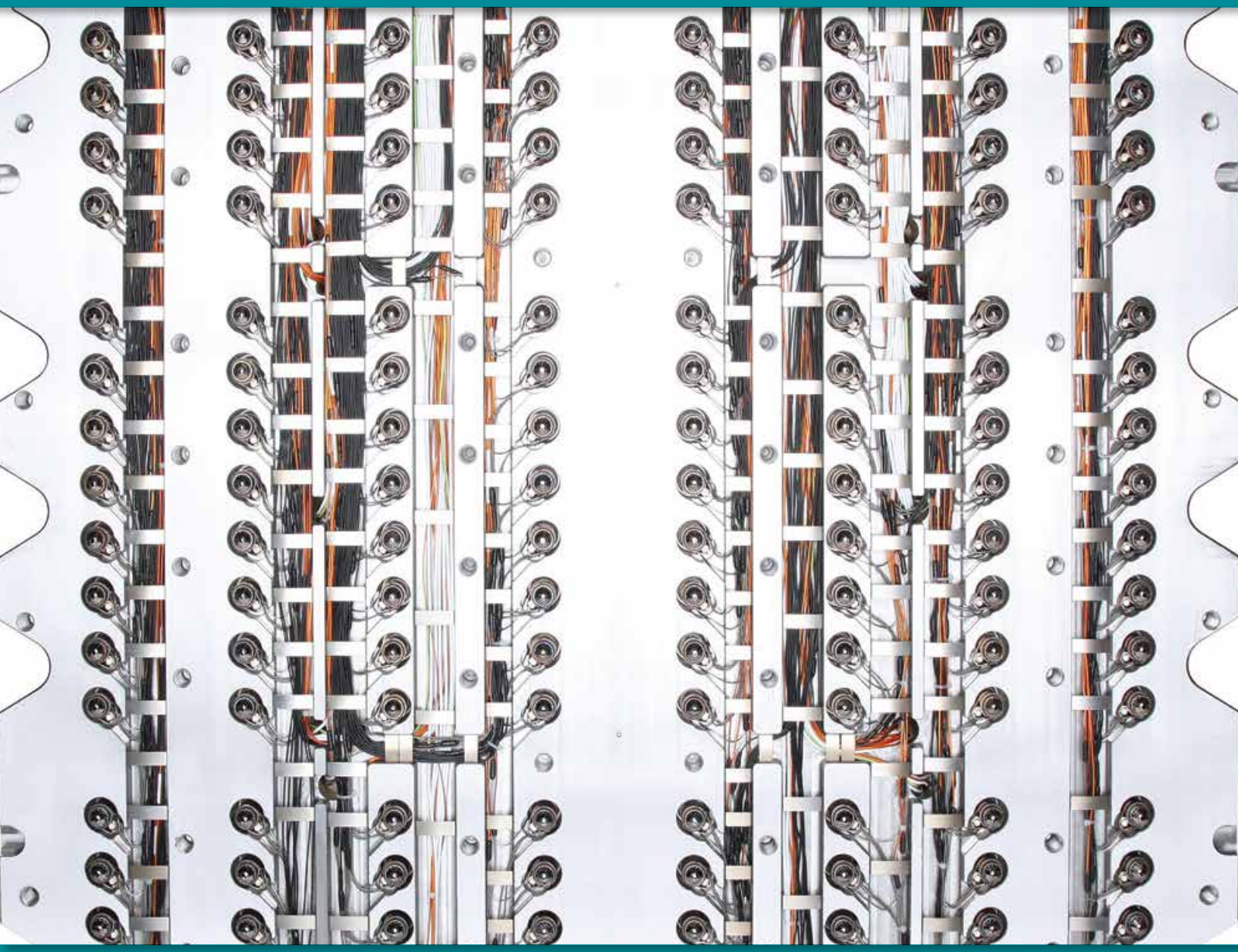
Mold Masters

PET series

User Manual

version 1



Original Instructions

Contents

Section 1 - Introduction

This manual is intended to provide information for operating and maintaining the ***PET*** Hot Runner, manufactured by *Mold-Masters Ltd*. For additional information, please contact your representative or a ***PET*** office.

1.1 Symbols Used in the Manual

General description of common symbols used in the manual.

WARNING

Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death.

CAUTION

Failure to follow instructions may damage equipment.

NOTE

Indicates additional information or used as a reminder.

1.2 Warranty and Documentation

Please check with your original documentation for warranty details.

NOTE

Please do not return any parts without pre-authorization and a return authorization number.

Documentation will include one or more of the following:

- Parts list of all system components. Together with the general assembly drawing, the parts list should be referenced when ordering spare parts.
- Hot half drawing used to integrate hot half to cavity plate.

WARNING

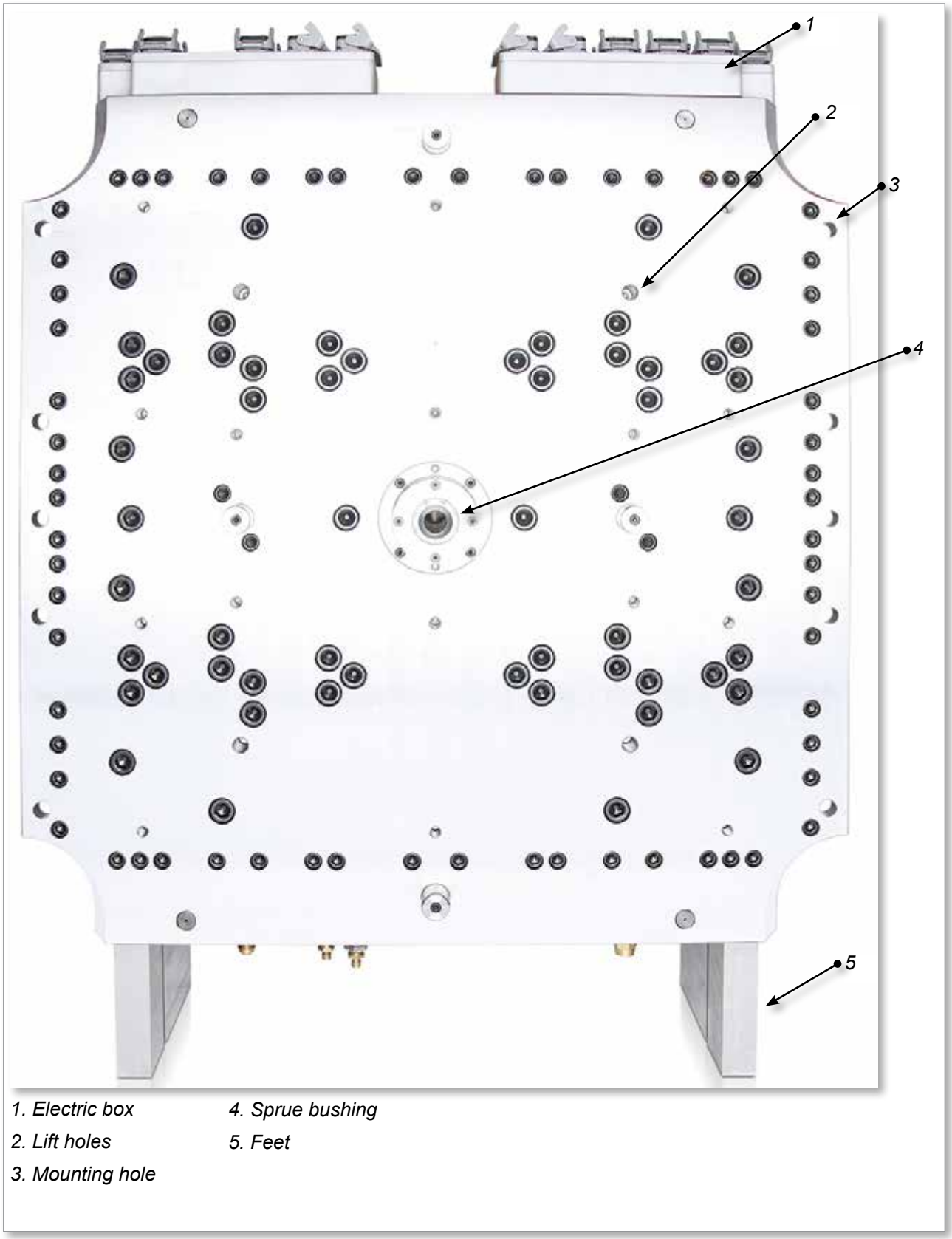
This manual must be used in conjunction with any appropriate Machine, Mold and Temperature Controller User Manual.

1.3 Release Details

Table 1-1 Release Details

Document #	Release Date	Version
HRPET--UM--EN--00--01	August 2021	01

1.4 PET System Overview—Back



1. *Electric box*
2. *Lift holes*
3. *Mounting hole*
4. *Sprue bushing*
5. *Feet*

*Figure 1-1 **PET** system overview—back*

Section 2 - Global Support

2.1 Corporate Offices

GLOBAL HEADQUARTERS
CANADA
Mold-Masters (2007) Limited
233 Armstrong Avenue
Georgetown, Ontario
Canada L7G 4X5
tel: +1 905 877 0185
fax: +1 905 877 6979
canada@moldmasters.com

EUROPEAN HEADQUARTERS
GERMANY / SWITZERLAND
Mold-Masters Europa GmbH
Neumattring 1
76532 Baden-Baden, Germany
tel: +49 7221 50990
fax: +49 7221 53093
germany@moldmasters.com

ASIAN HEADQUARTERS
CHINA/HONG KONG/TAIWAN
Mold-Masters (KunShan) Co, Ltd
Zhao Tian Rd
Lu Jia Town, KunShan City
Jiang Su Province
People's Republic of China
tel: +86 512 86162882
fax: +86 512-86162883
china@moldmasters.com

SOUTH AMERICAN HEADQUARTERS
BRAZIL
Mold-Masters do Brasil Ltda.
R. James Clerk Maxwel,
280 – Techno Park, Campinas
São Paulo, Brazil, 13069-380
tel: +55 19 3518 4040
brazil@moldmasters.com

INDIAN HEADQUARTERS
INDIA
Milacron India PVT Ltd. (Mold-Masters Div.)
3B,Gandhiji Salai,
Nallampalayam, Rathinapuri Post, Coimbatore T.N. 641027
tel: +91 422 423 4888
fax: +91 422 423 4800
india@moldmasters.com

JAPAN
Mold-Masters K.K.
1-4-17 Kurikidai, Asaoku Kawasaki, Kanagawa
Japan, 215-0032
tel: +81 44 986 2101
fax: +81 44 986 3145
japan@moldmasters.com

UNITED KINGDOM & IRELAND
Mold-Masters (UK) Ltd Netherwood Road
Rotherwas Ind. Est.
Hereford, HR2 6JU
United Kingdom
tel: +44 1432 265768
fax: +44 1432 263782
uk@moldmasters.com

USA
Mold-Masters Injectioneering LLC, 29111 Stephenson Highway, Madison Heights, MI 48071, USA
tel: +1 800 450 2270 (USA only) tel: +1 (248) 544-5710
fax: +1 (248) 544-5712
usa@moldmasters.com

AUSTRIA / EAST & SOUTHEAST EUROPE
Mold-Masters Handelsges.m.b.H.
Pyhrnstrasse 16
A-4553 Schlierbach
Austria
tel: +43 7582 51877
fax: +43 7582 51877 18
austria@moldmasters.com

CZECH REPUBLIC
Mold-Masters Europa GmbH
Hlavni 823
75654 Zubri
Czech Republic
tel: +420 571 619 017
fax: +420 571 619 018
czech@moldmasters.com

FRANCE
Mold-Masters France
ZI la Marinière,
2 Rue Bernard Palissy
91070 Bondoufle, France
tel: +33 (0) 1 78 05 40 20
fax: +33 (0) 1 78 05 40 30
france@moldmasters.com

ITALY
Mold-Masters Italia
Via Germania, 23
35010 Vigonza (PD)
Italy
tel: +39 049/5019955
fax: +39 049/5019951
italy@moldmasters.com

KOREA
Mold-Masters Korea Ltd. E dong, 2nd floor, 2625-6, Jeongwang-dong, Siheung City, Gyeonggi-do, 15117, South Korea
tel: +82-31-431-4756
korea@moldmasters.com

MEXICO
Milacron Mexico Plastics Services S.A. de C.V.
Circuito El Marques norte #55
Parque Industrial El Marques
El Marques, Queretaro C.P. 76246
Mexico
tel: +52 442 713 5661 (sales)
tel: +52 442 713 5664 (service)
mexico@moldmasters.com

Corporate Offices - continued

SINGAPORE*
Mold-Masters Singapore PTE. Ltd.
No 48 Toh Guan Road East
#06-140 Enterprise Hub
Singapore 608586
Republic of Singapore
tel: +65 6261 7793
fax: +65 6261 8378
singapore@moldmasters.com
*Coverage includes Southeast Asia, Australia, and New Zealand

SPAIN
Mold-Masters Europa GmbH
C/ Tecnología, 17
Edificio Canadá PL. 0 Office A2
08840 – Viladecans
Barcelona
tel: +34 93 575 41 29
e: spain@moldmasters.com

TURKEY
Mold-Masters Europa GmbH
Merkezi Almanya Türkiye
İstanbul Şubesi
Alanaldı Caddesi Bahçelerarası
Sokak No: 31/1
34736 İçerenköy-Ataşehir
Istanbul, Turkey
tel: +90 216 577 32 44
fax: +90 216 577 32 45
turkey@moldmasters.com

2.2 International Representatives

Argentina
Sollwert S.R.L.
La Pampa 2849 2ʃ B
C1428EAY Buenos Aires
Argentina
tel: +54 11 4786 5978
fax: +54 11 4786 5978 Ext. 35 sollwert@fibertel.com.ar

Belarus
HP Promcomplect
Sharangovicha 13
220018 Minsk
tel: +375 29 683-48-99
fax: +375 17 397-05-65
e:info@mold.by

Bulgaria
Mold-Trade OOD
62, Aleksandrovska
St. Ruse City
Bulgaria
tel: +359 82 821 054
fax: +359 82 821 054
contact@mold-trade.com

Denmark*
Englmayer A/S
Dam Holme 14-16
DK – 3660 Stenloese
Denmark tel: +45 46 733847
fax: +45 46 733859
support@englmayer.dk
*Coverage includes Norway and Sweden

Finland**
Oy Scalar Ltd.
Tehtaankatu
10 11120 Riihimaki
Finland
tel: +358 10 387 2955
fax: +358 10 387 2950
info@scalar.fi
**Coverage includes Estonia

Greece
Ionian Chemicals S.A.
21 Pentelis Ave.
15235 Vrilissia, Athens
Greece
tel: +30 210 6836918-9
fax: +30 210 6828881
m.pavlou@ionianchemicals.gr

Israel
ASAF Industries Ltd. 29 Habanai Street
PO Box 5598 Holon 58154 Israel
tel: +972 3 5581290
fax: +972 3 5581293
sales@asaf.com

Portugal
Gecim LDA
Rua Fonte Dos Ingleses, No 2
Engenho
2430-130 Marinha Grande
Portugal
tel: +351 244 575600
fax: +351 244 575601
gecim@gecim.pt

Romania
Tehnic Mold Trade SRL
Str. W. A Mozart nr. 17 Sect. 2
020251 Bucharesti
Romania
tel: +4 021 230 60 51
fax : +4 021 231 05 86
contact@matritehightech.ro

Russia
System LLC
Prkt Marshala Zhukova 4
123308 Moscow
Russia
tel: +7 (495) 199-14-51
moldmasters@system.com.ru

Slovenia
RD PICTA tehnologije d.o.o.
Žolgarjeva ulica 2
2310 Slovenska Bistrica
Slovenija
+386 59 969 117
info@picta.si

Ukraine
Company Park LLC
Gaydamatska str., 3, office 116
Kemenskoe City Dnipropetrovsk Region 51935, Ukraine
tel: +38 (038) 277-82-82
moldmasters@parkgroup.com.ua

For support in regions not listed above, please contact the nearest headquarters and they will connect you with the appropriate representative.

