

Mould Design Recommendations for Hot Runner Applications



smart hot runner solutions

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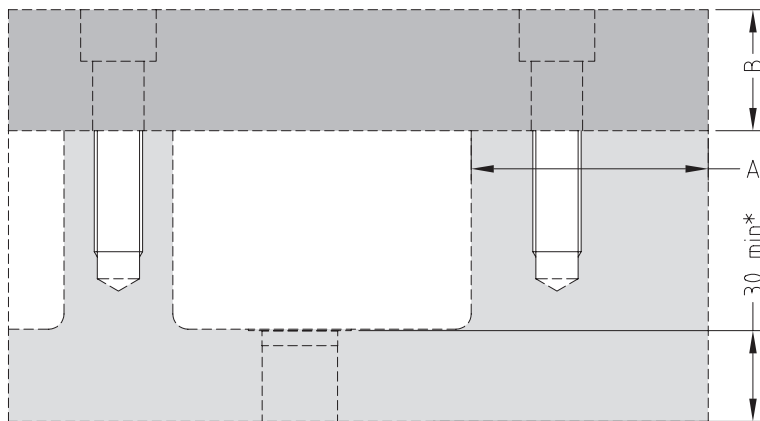
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Introduction

This information is provided to ensure the successful design and manufacture of a mould using a Mastip Hot Runner System. It contains comprehensive details relating to plate design and critical dimensions. Refer to system approval drawings supplied by Mastip for application specific dimensions. A check sheet is provided with the system approval package. The check sheet is to be filled in by the authorised Mastip installer and returned to Mastip along with the signed approval drawing where it is reviewed by a Mastip design engineer.

→ Refer www.mastip.com for additional copies of the check sheet.

1.0 Plate Requirements



*max 40mm for MJ09

Minimum Plate Requirements		
Manifold Plate Size (mm)	B = Minimum Back Plate Thickness (mm)	Minimum Bolt Size
< 500 x 500	40	M12
500 x 500	50	M16
< 800 x 800	50	M16
> 800 x 800	55	M20

Manifold and Back Plate Material

- High strength material must be used for the plates.
- Minimum plate material is 1.2311/1.2312, 30HRC, 800MPa Yield Strength.

Manifold and Back Plate Thickness

- The minimum recommended back plate thickness is 40mm which should increase as plate sizes increase.
- The minimum manifold plate material required below the nozzle head is 30mm. The material below the nozzle head should increase as the manifold pocket size increases to ensure system rigidity.

Clamping

- Sufficient clamping between the back plate and manifold plate is required to prevent the plates from being forced apart through thermal expansion of the hot runner system and to resist injection pressure.
- A minimum of 2 bolts per drop positioned as close to the drop positions as possible. High tensile grade bolts (12.9) must be used and sized according to the system size.

Minimum Plate Size

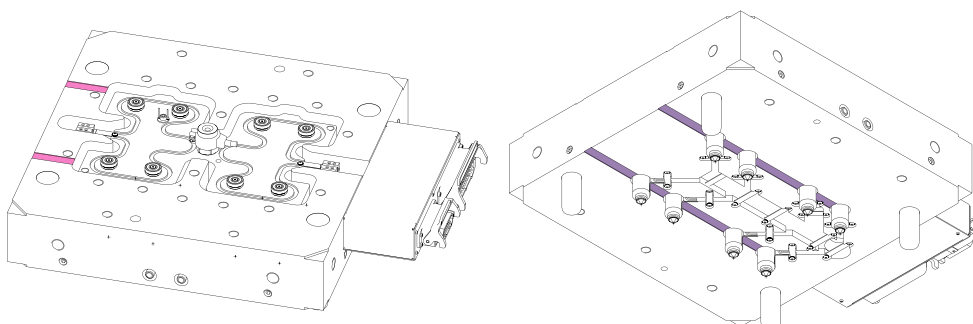
- Sufficient material is required around the manifold pocket (Dimension A) to ensure the rigidity of the system.
- 75mm of material around the pocket is required to give sufficient space for bolts, wire slots, guide pillars. This also maintains the system strength.

Central Supports

- To ensure rigidity of large systems - pillars may be required through the manifold to provide additional bolting close to the sprue bush.
- These integral supports reduce the risk of back plate bowing over large cavity pockets, or the hot runner system forcing the plates apart due to thermal expansion.

Venting






- Vent slots must be machined into the manifold plate to ensure any moisture from condensation is released from the manifold pocket and nozzle detail.
- 1mm x 16mm slots are recommended as depicted in the diagram below.

