless of the moving platen position. The signal is the acknowledgement for the "Enable ejector retraction" signal (See contact No B3), when the ejector sequence is selected. It is recommended to have HIGH signal when the ejector sequence is not in use.

## Plug and Socket Outlets - continued

Table 15-1 Plug on the Injection Molding Machine		
Signals from the Injection Molding Machine to the Handling Device / Robot		
Contact No. (Male)	Signal Designation	Description
<b>ZB4</b>	Ejector forward position	HIGH signal when the ejector has been advanced. The signal is the acknowledgement signal for the "Enable ejector advance." See contact No B4. It is recommended to have HIGH signal when the ejector sequence is not in use.
<b>ZB5 Optional</b>	Core pullers 1 in position 1 (Core pullers 1 free for handling device / robot to approach)	HIGH signal when the core pullers 1 are in position 1. See contact No B5. It is recommended to have LOW signal when the core puller sequence is not in use.
<b>ZB6 Optional</b>	Core pullers 1 in position 2 (Core pullers 1 in position to remove molding)	HIGH signal when the core pullers 1 are in position 2. See contact No B6. It is recommended to have LOW signal when the core puller sequence is not in use.
<b>ZB7 Optional</b>	Core pullers 2 in position 1 (Core pullers 2 free for handling device / robot to approach)	HIGH signal when the core pullers 2 are in position 1. See contact No B7). It is recommended to have LOW signal when the core puller sequence is not in use.
<b>ZB8 Optional</b>	(Core pullers 2 in position to remove molding)	HIGH signal when the core pullers 2 are in position 2. See contact No B8. It is recommended to have LOW signal when the core puller sequence is not in use.
<b>ZC5</b>		Reserved for future use of EUROMAP.
<b>ZC6</b>		Reserved for future use of EUROMAP.
<b>ZC7</b>		Reserved for future use of EUROMAP.
<b>ZC8</b>		Not fixed by EUROMAP, manufacturer dependent.
<b>ZC9</b>	Supply from handling device / robot	0 V (Reference potential)

## Plug and Socket Outlets - continued

Table 15-2 Plug on the Injection Molding Machine		
Signals from the Handling Device / Robot to the Injection Molding Machine		
Contact No (Female)	Signal Designation	Description
A1 C1	Emergency stop of handling device / robot Channel 1	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection molding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A2 C2	Emergency stop of handling device / robot Channel 2	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection molding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A3 C3	Mold area free	The switch contact is closed when the handling device / robot is outside the mold area and does not interfere with mold opening and closing movements. The switch contact must be opened when the handling device / robot leaves its start position. If the switch contact is open neither opening nor closing of the mold may occur. However the injection molding machine may ignore this signal when mold opening is carried out after e.g. an intermediate stop (See contact No ZA8), if the optional sequence is selected on the injection molding machine. The signal must have the described effect even when the handling device / robot is switched off. It is recommended to close the switch contact when the handling device / robot is unselected.
A4 C4		Reserved for future use by EUROMAP.
A5		Not fixed by EUROMAP, manufacturer dependent.
A6	Enable mold closure	HIGH signal when the handling device / robot is retracted enough for start of mold closure. The signal must remain HIGH at least until "Mold closed" (See contact No ZA6) is available. If the signal is LOW as a result of a fault, mold closing must be interrupted. The signal "Enable mold closure" must not be a logical "or" with either other signals, e.g. "Close safety guard" or a push button in any operation mode. The signal must be HIGH if the handling device / robot is switched off. It is recommended to have HIGH signal when the handling device / robot is unselected.
A7 Optional	Enable full mold opening	HIGH signal when the handling device / robot has taken the part and allows to continue mold opening. The signal must remain HIGH until "Mold open" signal is given by the injection molding machine. See contact No ZA7.
A8		Reserved for future use by EUROMAP