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 choose 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.

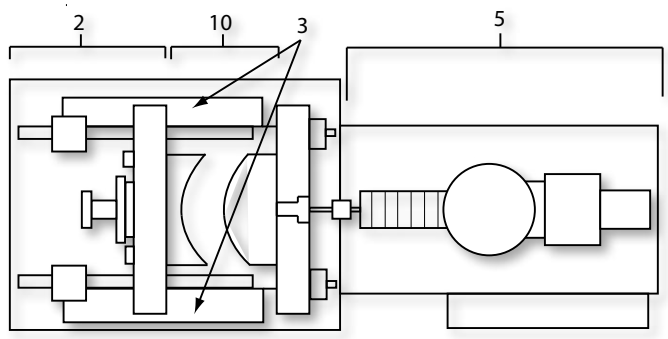
3.2 Safety Hazards

WARNING

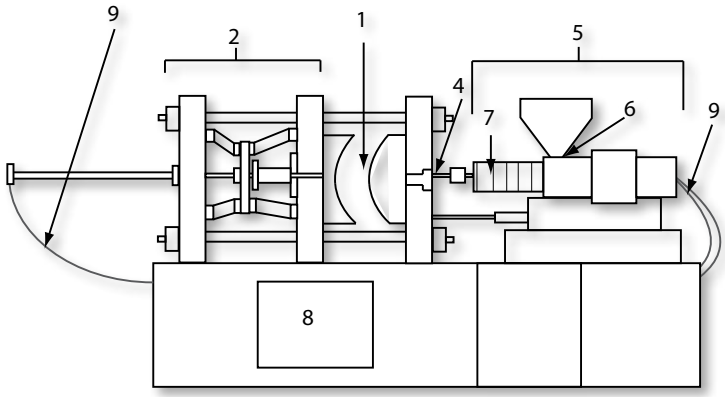
Also refer to all machine manuals and local regulations and codes for safety information.

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

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



Top view with guards removed



Front view with guards removed

1. *Mold area*
2. *Clamping mechanism area*
3. *Area of movement of core and ejector drive mechanisms outside areas 1 and 2*
4. *Machine nozzle area*
5. *Plasticating and / or injection unit area*
6. *Feed opening area*
7. *Area of the heater bands of the plasticizing and / or injection cylinders*
8. *Parts discharge area*
9. *Hoses*
10. *Area inside the guards and outside the mold area*

Figure 3-1 Injection molding machine hazard areas.

Table 3-1 Safety Hazards	
Hazard Area	**Potential Hazards**
Mold Area Area between the platens. See Figure 3-1 area 1	**Mechanical Hazards** 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. **Thermal Hazards** Burns and / or scalds due to operating temperature of: • The mold heating elements. • Plasticized material released from / through the mold.
Clamping Mechanism Area See Figure 3-1 area 2	**Mechanical Hazards** 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.
Movement of Drive Mechanisms Outside the Mold Area and Outside the Clamping Mechanism Area. See Figure 3-1 area 3	**Mechanical Hazards** Mechanical hazards of crushing, shearing and / or impact caused by the movements of: • Core and ejector drive mechanisms.
Nozzle Area The nozzle area is the area between the barrel and the sprue bushing. See Figure 3-1 area 4	M**echanical Hazards** 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. **Thermal Hazards** Burns and or scalds due to operating temperature of: • The nozzle. • Plasticized material discharging from the nozzle.
Plasticizing and / or Injection Unit Area Area from the adaptor / barrelhead / end cap to the extruder motor above the sled including the carriage cylinders. See Figure 3-1 area 5	**Mechanical Hazards** 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. **Thermal Hazards** 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. **Mechanical and / or Thermal Hazard** Hazards due to reduction in mechanical strength of the plasticizing and / or injection cylinder due to overheating.

Table 3-1 Safety Hazards	
Hazard Area	**Potential Hazards**
Feed Opening See Figure 3-1 area 6	Pinching and crushing between injection screw movement and housing.
Area of the Heater Bands of the Plasticizing and / or Injection Cylinders 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.
Parts Discharge Area See Figure 3-1 area 8	**Mechanical Hazards** 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. **Thermal Hazards** 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.
Hoses 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.
Area Inside the Guards and Outside the Mold Area 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.
Electrical Hazards	• 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.
Hydraulic Accumulators	High pressure discharge.
Power Operated Gate	Crush or impact hazards caused by the movement of the power operated gates.
Vapors and Gases	Certain processing conditions and / or resins can cause hazardous fumes or vapors.

3.3 General Safety Symbols

Table 3-2 Typical Safety Symbols	
Symbol	**General Description**
	**General – Warning** Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death.
	**Warning – Barrel Cover Grounding Strap** 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.
	**Warning – Crushing and / or Impact Points** Contact with moving parts can cause serious crushing injury. Always keep guards in place.
	**Warning – Crush Hazard Closing Mold**
	**Warning – Hazardous Voltage** 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.
	**Warning – High Pressure** Overheated fluids may cause severe burns. Discharge pressure before disconnecting water lines.
	**Warning – High Pressure Accumulator** 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.
	**Warning – Hot Surfaces** Contact with exposed hot surfaces will cause serious burn injury. Wear protective gloves when working near these areas.
	**Mandatory – Lockout / Tagout** 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).
	**Warning – Molten Material and / or High Pressure Gas** 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.

Table 3-3 Typical Safety Symbols	
Symbol	**General Description**
	**Warning – Read manual before operation** Personnel should read and understand all instructions in the manuals before working on equipment. Only properly trained personnel should operate the equipment.
	**Warning – Slip, Trip, or Fall Hazard** Do not climb on equipment surfaces. Serious slip, trip, or fall injuries can result from personnel climbing on equipment surfaces.
	**Caution - Failure to follow instructions may damage equipment**
	**Important - Indicates additional information or used as a reminder**
	**Disconnect from Electric Supply**

3.4 General Safety Warnings

The equipment supplied is subjected to high injection pressures and high temperatures.

Observe extreme caution 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.
- When necessary, wear heat-resistant personal protective equipment (PPE) to prevent burns from contact with hot surfaces or splatter of hot plastic and gases.
- It is highly recommended that all operators wear face shields and use heat resistant gloves when working around the feed throat, purging the machine or cleaning the gates of the mold.
- Remove purgings from the machine immediately.
- 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).
- Follow good housekeeping procedures and keep floors clean to prevent slips, trips and falls due to spilled pellets on the work floor.
- Apply engineering controls or hearing conservation programs as necessary to control noise.

- Never disable or bypass a safety device.
- Ensure high voltage and amperage cables are connected to the controller (220/240 VAC).
- Unplug from the controller before performing any maintenance work.
- High voltage and amperage cables are connected to the mold. Electric power must be shut off and lockout/tagout procedures followed prior to installing or removing any cables.
- All maintenance should be performed by properly trained personnel based on local law or regulation requirements. Electrical products may not be grounded when removed from the assembled or normal operating condition.
- Ensure proper grounding of all electrical products before performing any maintenance to avoid potential risk of electrical shock.
- 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 the other application.
- 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.
- Never perform any work on the mold machine unless the hydraulic pump has been stopped.
- 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.
- Check frequently for possible oil leaks / water leaks. Stop the machine and make repairs.
- Ensure that mold lifting equipment (eyebolts, fork lift truck, cranes, etc.) will have sufficient capacity to handle mold and hot runner weight.
- 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.
- For water-cooled gate inserts, coolant must be maintained with the proper mixture to prevent corrosion and circuit blockage.
- Care must be taken to ensure the heater-band terminal ends do not come in contact with the water / hydraulic fluid. The heater bands may short out or become damaged.

3.5 Lockout Safety

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

Table 3-4 Energy Forms, Energy Sources and General Lockout Guidelines

Energy Form	Energy Source	Lockout Guidelines
Electrical Energy	• Power transmission lines • Machine power cords • Motors • Solenoids • Capacitors (stored electrical energy)	• Turn off power at machine first (i.e., at point of operation switch), and then at the main disconnect switch for the machine. • Lock and tag the main disconnect switch. • Fully discharge all capacitative systems (e.g., cycle machine to drain power from capacitors) according to the manufacturer's instructions.
Hydraulic Energy	• Hydraulic systems (e.g., hydraulic presses, rams, cylinders, hammers)	• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off and blank lines as necessary.
Pneumatic Energy	• Pneumatic systems (e.g.,lines, pressure reservoirs, accumulators, air surge tanks, rams, cylinders)	• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off excess air. • If pressure cannot be relieved, block any possible movement of machinery.
Kinetic Energy (Energy of a moving object or materials. Moving object may be powered or coasting)	• Blades • Flywheels • Materials in supply lines	• Stop and block machine parts (e.g. stop flywheels and ensure that they do not recycle). • Review entire cycle of mechanical motion, ensure that all motions are stopped. • Block material from moving into area of work. • Blank as necessary.

Table 3-4 Energy Forms, Energy Sources and General Lockout Guidelines		
Energy Form	**Energy Source**	**Lockout Guidelines**
Potential Energy (Stored energy that an object has the potential to release due to its position)	• Springs (e.g., in air brake cylinders) Actuators • Counterweights • Raised loads • Top or movable part of a press or lifting device	• If possible, lower all suspended parts and loads to the lowest (rest) position. • Block parts that might be moved by gravity. • Release or block spring energy.
Thermal Energy	• Supply lines • Storage tanks and vessels	• Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off excess liquids or gases. • Blank lines as necessary.

3.5.1 Electrical Lockout

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.

Employers must provide an effective lockout / tagout program.

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 3-4.
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 foreperson 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.

3.6 Safety Guards and Interlocks

Plastic injection machines require guards to protect employees from nip points, numerous moving parts and exposure to high voltage and high temperature.

WARNING

Serious injuries including fatalities, amputations, avulsions, burns, cuts, and bruises can occur during operation if guards are missing, improperly installed, removed, or bypassed.

Never purposefully reach around, under, or over guards into hazardous areas.

Do not remove, alter, or attempt to otherwise bypass a safety interlock.

Never access the mold cavity via the operator's gate and do not remove a fixed guard during normal operation.

Never rely on interlocks rather than lockout/tagout procedures.

Table 3-5 Types of Guards

Method	Safeguarding Action
Fixed (Not Interlocked)	Provides a barrier
Moveable (Interlocked)	Shuts off or disengages power and prevents starting of machine when guard is open; should require the machine to be stopped before the worker can reach into the danger area

It is important to ensure that:

1. Safety guards are tested and inspected regularly for correct operation.
2. Operators and maintenance workers are trained in location of equipment safeguards, how they provide protection, and what hazards they protect against.
3. Operators and maintenance workers are trained in how and under what circumstances guards can be removed.
4. Operators and maintenance workers are trained in the location of emergency stops.

3.7 Handling Safety

WARNING

Please inform ***PET Systems*** immediately if interfacing an 'other than supplied' mold cold half or hot half as this will impact the weight of the mold and therefore lift bars, latches and mold mounting.

WARNING

The use of improper material handling equipment can cause injury or death. Ensure all equipment, including cranes, chains, slings, eye bolts and lift rings are rated to the required load.

It is the responsibility of the employer to:

1. Ensure the original and continuing coPETence of personnel operating material handling equipment including rigging, inspecting and using equipment.
2. Establish and follow a program of periodic and regular inspections of material handling equipment to ensure they are in safe operating condition.
3. Ensure all material handling equipment, including cranes, chains, slings, eye bolts and lift rings are rated to the required load.

Figure 3-2 General lifting safety.

3.8 General Safety When Lifting a Load

1. 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).
2. Choose lift equipment that is rated for the prescribed load.
3. Identify the characteristics (center of gravity, physical dimensions, weight, lifting points, etc.) of the object(s) being lifted.
4. Know the rigging requirements before the lift is performed. (If unsure of the rigging requirements, contact the Hoisting and Rigging Inspector or Plant Engineering Rigging Supervisors).
5. Identify and avoid potential pinch points (where an individual or a component of the lifting equipment or load may be caught between two surfaces).
6. Consider load balance, load configuration, dimensions and attachment points.
7. Never replace or modify a manufactured lifting component (for example, a shackle pin with a bolt in an eyebolt assembly).
8. Keep shackles straight for maximum capacity (in effect, prevent the load, as applied to the shackle, from creating an eccentric force or bending moment on the shackle body). Under certain conditions, this type of loading may cause the legs of the shackle to open up.
9. Know the intended use of the eyebolts when they are supplied as part of the equipment. It is possible that they are intended to lift only part of the mold/equipment.
10. Secure and balance the load in the chain or lifting device before it is lifted more than a few inches.
11. Minimize swinging by bringing the hook over the load appropriately.
12. Stand clear of the suspended load at all times.
13. Use shoulder eyebolts only, and de-rate them accordingly, depending on the angle (angle of the load path) of the corresponding connecting sling or wire rope.

3.8.1 Hot Half Weight Information Plate

Each ***PET Systems*** supplied hot half should have a plate indicating the weight, without cavity plate, as shown below.

Figure 3-3 Weight plate

3.8.2 Hoist Ring and Eyebolt Safety

Always inspect hoist ring before use. Make sure:

- The screw is tightened to recommended torque.
- The bushing sits flush against object being lifted.
- Hoist ring is free to swivel and pivot in every direction.
- There are no signs of corrosion, wear or cracks, especially on the screw, shoulder pins and bail.
- The shoulder pins are secure and do not rotate or come loose.