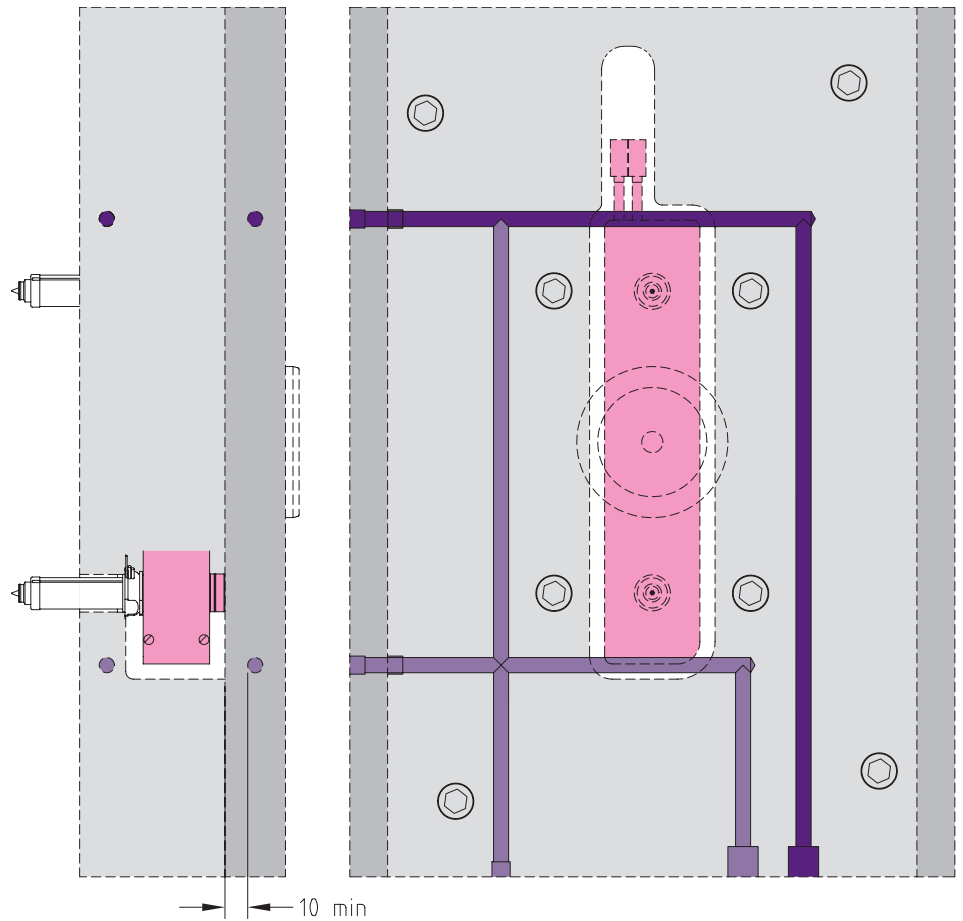


KEY	
	Nozzle Side Vent Slot
	Sprue Side Vent Slot

2.0 Minimum Cooling Circuits



Sufficient cooling is required in the back plate relative to the system size, layout and material being processed. One cooling circuit around the manifold pocket is the minimum requirement.

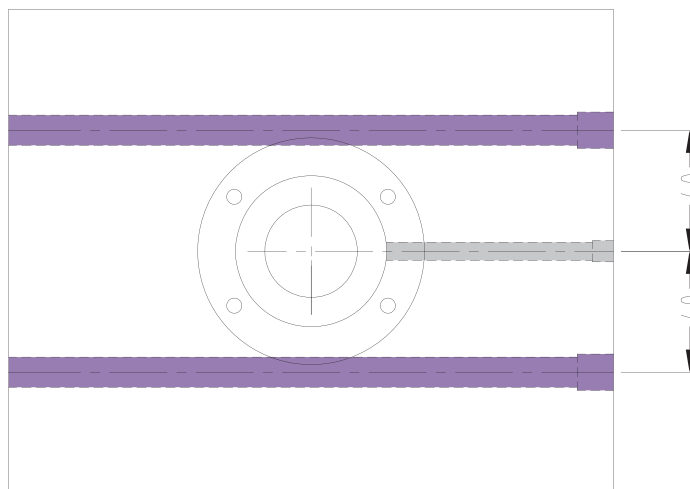
KEY	
	Water In Cooling Circuit
	Water Out Cooling Circuit
	Back Plate
	Manifold Plate
	Manifold



2.1 Valve Gate Cooling Circuits

Valve gate systems require additional cooling. Each cylinder must have cooling on two sides.