**Plug and Socket Outlets - continued**

Table 15-2 Plug on the Injection Molding Machine		
Signals from the Handling Device / Robot to the Injection Molding Machine		
Contact No (Female)	Signal Designation	Description
A9	Supply from injection molding machine	24V DC / 2A (Reference potential)
B2	Handling device / robot operation mode (operation with handling device / robot)	LOW signal when the handling device / robot mode switch is "Operation with injection molding machine". HIGH signal when the handling device / robot mode switch is "No operation with injection molding machine". HIGH signal when the handling device / robot is switched off.
B3	Enable ejector back	HIGH signal when the handling device / robot enables the movement for ejector back. The signal must remain HIGH at least until "Ejector back" signal is given by injection molding machine See contact No ZB3.
B4	Enable ejector forward	HIGH signal when the handling device / robot enables the movement for ejector forward. The signal must remain HIGH at least until "Ejector forward" signal is given by the injection molding machine. See contact No ZB4.
B5 Optional	Enable movement of core pullers 1 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 1" signal is given by injection molding machine (see contact No ZB5). The signal shall remain at least until position 2 has been left. See contact No ZB6.
B6 Optional	Enable movement of core pullers 1 to position 2 (Enable core pullers 1 to remove the molding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 2" signal is given by injection molding machine. See contact No ZB6. The signal shall remain at least until position 1 has been left. (See contact No ZB5).
B7 Optional	Enable movement of core pullers 2 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 1" signal is given by injection molding machine. See contact No ZB7. The signal shall remain at least until position 2 has been left. See contact No ZB8.
B8 Optional	Enable movement of core pullers 2 to position 2 (Enable core pullers 2 to remove the molding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 2" signal is given by injection molding machine. See contact No ZB8. The signal shall remain at least until position 1 has been left. See contact No ZB7.
C5		Not fixed by EUROMAP, manufacturer dependent.
C6		Reserved for future use by EUROMAP.
C7		Reserved for future use by EUROMAP.
C8		Not fixed by EUROMAP, manufacturer dependent.
C9	Supply from injection molding machine	0V (Reference potential)

# Section 16 - Water Quality

<b>Table 16-1 Detailed Water Quality Specification</b>			
<b>Constituents</b>	<b>Units</b>	<b>Closed Loop</b>	<b>Tower Water</b>
pH	pH Units	7.2 - 8.5	7.2 - 8.5
"M" Alkalinity	ppm	N/A	< 500
"P" Alkalinity	ppm	0	0
Total Hardness (as CaCO <sub>3</sub> )	ppm	< 10	60 - 800
Calcium Hardness (as CaCO <sub>3</sub> )	ppm	< 10	60 - 800
Conductivity	µmhos/cm	< 3000	1000 - 2000
Ryznar Stability Index	RSI	5.0 - 6.0	5.0 - 6.0
<b>Cations</b>			
Aluminum (as Al)	ppm	< 0.1	< 0.1
Copper (as Cu)	ppm	< 0.05	< 0.1
Manganese (as Mn)	ppm	< 0.05	< 0.05
Total Iron (as Fe)	ppm	<0.5	< 0.1
<b>Anions</b>			
Free Chlorine (as Cl <sub>2</sub> )	ppm	0	< 1.0
Chloride (as Cl)	ppm	< 400	< 400
Sulfate (as SO <sub>2</sub> )	ppm	< 300	< 300
Silica (as SiO <sub>2</sub> )	ppm	< 150	< 150
<b>Microbiological Activity</b>			
Sulfate Reducing Bacteria	Col./ml	< 1	< 1
Total Aerobic Bacteria	Col./ml	< 10 000	<10 000
<b>Solids</b>			
Suspended Solids	ppm	< 10	< 10
Solid Size	µm	< 5	< 5
<b>Maximum Corrosion Rate (of 90 Day Test Specimens, If Used)</b>			
Aluminum	mils Per Year	< 0.25	< 0.5
Copper	mils Per Year	< 0.25	< 0.2
Mild Steel	mils Per Year	< 1.0	< 2.0
Zinc	mils Per Year	< 2.0	< 2.0





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