Ensure hoist rings and eyebolts are used at correct lift angle. See Figure 3-4 and Figure 3-5.

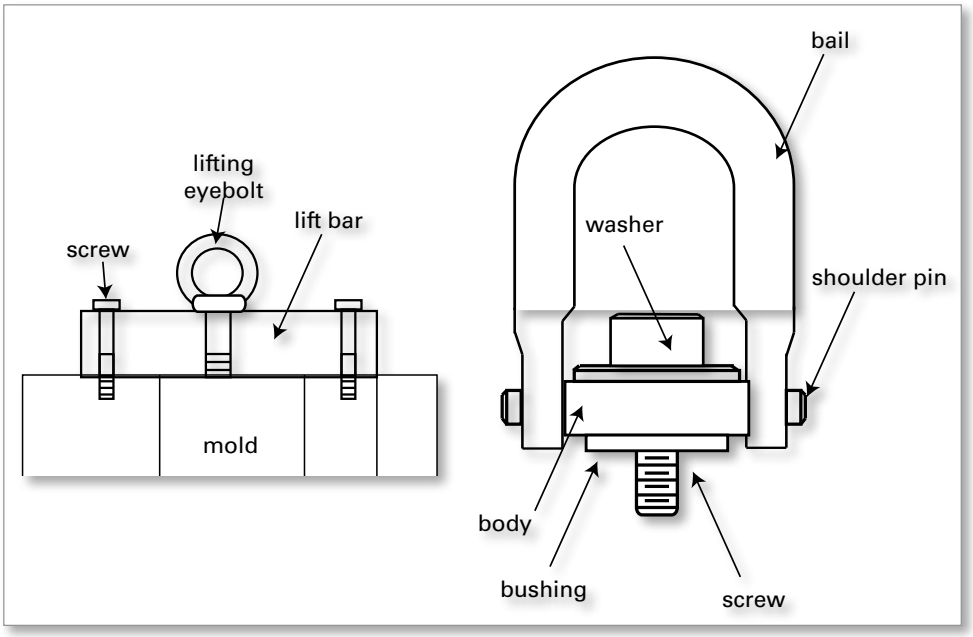


Figure 3-4 Eyebolt and hoist ring

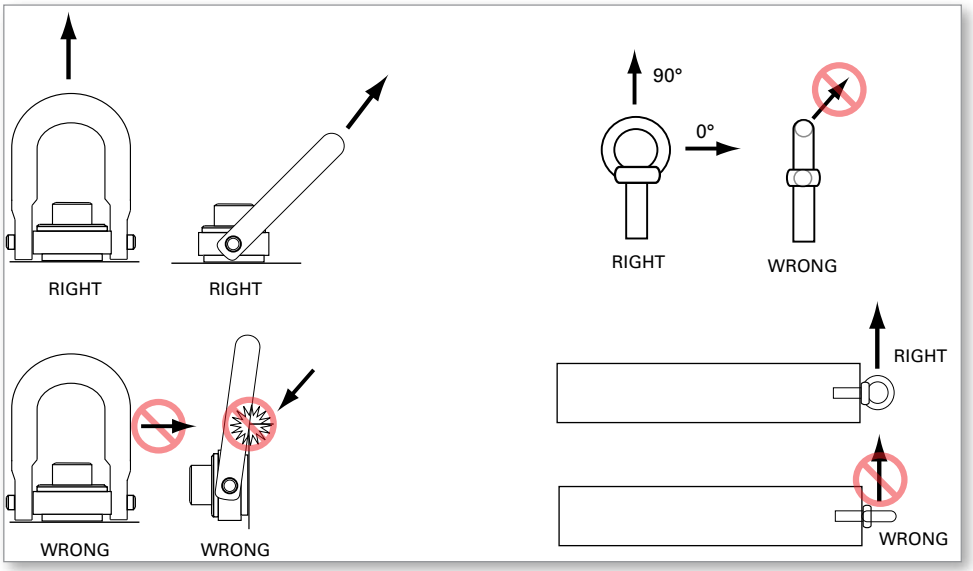


Figure 3-5 Correct lifting angles

3.8.3 Laying Down Plates or Molds

1. Align a wooden block under the plate or mold at the side opposite to where the plate or mold is to be laid down.

Figure 3-6 Align wooden block beneath the plate or mold

2. Slowly lower the plate or mold onto the wooden block.
3. Slowly lower the plate or mold downward onto the work bench or surface.
4. Move the crane so that the chain or sling maintains a vertical orientation.

As required, insert wooden blocks under plates or mold to prevent any damage to components on underside and to ensure stable horizontal orientation.

Figure 3-7 Lower plate or mold

Figure 3-8 Wooden blocks beneath plate or mold as required

3.8.4 Picking Up Plates or Molds

WARNING

Use a block of wood when raising the plates or mold to prevent the load from tipping over the opposite way which could cause bodily harm.

Lift the plate or mold slowly off the wooden block to minimize any swinging or pendulum motion that could cause bodily harm.

1. Align a wooden block under edge of plate or mold.
2. Lift the plate or mold off the workbench onto the wooden block.
3. Slowly lift the plates or mold off the bench.

3.9 Latching

3.9.1 Latching Introduction

WARNING

Under no circumstances are plates to be pulled or handled with only one latch attached.

There are two reasons latches are used in a mold:

- To tie the mold halves together for transportation and handling,
- To gain access between two mold plates which are screwed together during normal mold operation.

Latches are always used in pairs mounted on diagonally opposite sides of the mold to provide equal pull on the plates.

The latches are located on:

- The operator's side
- Non-operator's side of the mold or
- Top and bottom of the mold

Latch locations are shown on the General Assembly drawings. During mold operation the latches must be removed from the mold and stored elsewhere.

3.9.2 Latching the Cavity Plate to the Core Half (Cold Half)

WARNING

Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

Make sure the lifting eyebolt, lifting chain and crane are rated to adequately support the weight of the plate(s).
Failure to do so can cause a serious injury.

Install latches before removing the cavity plate mounting screws.
Failure to do so may lead to serious injury or death.

Use this procedure for reference purposes only.

For latch locations, refer to the General Assembly drawing.

For additional instructions on latching in the machine refer to the machine manufacturers manual.

1. Open the mold.
2. Check the machine and Hot Runner controller has been locked out and tagged out. Refer to the controller and machine manufacturers documentation for procedures.
3. Apply lockout / tagged out to the machine power source and Hot Runner controller. Refer to the controller and machine manufacturers documentation for procedures.
4. Allow the mold to cool to room temperature. Continue to circulate the mold cooling water in all plates to cool the mold faster.
5. If the mold has no leader pins, attach a crane that is rated to adequately support the weight of the cavity plate.
6. Latch the cavity plate to the manifold or manifold backing plate.
See Figure 3-9 on page 3-17.

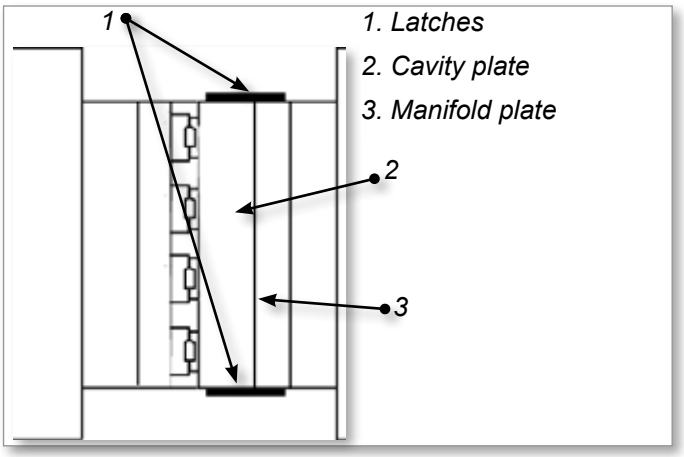


Figure 3-9 Latch cavity plate to manifold plate

7. Check that the cavity plate hoses are long enough to allow the cavity plate to be latched over to the core half (cold half), without damaging the hoses.
8. Remove all cavity plate mounting screws.
9. Remove lockout / tagged out.
10. Place the machine in Mold Set mode.
11. Close the mold slowly.
12. Apply lockout / tagged out. Refer to machine manufacturers documentation for procedures.
13. Remove the latches.
14. Latch the cavity plate to the core plate or cold half.
15. Remove lockout / tagged out.
16. Check the machine is in Mold Set mode.
17. Open the mold moving the cavity plate away from the manifold plate.
18. Apply lockout / tagged out. Refer to the controller and machine manufacturers' documentation for procedures.

3.9.3 Latching the Cavity Plate to the Manifold Plate (Hot Half)

WARNING

Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures.
Failure to do so may lead to serious injury or death.

CAUTION

The nozzles must be within 150°C (270°F) of mold temperature to prevent damage to Hot Runner and mold components.

For cylindrical valve gated systems, valve pins should be in the open position prior to removal of the cavity plate to prevent damage.

1. Lockout / tagout the machine. Refer to the controller and machine manufacturers documentation for procedures.
2. Lubricate the guide pins on the hot half.
3. Remove lockout / tagout.
4. Check the machine is in slow speed (Mold Set) mode.
5. Slowly close the mold.
6. Lockout / tagout the machine. Refer to the controller and machine manufacturers' documentation for procedures.

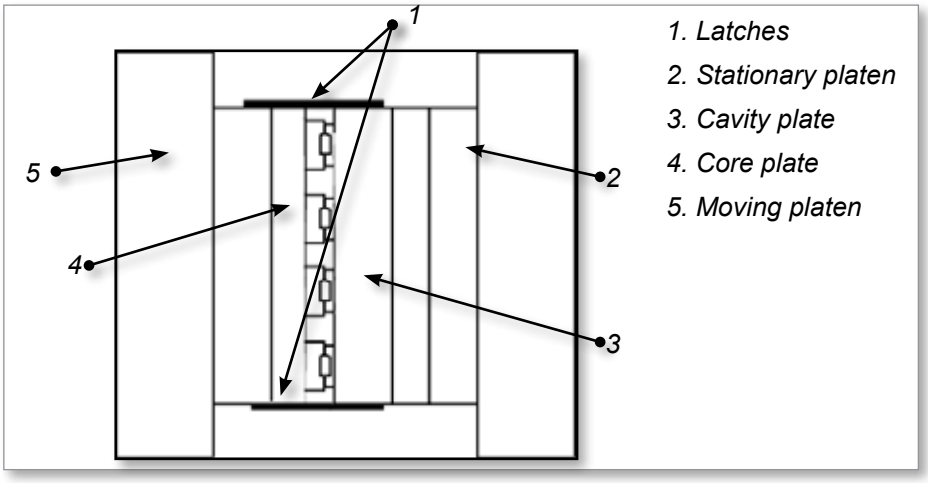


Figure 3-10 Cavity plate to core plate

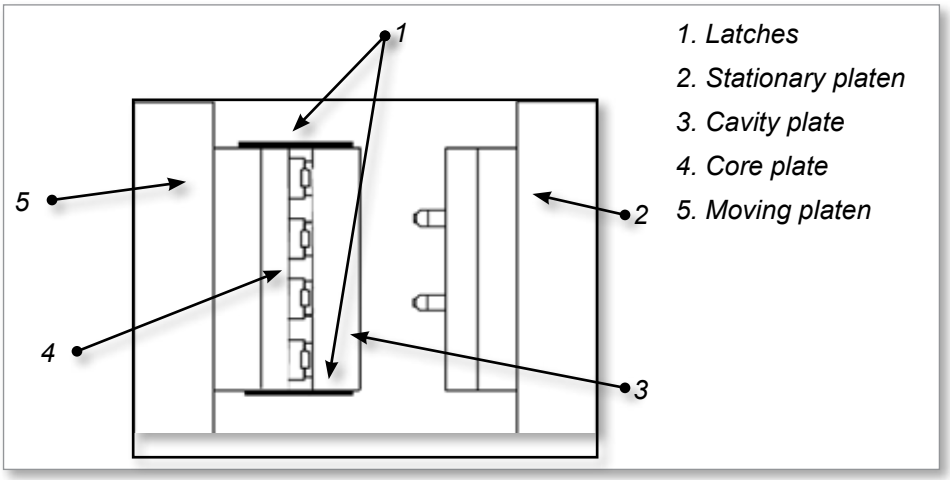


Figure 3-11 Latch cavity plate to the core plate

7. Remove the latches on both sides of the mold.
8. Latch the cavity plate to manifold plate or manifold backing plate.
9. Remove lockout / tagout.
10. Open the mold.
11. Lockout / tagout the machine. Refer to the controller and machine manufacturers' documentation for procedures.
12. Install and torque the cavity plate mounting bolts. Torque to required specifications. Refer to General Assembly drawing for required torque settings.
13. Install hoses if required.
14. Remove latches from both sides of the mold.

Section 4 - Preparation

4.1 Introduction

The following section is a step-by-step guide to preparing your ***PET System*** for use.

4.2 Screw Specifications

Be aware of warnings placed on the assembly drawings. When the manifold is heated the metal expands stretching the mounting screws, if screw lengths are shortened there is a possibility of shearing. The expansion factor is calculated into the length of each screw size.

4.3 Tools

Depending on the size and complexity of your ***PET System***, you will require most of the tools and materials listed below.

- Allen keys (hex wrench) - Set of imperial size keys and metric sizes for use on both imperial and metric cap screws (depending on system)
- Anti-seize compound - To prevent oxidation of screw threads that could cause screws to seize with high temperatures
- Calibrated torque wrench and adjustable wrenches
- Hex head socket driver
- Pry bars
- Feeler gauges
- Bluing compound - For checking face contact
- Sockets
- Plastic / brass face hammer
- Brass bristle wire brush
- Brass scrapers
- Grease gun
- Flashlight
- Eyebolt
- Inspection mirror

4.4 Recommended Equipment

The following must meet weight requirements:

- Work bench
- Crane
- Test controller suited for mold requirements

4.5 Unpacking

1. Carefully remove components from the shipping container and check that all components listed on the packing slip were supplied.
2. Check that all mold base dimensions are correct and correspond to ***PET Systems*** general assembly drawings.

4.6 Cleaning

1. Carefully remove any rust inhibitor that has been applied to the system to avoid contamination of a food packaging mold.

4.7 Machine Checks

1. Check that machine is level and, if necessary, adjust per machine manual.
2. With mold open and leader pin not engaged, check machine parallelism and if necessary adjust per machine manual.
3. With mold closed but not in clamp-up, check machine parallelism and, if necessary, adjust per machine manual.

CAUTION

Failure to ensure machine is level and parallel could result in damage to mold or machine.