KEY	
	Cooling Circuit
	Airway

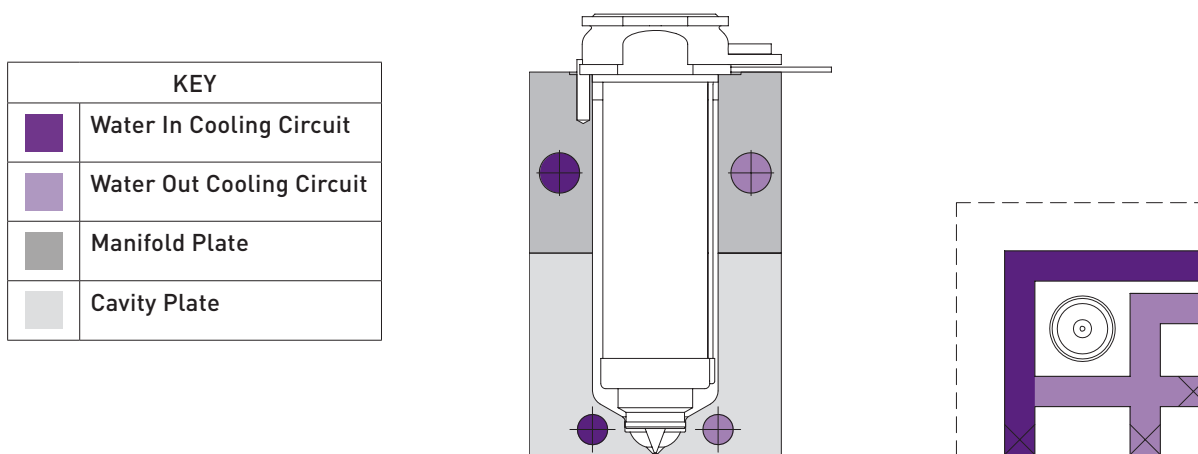


2.2 Manifold Plate Cooling

- Sufficient cooling is required to maintain the system mould temperature. Precise temperature control is critical as it ensures the correct thermal expansion. Accurate thermal expansion results in correct crush in the system and prevents leakage between the nozzles and manifold.
 - It is essential to have one cooling channel between each row of nozzles.
- Refer to the Section 2.0 for back plate cooling diagram and minimum cooling requirements.

2.3 Gate Temperature Control / Cooling

- Efficient gate temperature control is vital to ensure the best performance over the widest moulding window.
- Gate cooling must be on a separate circuit from mould, plate, and cavity cooling.
- A simple gate cooling circuit is shown, though inserts with cooling channels may be required for applications requiring high levels of gate cooling.
- Engineering resins may require higher gate temperatures than surrounding plates. Oil may be required in place of water in these applications, or separation of the gate area by using inserts or bush/sprue nuts.



3.0 Manifold Pocket Design

Thermal Insulation

- A minimum 10mm air gap between the two plates is required to ensure adequate thermal insulation between the two manifold and mould plates.

Heater Exit Clearance

- Sufficient clearance for the heater exit is required to ease wiring. A minimum of 34mm wide by 75mm long clearance is required.

Expansion Allowance

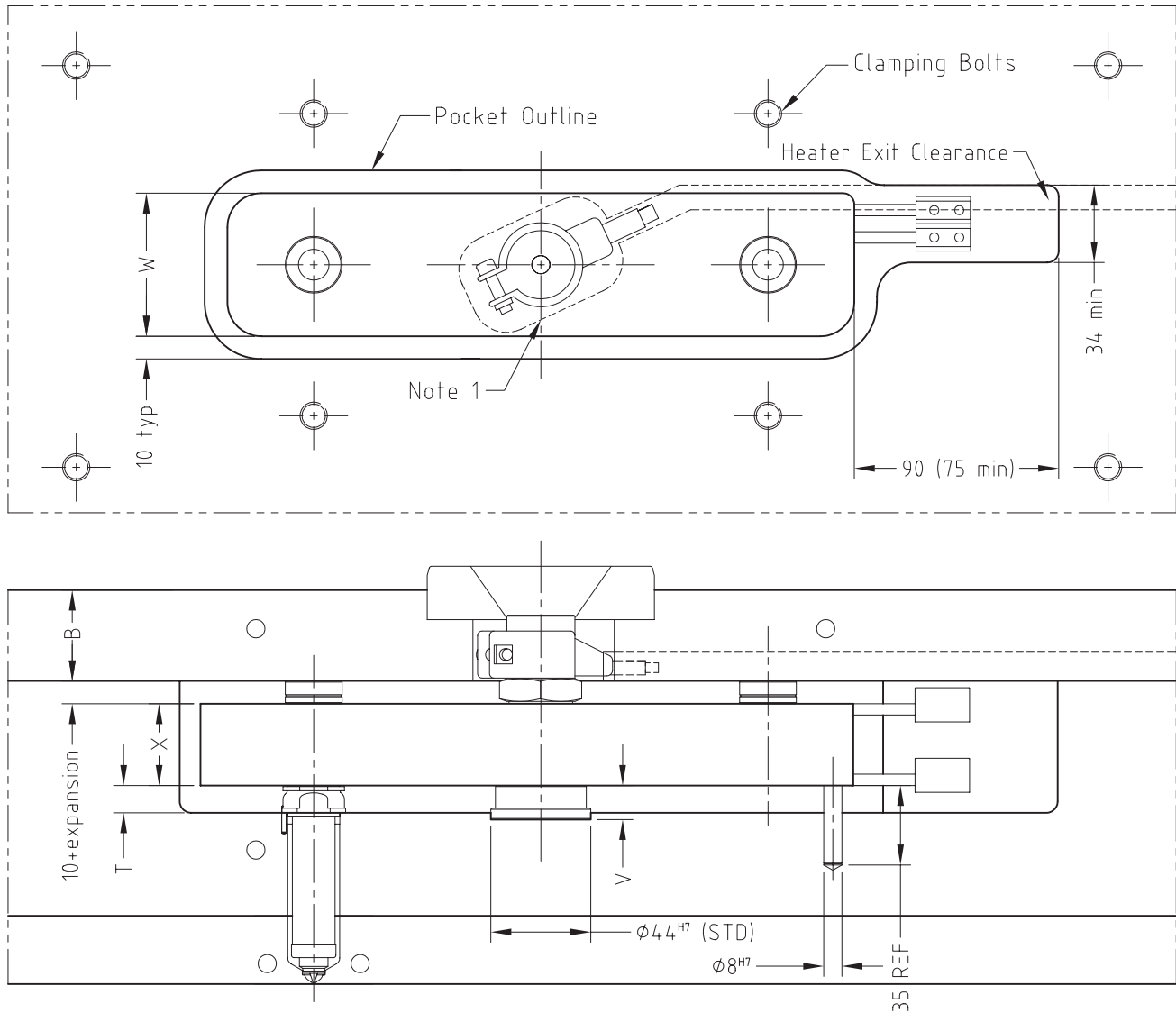
- The expansion allowance given is based on specific mould and manifold temperatures and given spacer thicknesses. If any of these are not as per the Mastip drawing (e.g. thicker spacers), the expansion will need re-calculating.
- The Manifold Cavity Design Diagram gives a general system view only, please refer to your approval drawings for system specific manifold thickness (X), pocket depth (T), locator depth (V), expansion and dowel position.

Machining Tolerances

- The seating faces for the nozzles and spacers must be machined to a high tolerance (+0/-0.01) to ensure correct system sealing.
- The locator depth must be +0.02/-0.

Orientation Dowel

- The dowel hole must be accurately positioned to ensure correct orientation between manifold and nozzles.
- Accurate depth is important to ensure the dowel sits inside the dowel slot without the manifold sitting on top of the dowel.



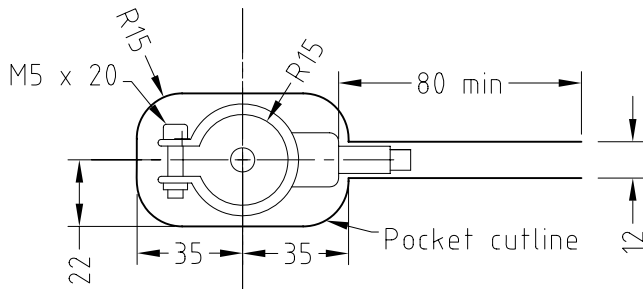
4.0 Locating Ring and Sprue Bush Pocket

Clearances

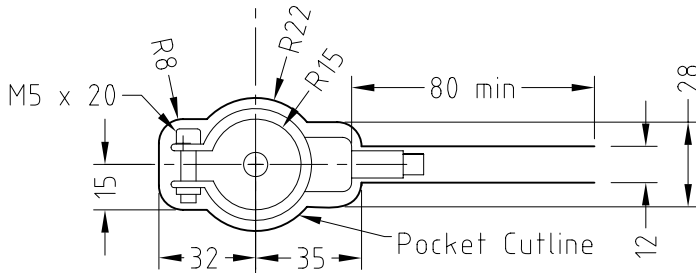
- Clearance is required between the sprue bush and locating ring as contact will draw off heat to the back plate.