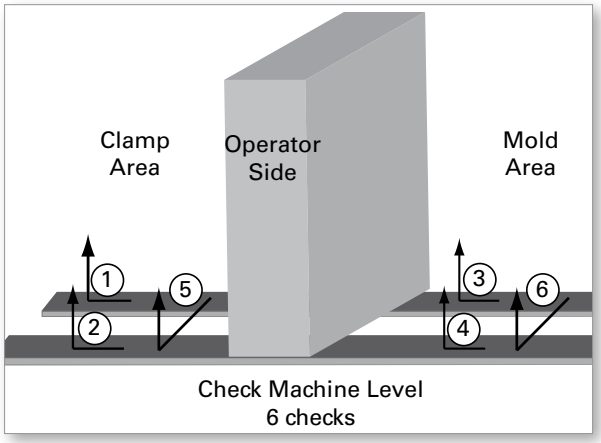


Figure 4-1 Level check locations.

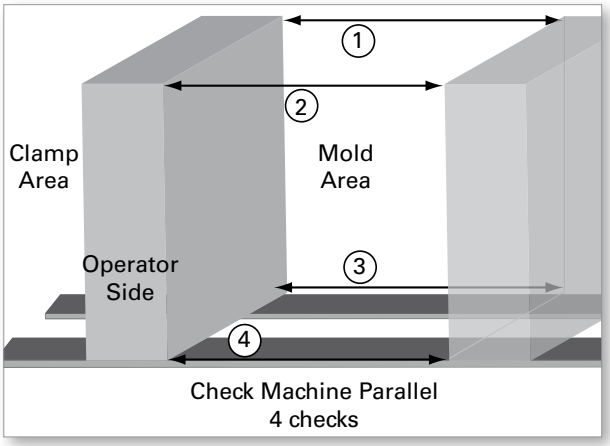


Figure 4-2 Parallelism check locations.

4.8 Removing Temporary Components

Any temporary components that are needed for moving and lifting (latches, lift bars, etc.) are all marked in YELLOW and must be removed before using the hot runner for production.

CAUTION

Failure to remove these temporary components before production will damage the mold or machine.

WARNING

Any components marked in red are essential safety components that *must not be removed.*

Section 5 - Electrical Testing

5.1 Electrical Testing Introduction

This section contains guidelines for electrical testing of your

PET System. The testing is based on the following European and North American standards:

- EN 60204-1 / DIN EN 60204-1 (IEC 60204-1, modified) Safety of machinery - electrical equipment of machines
- NFPA 79 Electrical Standard for Industrial Machinery

The standards themselves are the final authority for testing requirements (also any additional testing requirements from any national standards where the hot runner is in use).

WARNING

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

WARNING

To avoid serious burns wear safety clothing consisting of a protective heat-resistant coat, heat-resistant gloves and a full face shield over safety glasses. Use adequate ventilation for fumes.

Contact with heated components may cause serious burns. Use a sign in a visible location indicating “Danger: Do Not Touch”.

Before you carry out electrical work, make sure that the hot runner system is securely grounded. Turn the temperature control off and disconnect all electric wires coming from the mold. Failure to follow any of these steps may lead to serious injury or death.

5.2 Wiring Check

1. Check that each wire and thermocouple has a zone number.
2. Check that wires are organized and taped together by zone and plug.
3. Check that all wires are secured in wire channels.
4. Connect all power leads and thermocouple wires to mold plugs.
5. The electricity mains should only be connected to the injection mold when all electrical connections are grounded and the mold is closed.

WARNING

A disassembled nozzle should only be connected to an electrical supply when the nozzle has been grounded or a safety isolating transformer is used.

5.3 Electrical Safety Testing

Electrical safety tests shall be performed according to DIN EN 60204-1, paragraph 18 and NFPA 79. Testing guidelines are given below, however, the standards identified earlier, in the introduction, are the final authority.

5.3.1 Verify Equipment to its Technical Documentation

First, verify that the electrical equipment complies with its technical documentation.

5.3.2 Insulation Resistance Test

Measure the insulation resistance between each pin of the ***PET*** power connector, in particular the heating circuit and ground.

The insulation resistance is measured at a DC voltage of 500V. The insulation resistance must not be less than 1 MΩ. If this value is not reached when heating, the cause is often moisture inside the heating element, which should be removed using a control unit equipped with this function.

Where a mold has not been in use for several weeks or months, it should be re-tested.

5.3.3 Verification of Conditions for Protection by Automatic Disconnection of Supply

WARNING

The user is responsible to take protective measures against shock by indirect contact, while performing the tests.

The conditions for automatic shutdown of the supply is set at the ***PET*** facility and is usually set such that the protective conductor resistance between the grounding conductor connection and all of the protective earth conductor connected parts, is maximum 0.3 Ω.

In TN systems the following two checks must be made:

Test 1 - Verifies the continuity of the protective bonding circuit

The purpose of this test is to check whether all relevant touchable conductive parts are properly grounded. See the relevant requirements of the standard DIN EN 60204-1/ NFPA 79.

The protective conductor resistance is measured with a special instrument with a current between at least 0.2 A and approximately 10 A derived from an electrically separated supply source (for example SELV, see 413.1 of IEC 60364-4-41) having a maximum no-load voltage of 24 V AC or DC.

The resistance should be within the expected range.

Test 2 - Fault loop impedance verification and suitability of the associated overcurrent protective device

The power supply connections and incoming external grounding connections to the Hot Runner system (usually through a temperature control device), must be verified by inspection.

The conditions for protection by automatic disconnection of supply must be checked by both:

1. Checking the impedance of the fault loop by calculation or measurement.
2. Confirming that the setting and characteristics of the associated overcurrent protective device are in accordance with the requirements of the standard.

For more information, see the text of the EN 60204-1/ NFPA 79 standards.

5.3.4 Thermocouple Continuity Test

1. Measure the resistance between each pair of thermocouple wires and the mold's thermocouple connector. (See Figure 5-1 on page 5-3). The resistance should be between 2.5 Ω and 25 Ω.
2. To verify alignment of thermocouple in the heating element, turn on one zone after the other and check that the temperature responds accordingly if the set temperature is adjusted.

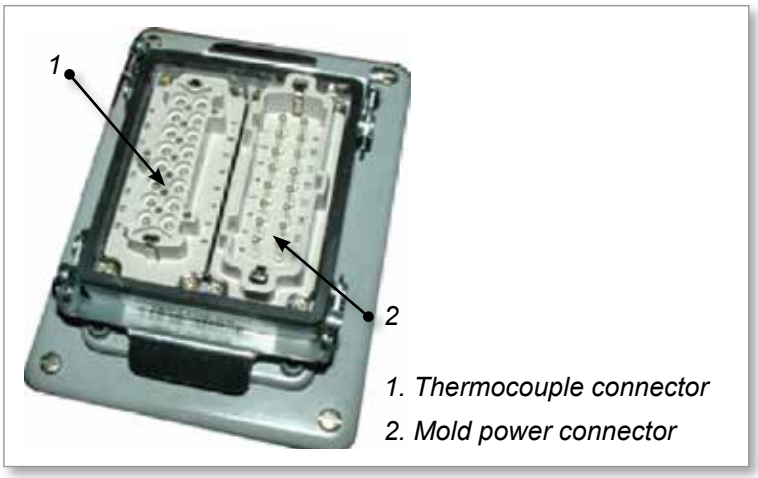


Figure 5-1 Mold plug

5.3.5 Pinch Point Test

1. If there is a suspected pinch point on the thermocouple, remove the thermocouple from the hot runner.
2. Connect a temperature control device to read the temperature.
3. Immerse the sheath of the thermocouple in boiling water to the point where the thermocouple reads the temperature.
4. A good thermocouple will show a temperature rise as soon as the tip of the thermocouple is immersed in water. If there is a pinch point in the thermocouple there will be no change in the reading until the pinch point on the thermocouple is immersed in water.

5.3.6 Heating Element Check

Measure the resistance between each pair of heater power wires at the mold power connector.

Compare your reading with your general assembly drawing.

Where: $$R = \frac{U^2}{P}$$

R = resistance U = voltage P = power

5.4 Thermocouple Wiring Guidelines

CAUTION

Exceeding controller zone amperage will cause controller fuses to blow.

- Thermocouples are Type “J”, ungrounded and color coded to ASA standards. (White “+”/Red “- “).
- The tip must not be truncated or squeezed and must touch the bottom of the bore in order to measure the correct temperature.
- Each heat source should have its own closed loop temperature control in order to achieve accurate control.
- If there are not enough control zones, heat sources that have the same wattage and affect the same environment, may be grouped together.

5.5 Functional Test with a Temperature Controller

The functions of the electrical equipment must be checked. This test is carried out with an appropriate temperature control device.

- Monitor the initial heating of the system to minimize risk.
- Never start the heating with more than 40% of power.
- Stay a minimum of 5 minutes at 100°C (212°F) before increasing heat.

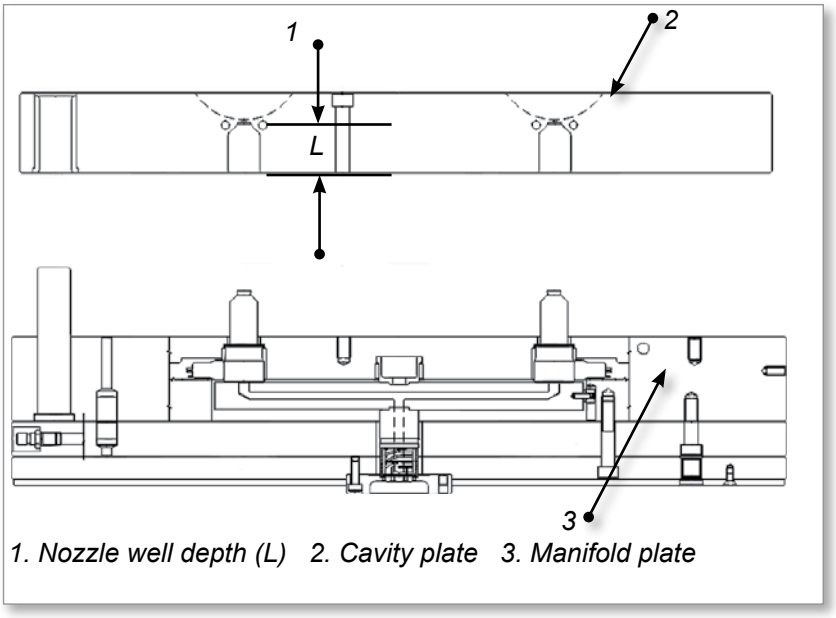
5.6 Re-testing

Where a portion of the electrical equipment is changed or modified, that portion must be re-verified and retested, as appropriate.

Section 6 - Hot Half Assembly

6.1 Assembling the Hot Half

1. Check that the nozzle well depth (L) in the cavity plate is to ***PET*** system specifications.



1. Nozzle well depth (L) 2. Cavity plate 3. Manifold plate

Figure 6-1 Nozzle depth

2. Attach a crane that is rated to adequately support the weight of the cavity plate.

WARNING

Make sure the lifting eyebolt, lifting chain and crane are rated to adequately support the weight of the plate(s). Failure to do so can cause a serious injury.

CAUTION

Potential pinch point. Ensure that all wires are in the retainer grooves. Failure to do so can cause lost production due to Hot Runner down time. For valve gated systems it is recommended to have the pins in the open position to reduce the possibility of damage.

3. Protect the gate seals before installing the cavity plate in the manifold plate.
4. Prepare the cavity plate for assembly.
5. Install the cavity plate to the manifold plate. If the plates are not assembling easily, remove the cavity plate and check for interference.
6. Install the mounting screws and torque to required specifications .
7. Attach a crane that is rated to adequately support the weight of the mold (cold half).
8. Latch the hot half to the cold half.
9. Refer to machine manufacturers documentation for operating procedures.
10. Install the mold into the molding machine.
11. Torque the mold mounting screws to required specifications.
12. Connect wire lines, hydraulic, pneumatic and electrical components.

WARNING

Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

13. Remove latches.

Section 7 - System Startup and Shutdown

7.1 Introduction

This procedure explains how to start up and shut down your ***PET System***.

IMPORTANT

Ensure the machine nozzle orifice matches or is, at most, 1.0 mm (0.040 in.) less than the melt entrance of the hot runner system.

CAUTION

Check that the system is heated to processing temperature before actuating the valve pins. Failure to do so could cause damage to the valve pins.

7.2 Startup

1. Turn on the mold cooling, and ensure that the water flow is correct.
2. Ensure that all mold surfaces are clean.
3. Ensure that the valve-gate air pressure is correct.
4. Turn on all manifold heats to 280°C (550°F).
5. When the manifold heats have reached their set point, turn nozzles on to 45% power. Wait 4-6 minutes for the nozzle heaters to come up to temperature.

CAUTION

Begin processing within 4-6 minutes of turning on the nozzles.

6. Use machine screen to determine when the all heats have reached their set points from the mold test, then proceed with mold startup.
7. Reduce the manifold heats and nozzle heats to specified temperatures.

CAUTION

Failure to follow the above procedure may result in leakage/damage occurring in the hot runner.

8. Check to ensure all preform quality is acceptable for production.

CAUTION

If, for any reason, plastic has not been injected for 20 minutes, the heater zones should be put in Stand-by Mode at 180°C (350°F) (or manifold and nozzles at 22% power). Failure to do so can result in degradation of the PET which can lead to burnt material in the parts and/or damage to the hot runner system.

7.3 Shutdown

1. Shift pins to closed position.
2. If system downtime is expected to be less than half an hour, switch manifold heater zones to standby mode at 180°C (350°F). Set nozzles to 20% power.

   If system downtime is expected to be more than half an hour, turn all manifolds and nozzles off.
3. When the Hot Runner temperature is below 100°C (212°F), turn off mold cooling and / or chiller.

CAUTION

Do not increase nozzle heater temperatures above 65% power at any time. Doing so can result in degradation of the PET which can lead to burnt material in the parts and/or mechanical damage to the Hot Runner components.

CAUTION

Do not increase the hot runner manifold temperature above 285°C ± 10°C (545°F ± 18°F) at any time. Doing so can result in degradation of the PET which can lead to burnt material in the part and / or damage to the Hot Runner components.

Section 8 - Maintenance

8.1 Introduction

This chapter is a guide to maintaining these selective Hot Runner components:

- Actuator seal and valve pin
- Nozzle components and band heater
- Manifold thermocouples

All other maintenance or repairs should be performed with the assistance of ***PET*** service personnel or at a ***PET*** service depot.

A recommended preventive maintenance schedule is supplied at the end of this section.

CAUTION

Always use the correct tool during disassembly and assembly. If a part resists removal, ensure you are using the correct tool and procedure.