Pocket Detail

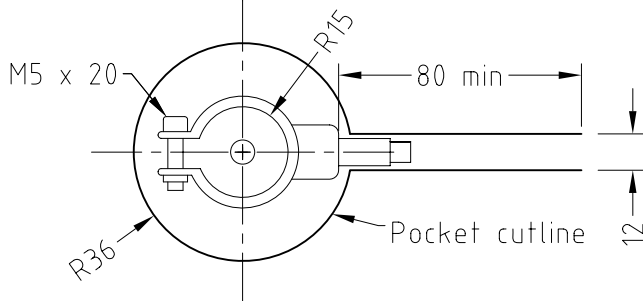
- The detail below shows the recommended style for simple machining while maintaining plate strength.
- If system strength is not compromised the sprue bush pocket can be a simple through hole (Style C).



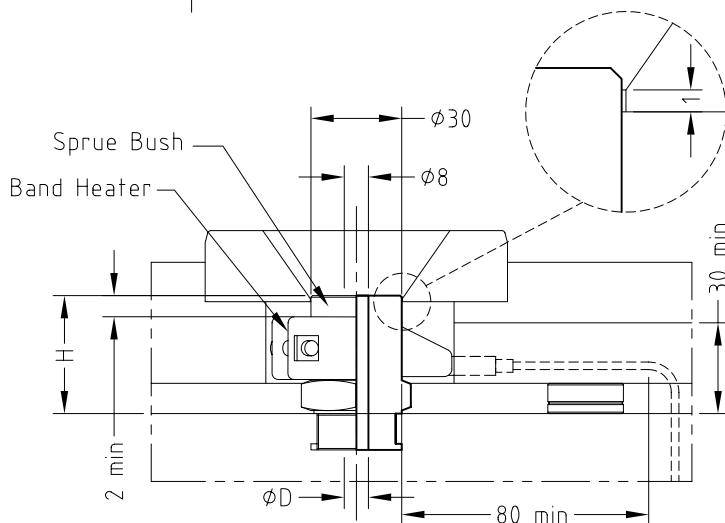
Style A	Preferred Style Satisfactory material removal Simple to machine Satisfactory strength
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Style B	If the Manifold design dictates a smaller sprue Bush Pocket Style B must be used. Minimum material removed Longer production time Maximum mould strength
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Style C	Maximum material removed Very easy to machine Minimum strength
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5.0 Nozzle Pocket

System Specific

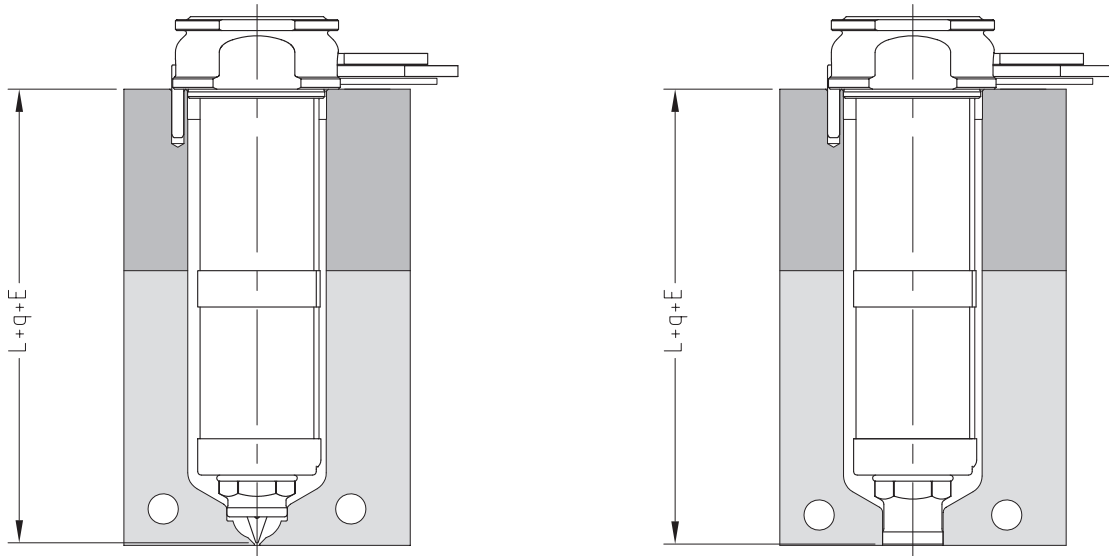
- System specific details for nozzle expansion and gate details are supplied in the Mastip approval drawing.
- Please check that mould and manifold operating temperatures are accurate.

Nozzle Expansion

- Nozzle expansion is critical to position the tip and nut of the nozzle correctly in the gate detail.

Expansion Calculation

- Use the following equation to calculate Nozzle Expansion: $E = L \times 0.0000132 \times (T^{\circ} \text{ material} - T^{\circ} \text{ Mould})$

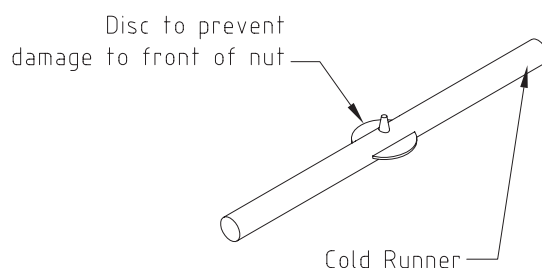


Gate Detail

- Correct gate diameter and land length is critical to maintain good gate vestige and minimise cycle times.
- Standard dimensions are provided on the approval drawings.
- Always start with a smaller gate diameter to allow fine tuning.

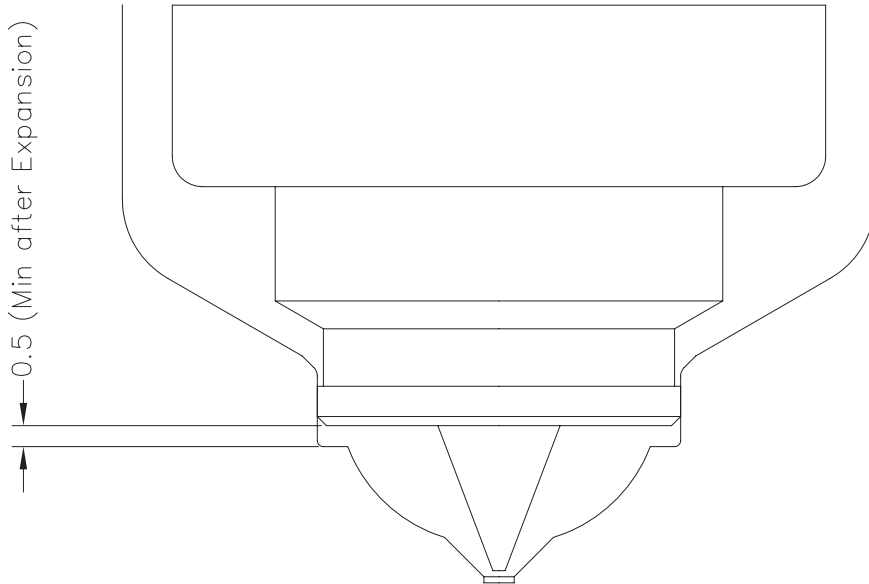
→ Refer to the Technical Specifications Guide for fine tuning Gate Detail instructions.

Thermal Gate Detail	Sprue Nut Detail	Valve Gate Detail



Open Nut Clearance

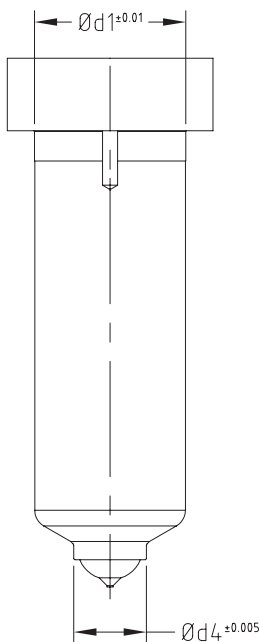
- To minimise heat loss the open nut front face must not contact the cavity detail when the nozzle expansions.
- There should be a minimum of 0.5mm clearance when the nozzle and mould are at operating temperatures.



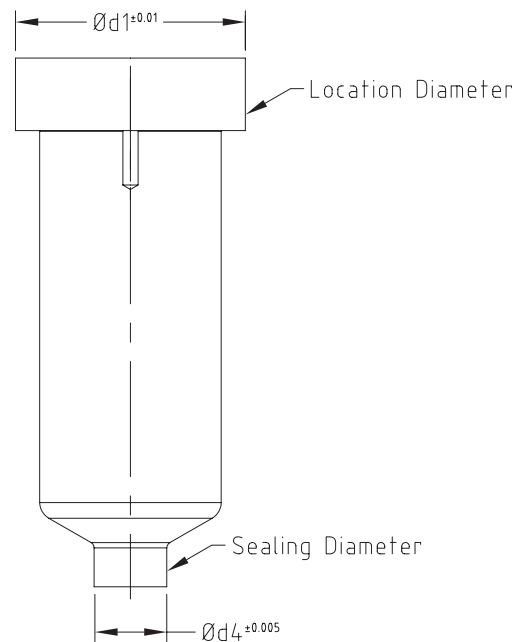
Nozzle Sealing and Location Dimensions

- To avoid leakage it is critical that the location diameter and nut sealing diameters are accurately positioned.
- Concentricity between diameters must be 0.01mm and roundness 0.005mm.