Use penetrating oil and heat / cool parts as required.

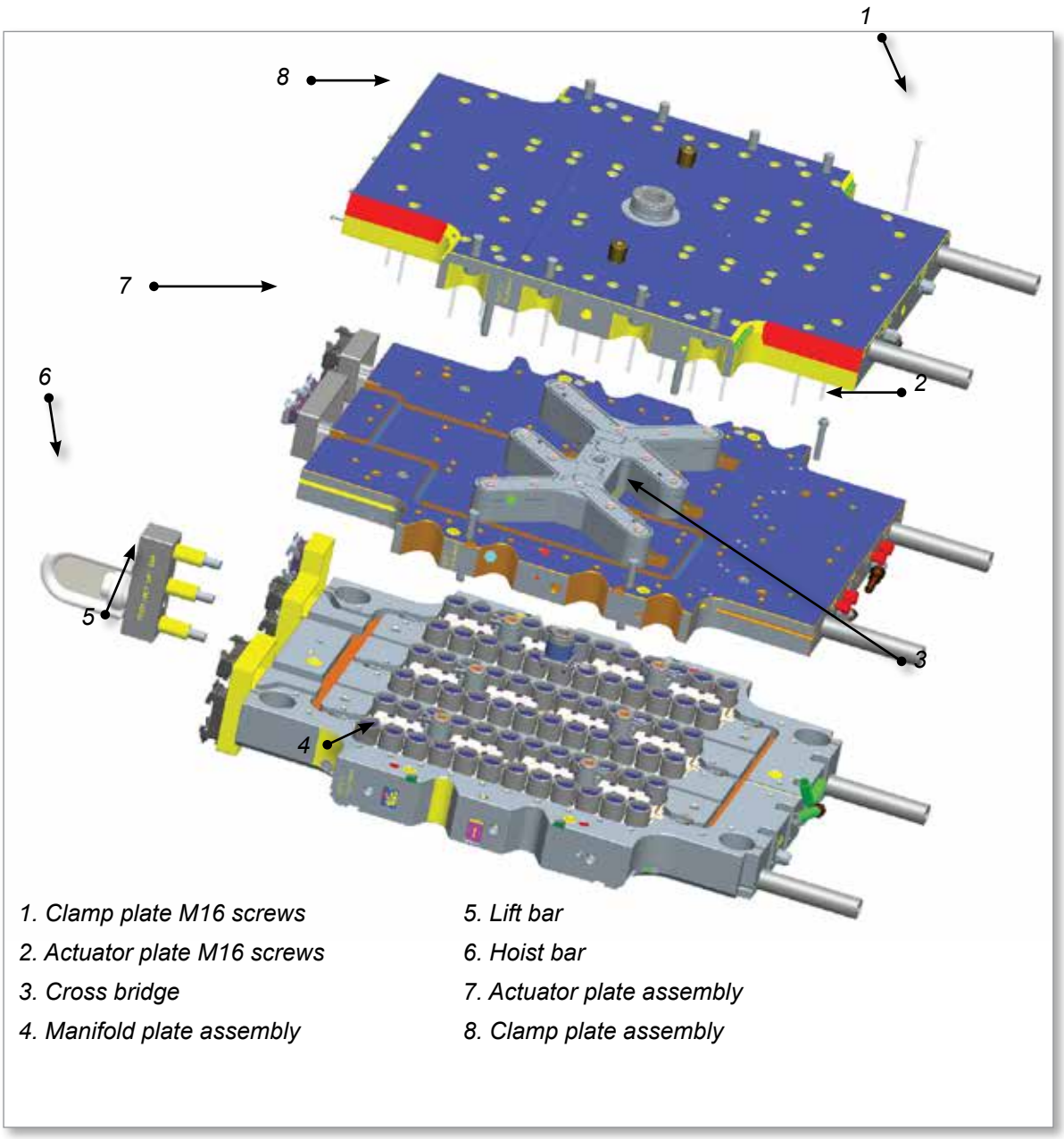
8.2 Manifold Plate

This procedure is done at cold condition.

WARNING

Before removing the hot half, lock out all power sources following proper lock out procedures.

Ensure all equipment, including cranes, chains, slings, eye bolts and lift rings are rated to the required load.
The use of improper material handling equipment can cause injury or death.

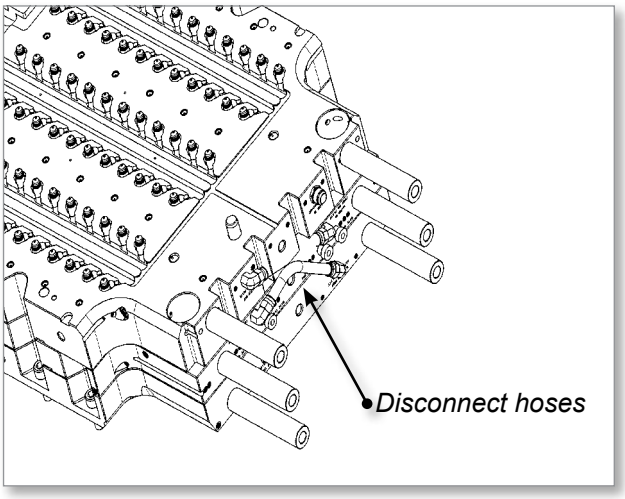


1. Clamp plate M16 screws
2. Actuator plate M16 screws
3. Cross bridge
4. Manifold plate assembly
5. Lift bar
6. Hoist bar
7. Actuator plate assembly
8. Clamp plate assembly

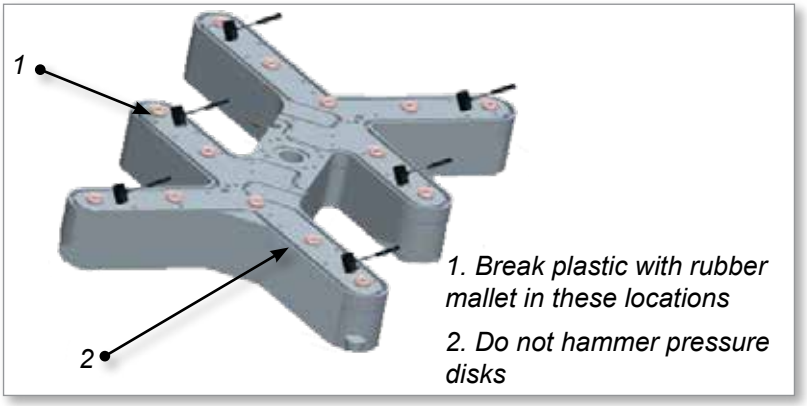
Figure 8-1 Hot half plate assembly

8.2.1 Accessing the Manifold Plate

1. Remove the hot half assembly from the machine.
2. Lay the hot half on a work bench with the clamp plate facing up.
3. Remove the hot half hoist ring and lift bar.
4. Disconnect mold electrical cables and hoses between the clamp plate, the actuator plate and the manifold plate.



5. Remove the M16 SHCSs (60) from the clamp plate.
6. Install lifting rings in the lift holes of the clamp plate and remove the clamp plate assembly.
7. Remove the M16 SHCSs (4) from the actuator plate.
8. Using a hard rubber hammer, break the plastic between the bridge and transfer link. Hammer the bridge only in the locations indicated below.



9. Gently tap the side of the bridge to confirm that the plastic is broken.

NOTE

The sound produced by broken plastic will be different from that of unbroken plastic.

10. Install lifting rings in the lift holes of the actuator plate and lift the actuator plate assembly. The manifold plate assembly is now accessible.

8.3 Maintenance of Valve-Disk Piston Assembly

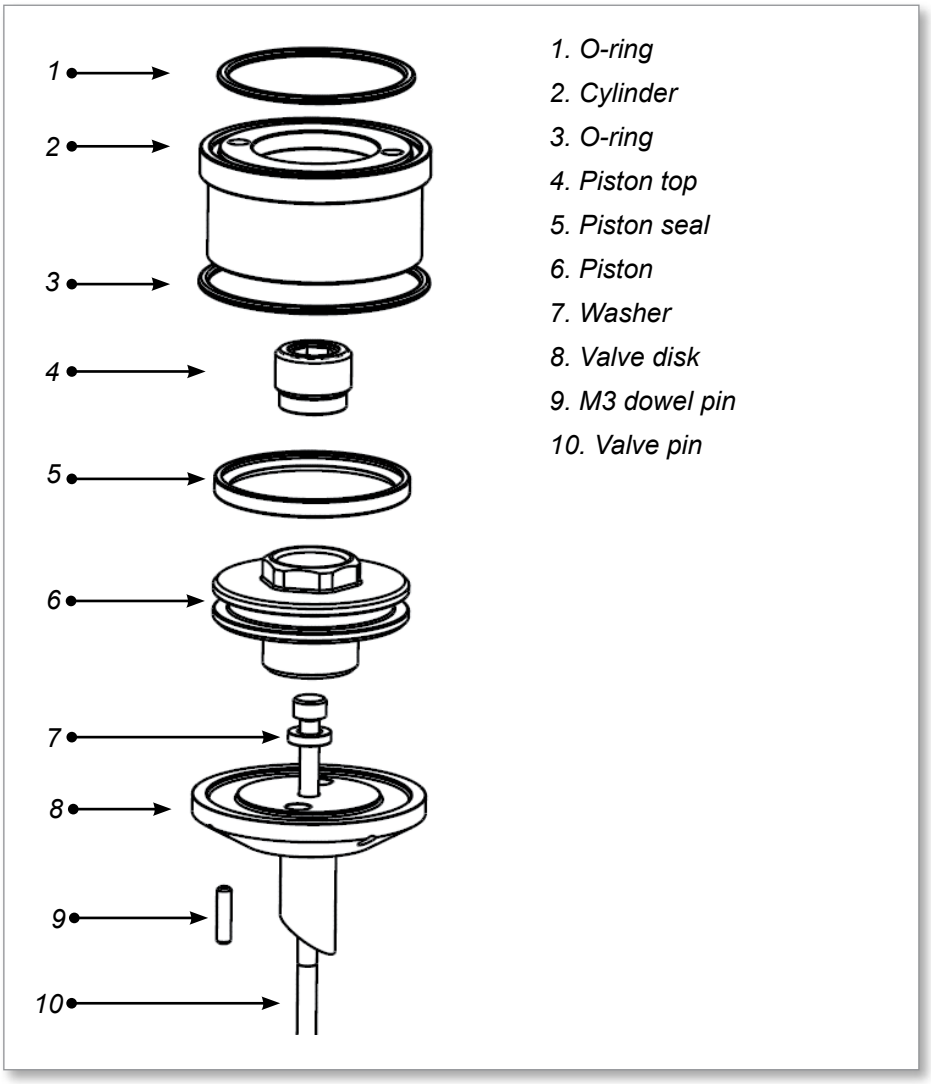


Figure 8-2 Valve-disk piston assembly

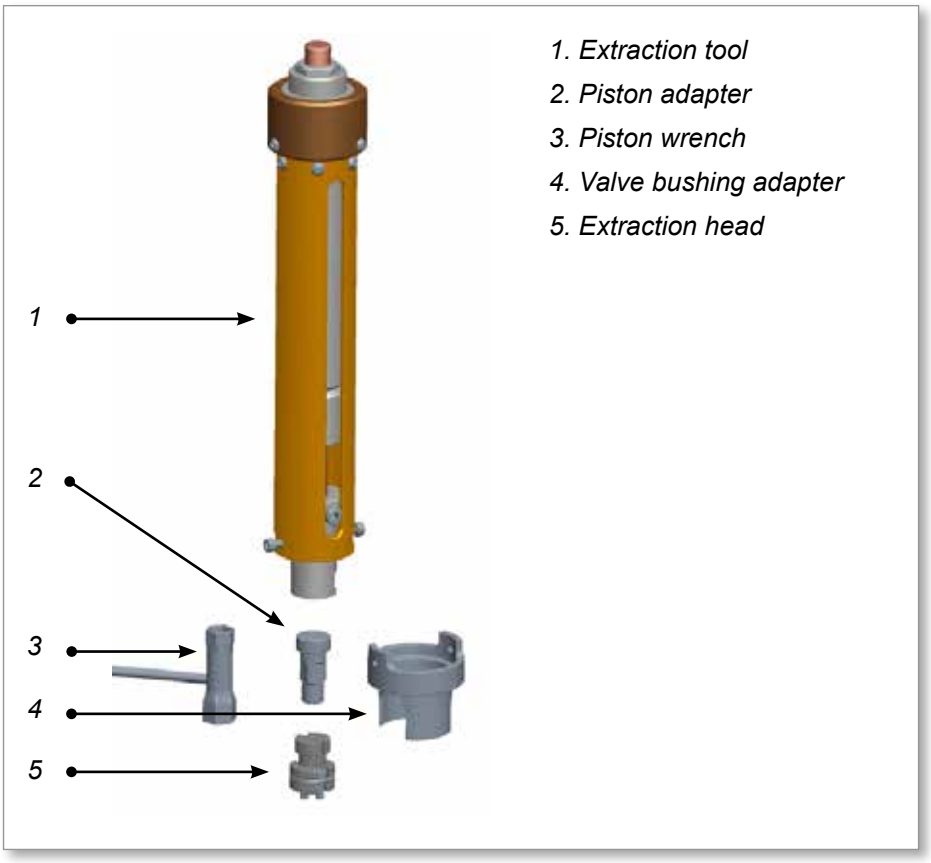
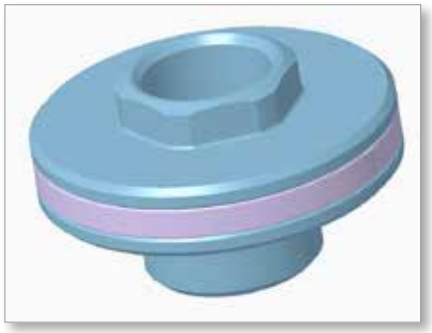


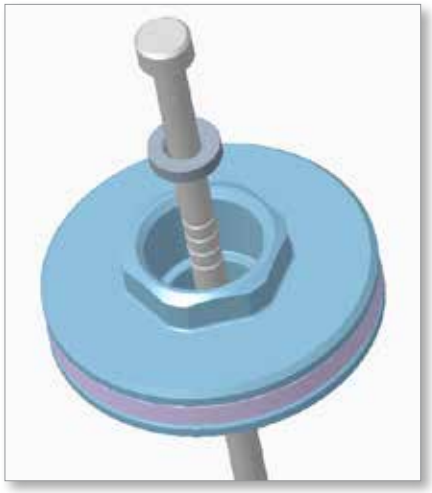
Figure 8-3 Extraction tools

8.3.1 Installing the Piston Cylinder

1. Install the piston seal in the piston bottom.



2. Assemble the washer and valve pin, and install them in the piston bottom.



CAUTION

Do not over-tighten the piston top.