MX Nozzle Location
Open Nut



BX Nozzle Location
Bush/Sprue Nut



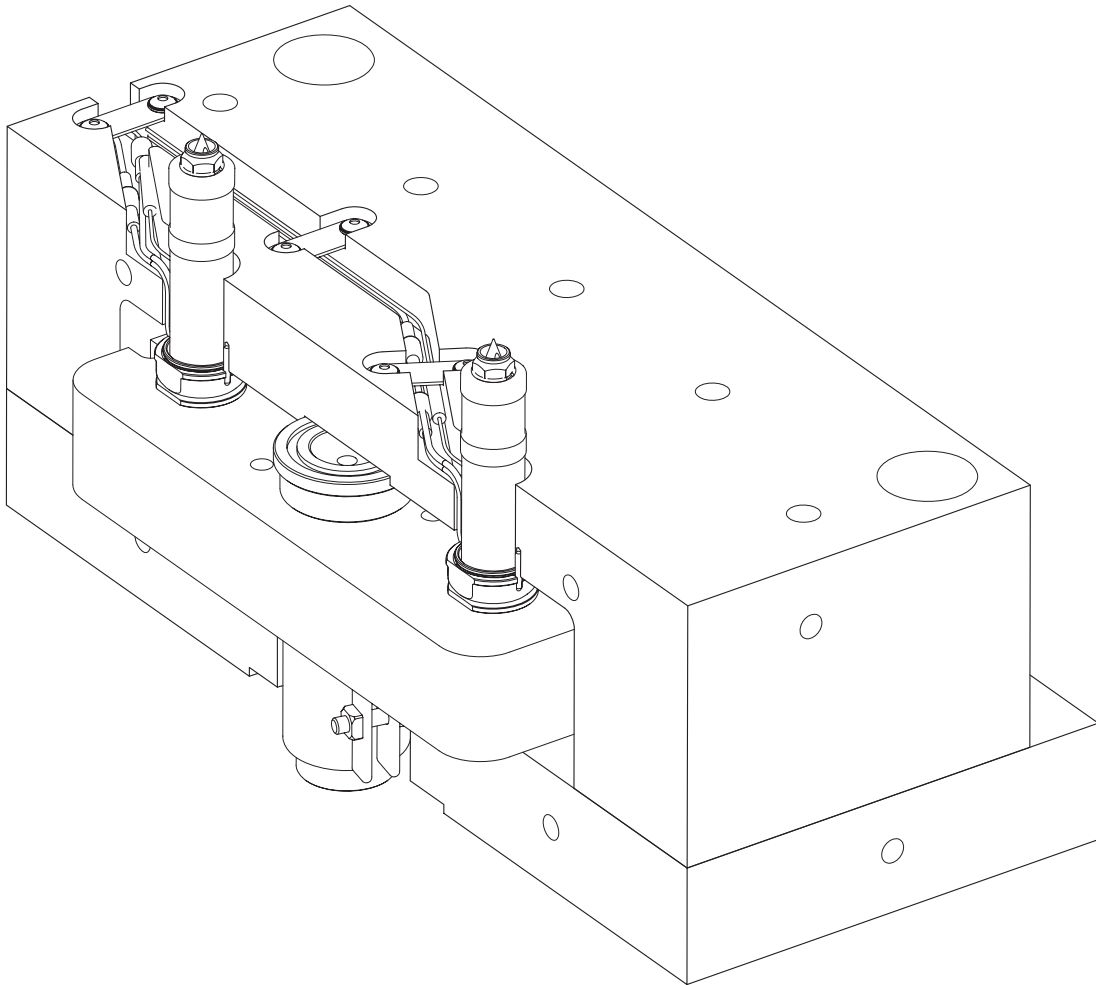
6.0 System Wiring

Wire Slots

- Plate design must include wiring slots to provide a secure channel for all wiring.
- Sufficient sized channels are required to ensure wires are not squashed or pinched between plates during assembly.
- Channel sizes will vary between MX and BX nozzles.

Retaining Clamps

- Wire clamps are required to keep the wiring sitting in place correctly.