3. Install the piston top in the piston bottom, and tighten to a torque of 145 N•m (107 ft-lb).

4. Make sure that the valve pin is floating in the radial direction.
5. Insert the piston assembly in the cylinder body.

6. Install the O-rings in the cylinder body.

7. Install the actuator assembly in the actuator plate.

8.3.2 Removing the Piston

1. Use the piston wrench and an Allen key to remove the piston top.

2. Use your hand to tighten the thread piston adaptor to the bottom of the piston.

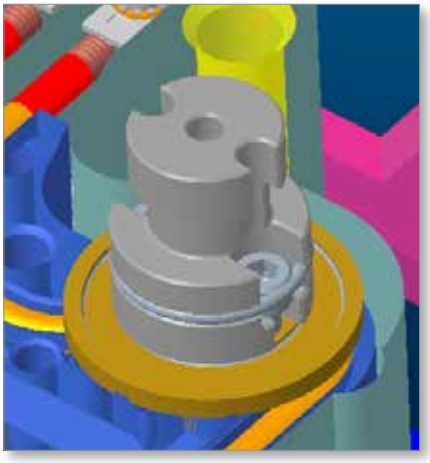
3. Install the valve bushing adapter in the extraction tool.

4. Install the extraction tool onto the extraction head so that the extraction tool's T-slot mates with the extraction head.

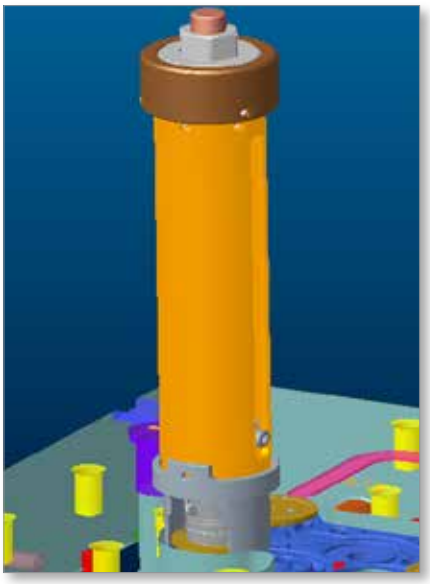
5. Raise the piston bottom and valve pin by turning the jack screw of the extraction tool.

8.3.3 Removing the Valve Bushing

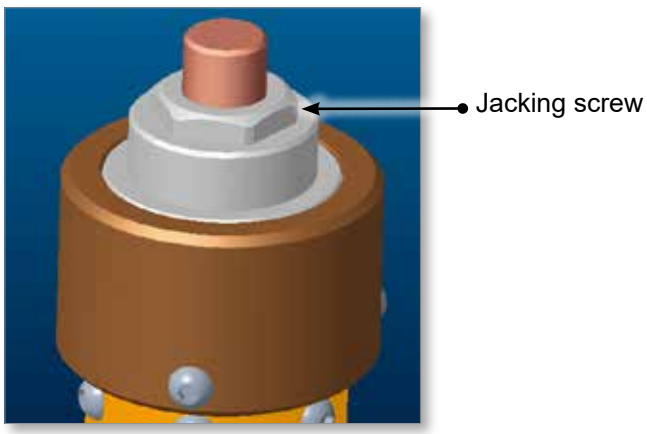
1. Install the extraction head onto the valve bushing, and secure the corresponding screws.



2. Install the extraction tool onto the extraction head so that the extraction tool's T-slot mates with that of the extraction head.

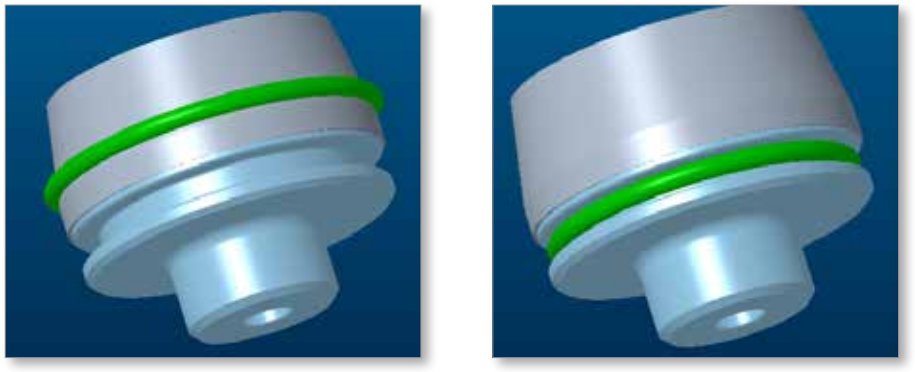


3. Raise the valve disk pin by turning the jacking screw on the extraction tool.

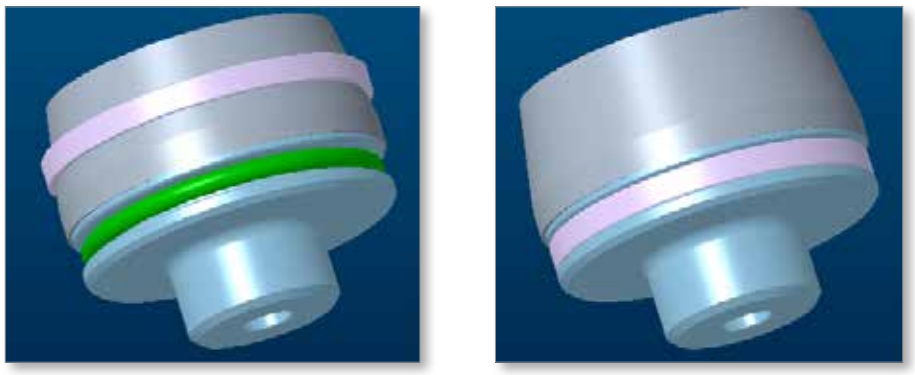


8.3.4 Installing a Seal

1. Install the inner ring on the piston by sliding it over the seal stretch tool.



2. Install the outer ring on the piston by sliding it over the seal stretch tool.



8.4 Nozzle Assembly Maintenance

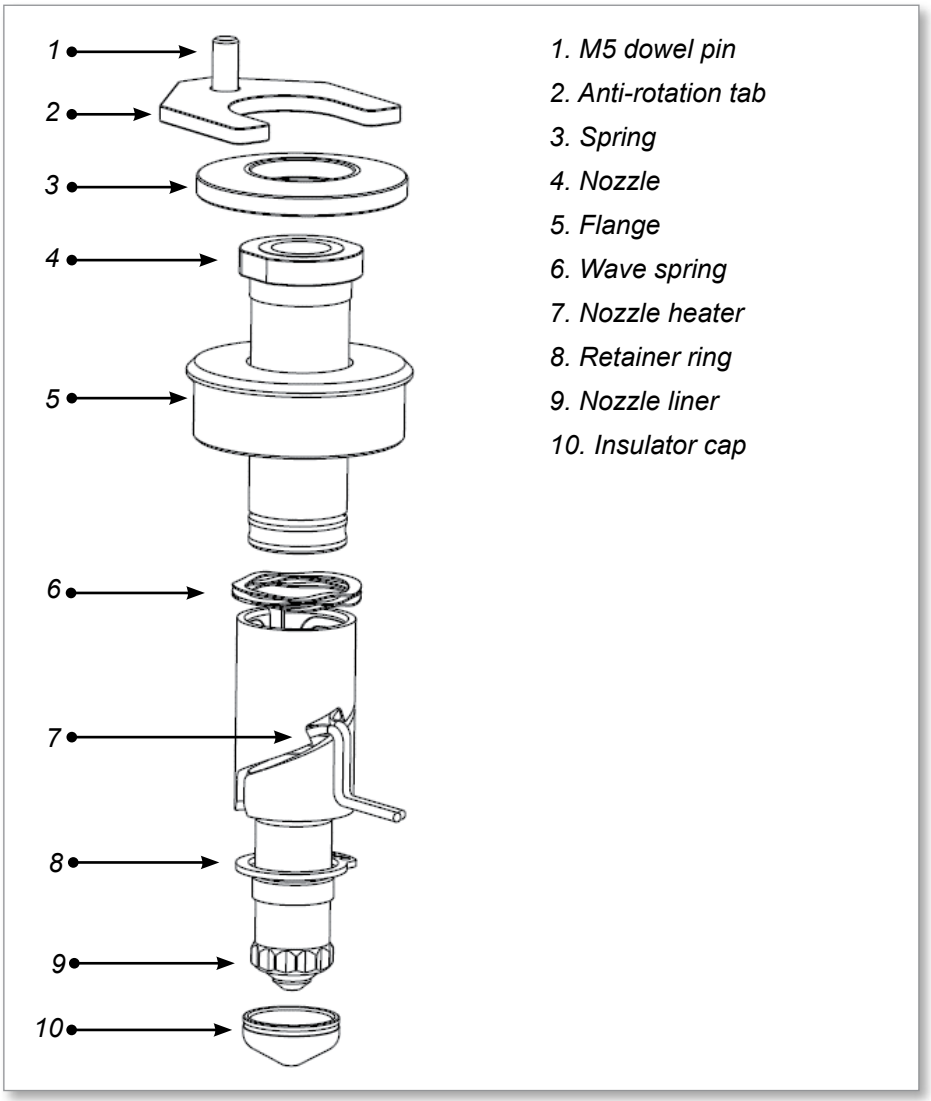


Figure 8-4 Nozzle components

Reasons to do gate seal maintenance:

- Nozzle liner wear or damage
- Obstruction to melt flow

8.4.1 Removing a Nozzle Liner

1. Slightly heat the nozzle so that the nozzle liner can be easily removed.
2. Remove the cavity plate to expose the nozzle liners.
3. Remove the insulator cap from the nozzle liner.

CAUTION

When heating the nozzle liner with a propane torch, do not overheat the nozzle liner.

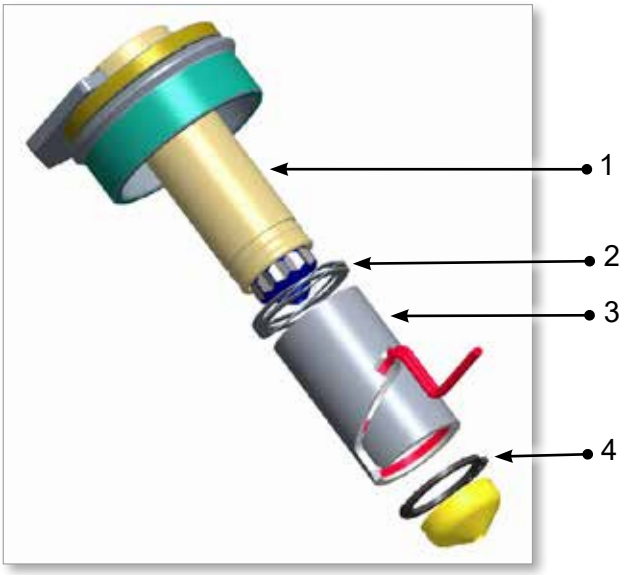
4. Use a 12-point (14 mm) socket wrench to remove the nozzle liner.

If the nozzle liner is difficult to remove, use a propane torch to slightly heat the gate well area to soften the melt.

8.4.2 Installing a Nozzle Liner

1. Remove all residual plastic from the nozzle threads and the tip/nozzle sealing surface.
2. Use a hardened tool and a 300-grit lapping compound to clean the tip/nozzle sealing surface in a circular manner.
3. Apply blue die-spotting compound to the surface of the nozzle liner, and check for proper mating.
4. After confirming good contact, remove the blue die-spotting compound.
5. Apply nickel-based anti-seize compound to the threads of the nozzle liner.
6. Install the nozzle liner onto the nozzle.
7. Use a 12-point (14 mm) socket wrench to tighten the nozzle liner to a torque of 41 N•m (30 ft-lb).
8. Install the insulator cap onto the nozzle liner.

8.5 Nozzle Heater Sleeve



1. Nozzle
2. Wave spring
3. Nozzle heater
4. Retainer ring

8.5.1 Removing a Nozzle Heater Sleeve

1. Remove the cavity plate to expose the heater sleeve.
2. Remove the retainer ring.

The spring should push up the sleeve.

3. Optional: If the sleeve is stuck, insert a small screwdriver in the slot to loosen it.
4. Remove the heater sleeve wire from the wire channel and the electrical connection, and remove the heater sleeve.

8.5.2 Installing a Nozzle Heater Sleeve

1. Install the spring.
2. Slide the heater sleeve over the spring.
3. Install the retainer ring.
4. Put the heater sleeve wire in the wire channel and connect it to the electrical connection.

8.6 System and Plate Screw Torques

CAUTION

A calibrated torque wrench must be used for system screws.

Quality (12.9 grade) and length of screws must be as specified on the general assembly drawing. Torque values presented here should be confirmed with the torque values in the General Assembly drawing.

Table 8-1 System Assembly Screw Torques

Metric			Imperial		
Screw	**Wrench Size (mm)**	**Torque Setting**	**Screw**	**Wrench Size (in.)**	**Torque Setting**
M5	4	7 Nm / 5 lb-ft	#10-32	5/32	7 Nm / 5 lb-ft
M6	5	14 Nm / 10 lb-ft	1/4-20	3/16	14 Nm / 10 lb-ft
M8	6	20 Nm / 15 lb-ft	5/16-18	1/4	20 Nm / 15 lb-ft
M10	8	40 Nm / 30 lb-ft	3/8-16	5/16	40 Nm / 30 lb-ft
M12	10	60 Nm / 45 lb-ft	1/2-13	3/8	60 Nm / 45 lb-ft
M16	14	145 Nm / 107 lb-ft	5/8-11	1/2	145 Nm / 107 lb-ft
M20	17	285 Nm / 210 lb-ft	3/4-10	5/8	285 Nm / 210 lb-ft

** Exception to the above - bridge manifold mounting screws should be torqued 1/3 higher than specified on general assembly drawing.*

Table 8-2 Plate Assembly Screw Torques

Metric			Imperial		
Screw	**Wrench Size (mm)**	**Torque Setting**	**Screw**	**Wrench Size (in.)**	**Torque Setting**
M5	4	10 Nm / 7 lb-ft	#10-32	5/32	9 Nm / 6 lb-ft
M6	5	16 Nm / 12 lb-ft	1/4-20	3/16	22 Nm / 16 lb-ft
M8	6	39 Nm / 29 lb-ft	5/16-18	1/4	48 Nm / 35 lb-ft
M10	8	77 Nm / 57 lb-ft	3/8-16	5/16	85 Nm / 63 lb-ft
M12	10	135 Nm / 100 lb-ft	1/2-13	3/8	209 Nm / 154 lb-ft
M16	14	330 Nm / 243 lb-ft	5/8-11	1/2	384 Nm / 283 lb-ft
M20	17	650 Nm / 479 lb-ft	3/4-10	5/8	678 Nm / 500 lb-ft
M24	19	See GA drawing	7/8-9	3/4	See GA drawing

Table 8-3 Nozzle-Liner Torque Setting

Nozzle Liner	41 Nm / 30 lb-ft

IMPORTANT

System plate screws should be tightened in a standard bolt pattern in a sequence starting from the center and moving outwards. The specified torque should be achieved in two steps (half torque and full torque).

Section 9 - Troubleshooting

9.1 Troubleshooting Matrix

Table 9-1 Troubleshooting Matrix

Problem Related to \ Defect	High AA Level	Black Specks	Bubbles	Burn Marks	Color Streaks	Yellow Preforms	Flash	Gate Crystallinity	Gate Depressions	Gate Flaking	Gate Void	Haze	HIgh IV Drop	Thickness Variation	Knit Line
Air pressure															
Water flow/temp/contamination									●		●				
Dryer air flow	●	●													
Dryer / resin temperature	●		●												
Dryer residence time	●		●												
Resin contamination		●													
Color mixer															
Robot alignment															
Stacks alignment							●								
Taper wear							●								
Gate insert (GI)											●				
Clearance between GI and valve pin															
Gate seal insulator											●				
Hot runner nozzle											●				
Valve pin											●				
Piston Seals															
Extruder temp	●	●	●	●			●								
Back pressure	●	●	●	●											
Transfer cushion	●														
Transfer speed	●														
Shot size (cushion)							●								
Screw speed	●	●	●	●											
Decompression stroke and time			●								●				
Hold pressure / time							●		●		●				
Injection speed				●			●								
Transition point							●								
Cooling time									●		●				
Hot runner manifold temperature	●			●							●				
Thermocouple	●	●		●											
Valve pin open or close delay											●				
Hot runner nozzle temperature		●		●							●				
Mold break											●				
Clamp force							●								
Mold opening speed															
Cycle time	●														
Injection time															

Table 9-2 Troubleshooting Matrix

Problem Related to \ Defect	Long Gate Vestige	Malformed Surface	Moisture Marks	P.L. Indentation	Peeling	Pulled Gate Vestige	Preform Buckling	Short Shot	Sink Marks	Splay Marks	Stringing	Surface Blemishes	Unmelts	White Spot
Air pressure	●													
Water flow/temp/contamination					●	●			●		●			
Dryer air flow														
Dryer / resin temperature														
Dryer residence time									●					
Resin contamination														
Color mixer														
Robot alignment									●					
Stacks alignment														
Taper wear														
Gate insert (GI)					●	●								
Clearance between GI and valve pin					●									
Gate seal insulator	●				●									
Hot runner nozzle	●				●	●								
Valve pin	●				●									
Piston Seals	●													
Extruder temp									●					
Back pressure														
Transfer cushion														
Transfer speed														
Shot size (cushion)									●					
Screw speed														
Decompression stroke and time					●	●			●					
Hold pressure / time	●				●	●			●					
Injection speed									●					
Transition point									●					
Cooling time					●	●			●					
Hot runner manifold temperature	●													
Thermocouple														
Valve pin open or close delay									●					
Hot runner nozzle temperature	●				●	●					●			
Mold break						●								
Clamp force														
Mold opening speed						●								
Cycle time														
Injection time														

9.2 Common Defects

9.2.1 High Acetaldehyde (AA) Level

Part Quality Defect

Thermal degradation of the PET resin

Possible Solutions:

1. Check the thermocouples on the mold, extruder and dryer.
2. Check the resin quality.
3. Reduce the dryer temperature.
4. Reduce the residence time in the dryer.
5. Increase the dew point by reducing the air flow in the dryer.
6. Check the extruder throat cooling.
7. Reduce the extruder temperature.
8. Check the heat settings of the hot runner. Reduce if necessary.
9. Reduce the back pressure.
10. Reduce the screw speed.
11. Reduce the hot runner manifold temperature.
12. Reduce the transfer speed and transfer cushion.
13. Reduce residence time in the extruder by reducing cycle time.

9.2.2 Black Specks (Contamination)

Part Quality Defect

Black particles that occur randomly in the preform

Possible Solutions

1. Check the thermocouples on the hot runner, extruder and dryer.
2. Check the dryer condition.
3. Check the resin quality.
4. Reduce the extruder temperature.
5. Reduce the hot runner manifold temperature.
6. Reduce the hot runner manifold temperature.
7. Reduce the screw speed and the back pressure.
8. Check the injection time, and adjust the speed if necessary.
9. Reduce the temperature during the extruder standby.

9.2.3 Bubbles

Part Quality Defect

Bubble(s) in any part of the preform

Possible Solutions

1. Increase the extruder temperature.
2. Increase the screw speed and the back pressure.
3. Check the residence time and the temperature of the dryer.
4. Decrease the decompression by decreasing the pullback stroke and the pullback dwell time.
5. Make sure that the resin flow of the feeding zone is constant.

9.2.4 Burn Marks

Part Quality Defect

Black marks and streaks in the gate area

Possible Solutions

1. Check all the temperature readings.
2. Check the thermocouples on the extruder and the hot runner.
3. Decrease the extruder temperature.
4. Decrease the hot runner manifold temperature.
5. Decrease the hot runner nozzle temperature.
6. Check the water cooling temperature and the flow.
7. Decrease the screw speed and the back pressure.
8. Decrease the injection speed.
9. Decrease the temperature during extruder standby.

9.2.5 Color Streaks

Part Quality Defect

Color streaks in the preform body

Possible Solutions

1. Make sure that the color feeder is dosing color correctly.
2. Make sure that no clogging has occurred.
3. Increase the transfer cushion by increasing the extruder position.
4. Increase the screw speed and the back pressure.
5. Increase the extruder temperature.
6. Make sure that the color mixer rotates continuously.

9.2.6 Degradation (Yellow Preforms)

Part Quality Defect

An abnormal yellow tint or discoloration throughout the entire preform

Possible Solutions

1. Check the resin dryer for proper operation: airflow, hopper residence time, and temperature (resin dependent).
2. Reduce the temperature of the hot runner.
3. Reduce the machine temperature settings.
4. Reduce the shear heat by reducing the screw speed, back pressure, and/or transfer/injection rate.
5. Minimize heat up times during start-ups.
6. Purge the barrel and shooting pot prior to start-up. Make sure that all discolored resin is flushed out.
7. During system shutdowns, purge the extruder barrel and shooting pot completely, and immediately reduce machine heats.
8. During system shutdowns, immediately turn off the hot runner nozzle heats. Then turn off the manifold heats, and keep the chilled water flowing through the mold until the hot runner manifold temperature dropped below 100°C.
9. Check the resin supply for degradation such as discoloration and reduced IV.
10. Make sure that the regrind supply is not overdried, discolored. or sticking to virgin resin pellets.

9.2.7 Flash

Part Quality Defect

A thin plastic protrusion (flash) at the parting lines

Possible Solutions

1. Reduce the shot size.
2. Increase the injection time.
3. Increase the transition point.
4. Make sure that there is no debris in the mold.
5. Reduce the hold pressure.
6. Reduce the injection speed to reduce the injection pressure.
7. Check the Stack / mold alignment.
8. Check for part interference during closing (e.g., tonnage block, leader pin, taper lock, and bolt.).
9. Check for any part damage (e.g., taper wear).
10. Increase the clamp force. (Do not exceed the maximum allowable clamp tonnage.)
11. Modify the extruder temperature according to the PET characteristics.
12. Check for parting line damage (if the mold has been flashed).

9.2.8 Gate Crystallinity

Part Quality Defect

White crystalline formations appearing in the preform gate area. Commonly found throughout the entire wall cross section, in the interior wall section, close to the core cap surface, and as a streak extending from the gate area into the preform body.

Possible Solutions

1. Increase the temperatures of the hot runner nozzles.
2. Optimize the dry cycle time of the machine.
3. Decrease the temperatures of the hot runner nozzles.
4. Make sure that the temperature, flow, and pressure of the mold chilled-water supply are proper.
5. Make sure that the water channels of the mold gate insert are free of contamination and blockages.
6. Make sure that the hot runner nozzle heater does not touch the gate insert.
7. Reduce the injection fill rate in order to reduce the melt shear heat in the gate seal / gate passage.
8. Make sure that the preform in the robot take-out tube contacts the spherical base insert.
9. Increase the preform cooling time.
10. Open the valve gates earlier prior to injection.
11. Increase the valve-gate open time after hold (preform gate quality permitting).
12. Reduce the hold pressure.
13. Increase the decompression by increasing the pullback stroke.
14. Increase the decompression by increasing the pullback dwell time.
15. Make sure that the hot runner nozzles and gate area are free of contamination and blockages.
16. Make sure that the valve pin is opening correctly.

9.2.9 Gate Depressions

Part Quality Defect

The outer surface of the preform gate / dome has indentations that are usually in a circular pattern. They may be smooth or wrinkled in appearance.

Possible Solutions

1. Check the flow rate and the temperature of the cooling water.
2. Increase the preform cooling time.
3. Decrease the hold time.
4. Increase the transition point.

9.2.10 Gate Flaking

Part Quality Defect

A portion of the gate vestige that remains trapped between the gate insert land and the valve pin is injected into the cavity in the next cycle. It appears as a torn crystalline vestige or a flake molded into the dome wall section of the preform.

Possible Solutions

1. Examine the hot runner valve pin and the gate insert for wear, and replace if necessary.
2. Examine the gate seal insulator and the gate seal for deformation and wear, and replace if necessary.
3. Increase the temperatures of the hot runner nozzles to melt the preform gate vestige to enable easier separation and correct valve gate shut off.
4. Decrease the hold pressure in order to decrease the cooling rate and melt pressure in the gate well area.
5. Increase the decompression by increasing the pullback stroke and/or the pullback dwell time to decrease the cooling rate and the melt pressure in the gate well area.
6. Adjust the valve-pin close-delay timer.

9.2.11 Gate Void (Pin Hole)

Part Quality Defect

A small hole on the gate nub or just below the gate nub

Possible Solutions

1. Check the flow and temperature of the cooling water.
2. Examine the valve pin, gate insert, nozzle, and gate seal insulator for wear and damage.
3. Reduce the mold break.
4. Increase the last hold pressure/time to favor cooling.
5. Decrease or increase the temperature of the hot runner nozzles.
6. Increase the cooling time.
7. Decrease the pullback stroke and pullback dwell time to prevent melt draw away.
8. Reduce the valve-pin close delay.
9. Increase the hot runner manifold temperature to favor the valve pin closing.
10. Check all the temperature readings and correct if necessary.
11. Check the compressed air of the valve gate.

9.2.12 Haze

Part Quality Defect

A cloudy white appearance in the preform body. It can be circumferential white streaks or localized cloudiness in thick wall sections of the preform.

Possible Solutions

1. Make sure that the dryer is operating correctly.
2. Make sure that the moisture level at the machine extruder throat is less than 50 ppm.
3. Make sure that the temperature (resin dependent), airflow, dewpoint, and hopper residence time of the resin dryer are correct.
4. Make sure that the dryer is operating correctly.
5. Make sure that the temperature (resin dependent), airflow, and hopper residence time of the resin dryer are correct.
6. Check for preferential resin-flow channeling in the hopper.
7. Increase the screw back pressure.
8. Check for resin bridging in the extruder feed zone. If necessary, clear the bridging and reduce the temperature of the extruder feed zone.
9. Increase extruder temperatures.
10. Increase the back pressure to increase the shear heating.
11. Increase the screw speed to increase the shear heating
12. Increase the screw back position in order to increase the screw cushion. (Generally the screw cushion is 10–20 mm.)
13. Make sure that the pressure, flow, and temperature of the water cooling system are correct.
14. Make sure that the mold cooling channels are free from contamination and blockages.
15. Increase the cooling time.

9.2.13 High Intrinsic-Viscosity (IV) Drop

IV is directly related to the physical properties of the molded preform and bottle, and therefore any loss of IV can lower product quality.

Possible Solutions

1. Make sure that the moisture level of the resin at the throat of the machine extruder is less than 50 ppm.
2. Make sure that the airflow, dewpoint, hopper residence time, and temperature (resin dependent) of the dryer are correct.
3. Decrease machine temperatures.
4. Decrease the screw speed and back pressure to decrease shear heating.
5. Decrease the transfer/injection rates to decrease the shear heating.
6. Keep the screw cushion to a minimum. (Generally the screw cushion is 10–20 mm.)
7. Decrease the cycle time to decrease the melt residence time.
8. Decrease the hot runner temperatures.
9. Measure the IV of the resin supply before and after drying.

9.2.14 High Wall-Thickness Variation

Part Quality Defect

There is variation in the wall thickness around the preform circumference.

Possible Solutions

1. Decrease the injection fill pressure.
2. Decrease the injection fill speed.
3. Decrease the hold pressure.
4. Decrease the hold time.
5. For better melt uniformity, make sure that the temperatures of the hot runner are similar to the machine temperatures, especially the shooting pot, distributor, and hot runner zones.
6. Make sure there are no worn mold components: neck rings, locking rings, cavity tapers, leader pins, bushings, and others.
7. Make sure there are no damaged cores.
8. Examine the level of the mold core and cavity halves. If necessary, adjust the machine level and/or platen parallelism.
9. Make sure that the mold core half is aligned to the cavity half.
10. Examine the core cooling tube for correct centering, straightness, and position.
11. Make sure that the core cooling tube and channel are free of contamination and blockages.

9.2.15 Knit Line (Weld Line)

Part Quality Defect

A microscopic groove that forms when two flow fronts converge but do not bond together, which creates a minute indentation along the interface at this boundary. Usually observed where the melt paths join around a thread vent blade up to the top sealing surface of a neck finish.

Possible Solutions

1. Increase the injection speed.
2. Increase the injection pressure.
3. Increase the hold speed.
4. Increase the hold pressure.
5. Increase the temperature of the mold chilled water. (Note: This may affect the preform quality and molding cycle time.)
6. Clean the mold neck ring and the locking ring vents.
7. Make sure that the mold vent size agrees with the drawing dimensions.
8. Make sure that the ambient dew point in the molding area is less than the temperature of the mold chilled water.
9. Increase the temperature of the mold chilled water to more than the ambient dew point in the molding area to prevent condensation. (Note: This may affect the preform quality and molding cycle time.)
10. Examine the mold cavity plate at the cavity and gate inserts for water leaks, and repair if necessary.
11. Examine the locking rings, nick rings, and neck ring slides of the mold core side for water leaks, and repair if necessary.
12. Examine the hose and fitting connections on the supply and return manifold and the neck ring slides for water leaks, and repair if necessary.
13. Make sure that the molding surfaces are free of contamination: mold spray residue, flash particles, and others.