7.0 MVG Valve Gate Requirements

Cooling

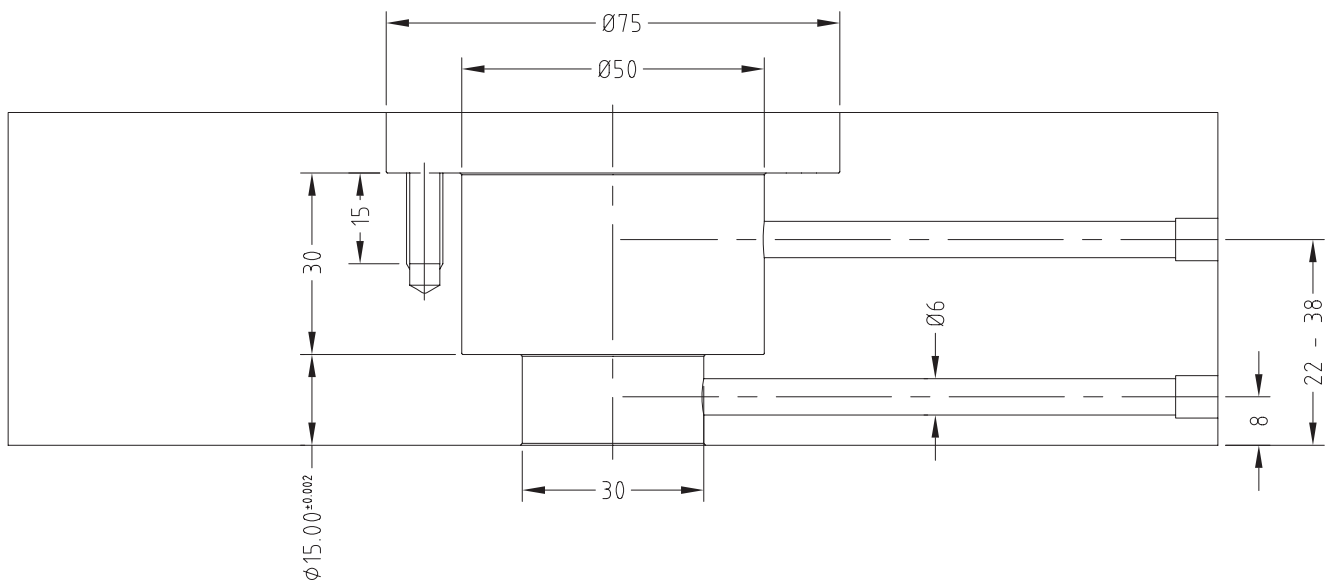
- Back plate must be cooled and not exceed 140°C.
- Cooling is required on two sides of each cylinder.

Air

- Filtered to 40uM
- Minimum air pressure of 4 Bar
- Maximum air pressure of 10 Bar
- Minimum airway diameter of 6mm

Back plate

- Minimum plate thickness of 55mm



8.0 System Check Sheet

The following design criteria must be completed and returned to Mastip with the signed approval drawing.

Circle Y for Yes. Circle N for No.

Project Information	
System Number	
Date	
Completion Date	

Plate Design	Value	Acceptable	Rectified
Back plate Material		Y / N	Y / N
Manifold Plate Material		Y / N	Y / N
Clamping		Y / N	Y / N
Back plate Thickness		Y / N	Y / N
Material Below Nozzle Head		Y / N	Y / N
Central Supports		Y / N	Y / N
Venting		Y / N	Y / N
Plate Overall Sizes		Y / N	Y / N

Cooling	Value	Acceptable	Rectified
Back plate Cooling		Y / N	Y / N
Manifold Plate Cooling		Y / N	Y / N
Gate Cooling		Y / N	Y / N

Manifold Pocket	Value	Acceptable	Rectified
Thermal Insulation		Y / N	Y / N
Heater Exit Clearance		Y / N	Y / N
Expansion Gap		Y / N	Y / N
Locator Pocket		Y / N	Y / N
Dowel Pin Hole		Y / N	Y / N
Nozzle Seating Depth		Y / N	Y / N
Nozzle Side Spacer Depth		Y / N	Y / N

Locating Ring & Sprue Bush Pocket	Value	Acceptable	Rectified
Ø30.4 Locating Ring Hole		Y / N	Y / N
Sprue Bush Pocket		Y / N	Y / N

Nozzle Pocket	Value	Acceptable	Rectified
Nozzle Expansion		Y / N	Y / N
Gate Land (q)		Y / N	Y / N
Gate Diameter (G)		Y / N	Y / N
Open Nut Clearance		Y / N	Y / N
Nozzle Location Diameter (d1)		Y / N	Y / N
Nut Location Diameter (d4)		Y / N	Y / N

MVG Valve Gate	Value	Acceptable	Rectified
Cooling		Y / N	Y / N
Air		Y / N	Y / N

System Wiring	Value	Acceptable	Rectified
Wire Slots		Y / N	Y / N

Date

Name

Authorised Signature

X

INTERNAL USE ONLY
System Acceptance
& Project Sign Off

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