9.2.16 Long Gate Vestige

Part Quality Defect

An elongated gate on a preform that appears as a melt protrusion

Possible Solutions

1. Check for foreign matter in the nozzle.
2. Check the valve pin for damage.
3. Check the piston seals of the valve pin for damage.
4. Make sure that the air pressure of the valve gate is correct, and clean the filter.
5. Check the gate seal insulator for damage.
6. Decrease the hold pressure / time to decrease the cooling rate and the melt pressure in the gate well area.
7. Increase the pullback stroke and the pullback dwell time to reduce the pressure in the preform.
8. Increase the hot runner manifold temperature to favour the valve pin closing.
9. Increase or decrease the temperature of the hot runner nozzles.

9.2.17 Malformed Top-Sealing Surface

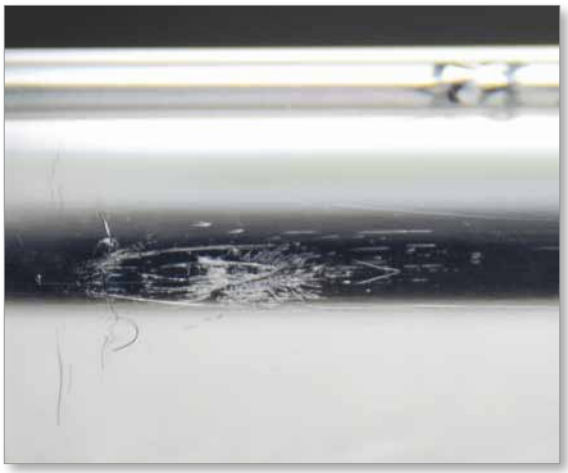
Part Quality Defect

The top sealing surface of the preform is not fully formed. This is usually seen as a glossy sink on or adjacent to the top sealing surface.

Possible Solutions

1. Make sure that the mold neck ring and the locking ring vents are clean.
2. Make sure that the sizes of the mold vents agree with the drawing dimensions.
3. Set the clamp tonnage to the minimum permitted by the process.

9.2.18 Moisture Marks



Part Quality Defect

Circumferential rings appear on the inner and/or outer surfaces of the preform. The rings are usually seen as clear ridges having an elliptical shape.

Possible Solutions

1. Make sure that the ambient dew point in the molding area is less than the temperature of the mold chilled water.
2. Increase the temperature of the mold chilled water to more than the ambient dew point in the molding area to prevent condensation. (Note: This may affect the preform quality and molding cycle time.)
3. Examine the mold cavity plate at the cavity and gate inserts for water leaks, and repair if necessary.
4. Examine the locking rings, nick rings, and neck ring slides of the mold core side for water leaks, and repair if necessary.
5. Examine the hose and fitting connections on the supply and return manifold and the neck ring slides for water leaks, and repair if necessary.

9.2.19 Parting Line Indentation

Part Quality Defect

A circumferential indent on the outer diameter of the preform at the neck ring / cavity parting line because of deformation when opening the mold.

Possible Solutions

1. Decrease the hold pressure.
2. Increase the injection transition position.
3. Decrease the shot size.
4. Increase the pullback stroke to increase the decompression.
5. Increase the pullback dwell time to increase the decompression.
6. Extend the valve-gate open timer after hold.
7. Increase the preform cooling time.
8. Make sure that the flow, pressure, and temperature of the water cooling system are correct.
9. Make sure that the mold cooling channels are free of contamination and blockages.

9.2.20 Peeling

Part Quality Defect

A torn section on the external surface of the preform, starting from the gate nub extending outward toward the hemispherical area. The torn section sticks on the molding surface of the gate insert and can remain for several cycles.

Possible Solutions

1. Check the gate insert, gate seal insulator, valve pin, and gate seals for any wear or damage and replace if necessary.
2. Check the clearance between the valve pin and the gate insert.
3. Check for an oval gate hole.
4. Make sure that the water cooling and the flow are correct.
5. Check the water channel for contamination.
6. Decrease the cooling rate at the preform tip.
7. Decrease the hold pressure/time to decrease the cooling rate and the melt pressure in the gate well area.
8. Increase the hot runner nozzle temperature to increase the melt in the gate well area.
9. Increase the decompression to decrease the cooling rate in the gate well area.
10. Increase the cooling time to increase the dome solidification and break the gate vestige during mold opening.
11. Make sure that the pressure of the compressed air of the valve gate is not below 7.6 bar (110 psi).

9.2.21 Pulled Gate Vestige

Part Quality Defect

An elongated gate on a preform that appears as a stretched crystalline vestige

Possible Solutions

1. Check the flow and temperature of the cooling water.
2. Decrease the mold break to zero.
3. Increase the mold opening speed.
4. Increase the last hold pressure to favor cooling.
5. Decrease the hot-runner nozzle temperature.
6. Increase the cooling time.
7. Decrease the pullback stroke and pullback dwell time to prevent melt draw away.

9.2.22 Preform Buckling

Part Quality Defect

The preform body collapses during ejection, usually at the thickest and hottest part of the wall section.

Possible Solutions

1. Make sure that the flow, pressure, and temperature of the water cooling system are correct.
2. Make sure that the mold cooling channels are free of contamination and blockages.
3. Increase the cooling time.
4. Increase the hold pressure.
5. Increase the hold time.
6. Decrease the machine temperatures.
7. Decrease the hot runner temperatures.
8. Decrease the hold pressure.
9. Make sure that the ambient dew point in the molding area is less than the temperature of the mold chilled water.
10. Increase the temperature of the mold chilled water to more than the ambient dew point in the molding area to prevent condensation. (Note: This may affect the preform quality and the molding cycle time.)

9.2.23 Short Shot

Part Quality Defect

A not fully filled preform from a completed injection cycle. It is usually seen as an underdeveloped thread section in the preform neck area and a decreased preform weight.

Possible Solutions

1. Increase the shot size.
2. Decrease the transition position.
3. Increase the hold time.
4. Increase the hold pressure.
5. Increase the injection speed.
6. Increase the injection pressure.
7. Increase the melt temperature to reduce the melt viscosity.
8. Make sure that the resin and preform have a correct IV.
9. Increase the hot runner manifold temperatures.
10. Increase the hot-runner nozzle temperatures.
11. Increase the machine temperatures.
12. Examine the hot runner gate seal for contamination, and clean if necessary.
13. Examine the valve pin for damage, and replace if necessary.
14. Examine the valve-pin piston seals for damage, and replace if necessary.
15. Increase the hot runner manifold temperature to allow increased valve pin movement.
16. Make sure that the air pressure of the valve pin is correct.
17. Examine the air mufflers of the valve gate for blockages, and clean or replace if necessary.
18. Clean the mold vents.
19. Make sure that the sizes of the mold vents agree with the drawing dimensions.

9.2.24 Sink Marks

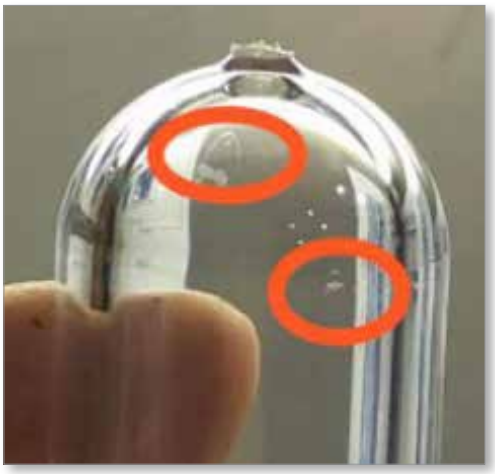
Part Quality Defect

Sink marks are depressions on the internal and/or external preform surfaces.

Possible Solutions

1. Check the mold cooling temperature and the flow.
2. Check the valve pin motion.
3. Make sure that the compressed air of the valve gate is sufficient.
4. Check the temperature and the residence time of the resin.
5. Check the robot and the *iChill* alignment.
6. Increase the hold time / pressure.
7. Increase the cooling time.
8. Reduce the injection speed.
9. Maintain a cushion of 5-8 mm on the plunger.
10. Decrease the transition point.
11. Reduce the extruder temperature.

9.2.25 Splay Marks



Part Quality Defect

Flow disturbances on the surface of the preform that appear as longitudinal or hooked, silvery white streaks flowing away from the gate

Possible Solutions

1. Make sure that the dryer is operating correctly.
2. Decrease the hot-runner nozzle temperatures.
3. Decrease the hot-runner manifold temperatures.
4. Decrease the machine temperatures.
5. Decrease the screw speed, back pressure, and/or transfer/injection rate to decrease the shear heating in the extruder.
6. Keep the hot runner heat-up time to a minimum.
7. Make sure that all discolored resin is purged from the barrel and the shooting pot before start-up.
8. Examine the hot-runner gate seal for damage that could create hang-up spots for the melt.
9. Examine the gate seal insulator and gate insert area for damage that could create hang-up spots for the melt.
10. Increase the screw back pressure.
11. Examine the resin supply for degradation, and replace if necessary.
12. Examine the extruder feed zone for plastic bridging. If necessary, clear the bridging, and reduce the temperature of the extruder feed zone.
13. Decrease the pullback stroke and/or pullback dwell time to decrease the decompression.

9.2.26 Stringing

Part Quality Defect

Hair-like strands that protrude from the gate nub

Possible Solutions

1. Check the flow and temperature of the cooling water.
2. Increase the preform cooling time.
3. Decrease the hold time.
4. Make sure that the hot runner heat settings are correct.

9.2.27 Surface Blemishes (Scratches)

Part Quality Defect

Random marks that appear as elliptical blemishes, scratches, and irregular impressions, or recurring marks that appear as longitudinal scratches or irregularities on the surface of the preform

Possible Solutions

1. Keep to a minimum the handling and transferring of preforms after robot ejection.
2. Keep to a minimum the distance the preforms fall from the robot to the conveyor.
3. Decrease the robot ejection force.
4. Increase the preform cooling time to reduce the preform surface temperature and sensitivity to damage.
5. Make sure that the flow, pressure, and temperature of the water cooling system are correct.
6. Make sure that the mold cooling channels are free of contamination and blockages.
7. Make sure that the cooling channels of the takeout plate tube of the robot are free of contamination and blockages.
8. Increase the cooling time.
9. Increase the cooling dwell time in the robot takeout plate.
10. Examine the molding surfaces for damage, and repair or replace if necessary.
11. Examine the molding surfaces for contamination, and clean if necessary.
12. Examine the molding surfaces for contamination, and clean if necessary.
13. Make sure that the mold core half and the cavity half are aligned.
14. Examine the level of the mold core and cavity halves, and adjust the machine level and/or platen parallelism if necessary.
15. Examine the robot takeout tubes for surface damage, and repair if necessary.
16. Examine the robot takeout tubes for interference when the preforms are ejected, and align if necessary.

9.2.28 Unmelts

Part Quality Defect

Resin pellets in the preform body that are fully or partially unmelted

Possible Solutions

1. Make sure that the airflow, hopper residence time, and temperature (resin dependent) of the dryer are correct.
2. Examine the hopper for preferential resin-flow channeling.
3. Examine the hopper infeed hose for irregularities.
4. Examine the resin for any discoloration (degradation).
5. Do a DSC analysis of the unmelted pellets in the preform body to measure the melting point and the crystallinity level.
6. Compare the size and uniformity of the pellets with the manufacturer's specifications.
7. Increase the screw back pressure.
8. Examine the extruder feed zone for plastic bridging, and remove any bridging that you find.
9. Reduce the temperature of the extruder feed zone, if necessary.
10. Increase the extruder temperatures.
11. Increase the back pressure to increase the shear heating.
12. Increase the screw speed to increase the shear heating.
13. Increase the screw back position to increase the screw cushion. (The screw cushion is generally 10–20 mm.)

9.2.29 White Spot in the Neck Finish

Part Quality Defect

There are two types of white spots commonly found in preform neck finishes:

- A crystalline spot that appears in the tamper-proof band
- A crystalline spot that appears in the support ring

Possible Solutions

White Spot in Tamper-proof Band

1. Increase the injection rate.
2. Decrease the injection transition position.
3. Increase the first hold-pressure zone.
4. Increase the machine temperature.
5. Increase the hot runner temperatures.
6. Increase the hot-runner nozzle temperatures.
7. Increase the back pressure and/or the screw speed to increase the extruder shear heating.
8. Clean the mold vents.
9. Make sure that the sizes of the mold vents agree with the drawing dimensions.

White Spot in the Support Ring

1. Decrease the injection fill rate.
2. Clean the mold vents.
3. Make sure that the sizes of the mold vents agree with the drawing dimensions.
4. Decrease the melt temperature to keep the vent clogging to a minimum.

Index

T

U

W

NORTH AMERICA

CANADA (Global HQ)
tel: +1 905 877 0185
e: canada@moldmasters.com

U.S.A.
tel: +1 248 544 5710
e: usa@moldmasters.com

SOUTH AMERICA

BRAZIL (Regional HQ)
tel: +55 19 3518 4040
e: brazil@moldmasters.com

MEXICO
tel: +52 442 713 5661 (sales)
e: mexico@moldmasters.com

EUROPE

GERMANY (Regional HQ)
tel: +49 7221 50990
e: germany@moldmasters.com

UNITED KINGDOM
tel: +44 1432 265768
e: uk@moldmasters.com

AUSTRIA
tel: +43 7582 51877
e: austria@moldmasters.com

SPAIN
tel: +34 93 575 41 29
e: spain@moldmasters.com

POLAND
tel: +48 669 180 888 (sales)
e: poland@moldmasters.com

CZECH REPUBLIC
tel: +420 571 619 017
e: czech@moldmasters.com

FRANCE
tel: +33 (0)1 78 05 40 20
e: france@moldmasters.com

TURKEY
Tel: +90 216 577 32 44
e: turkey@moldmasters.com

ITALY
tel: +39 049 501 99 55
e: italy@moldmasters.com

INDIA

INDIA (Regional HQ)
tel: +91 422 423 4888
e: india@moldmasters.com

ASIA

CHINA (Regional HQ)
tel: +86 512 86162882
e: china@moldmasters.com

KOREA
tel: +82 31 431 4756
e: korea@moldmasters.com

SINGAPORE
tel: +65 6261 7793
e: singapore@moldmasters.com

JAPAN
tel: +81 44 986 2101
e: japan@moldmasters.com

www.moldmasters.com