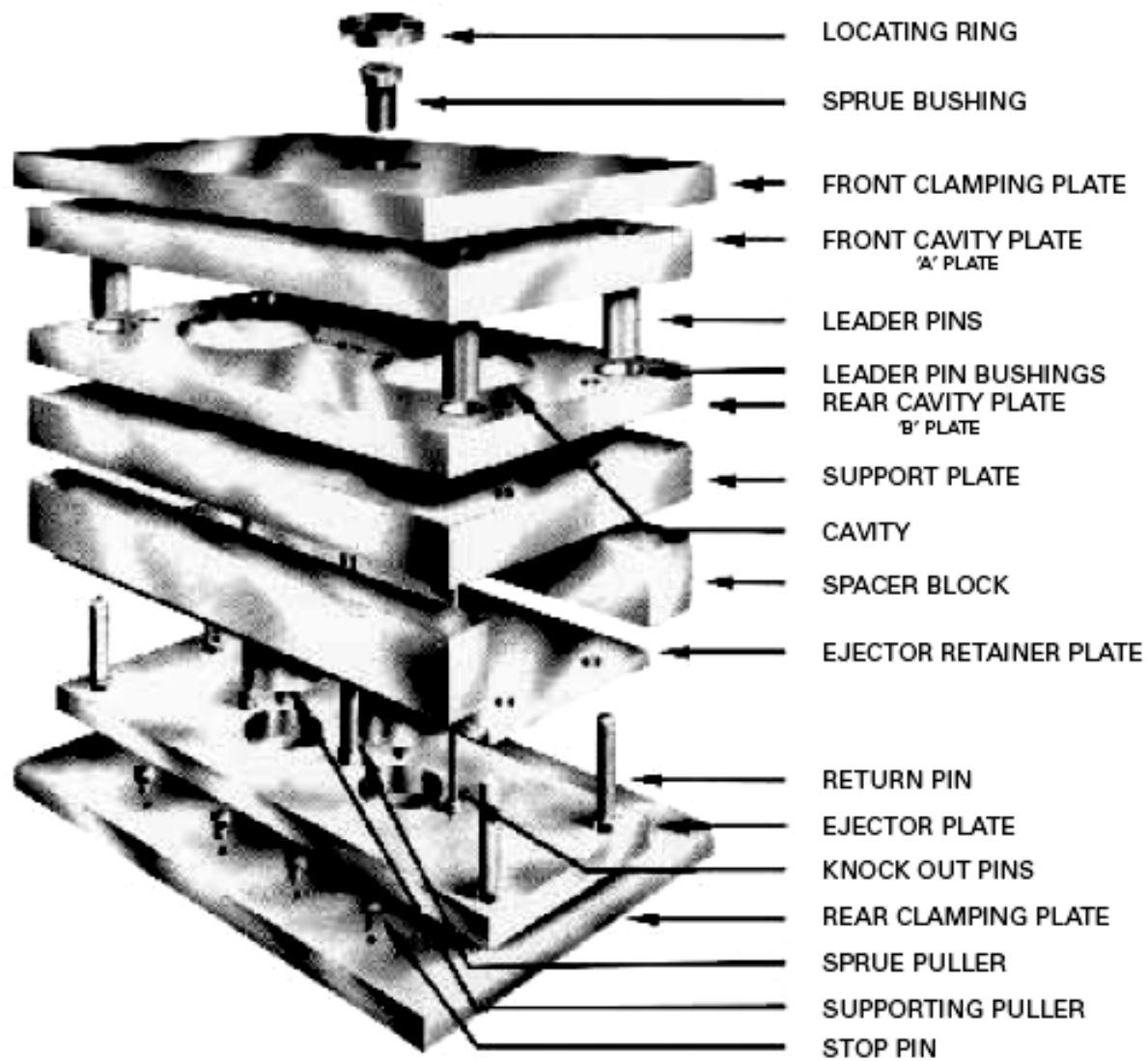




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## The Mould





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## The Metals

**Aluminium** or pre-hardened steel used for prototyping and short production runs.

**A-2 Steel** – Hardened to 58-60 Rockwell C resists serious abrasion.

**D-2 Steel** – Contains more Chromium, more abrasion resistance and harder to machine than A-2. Also brittle (more suited to small parts).

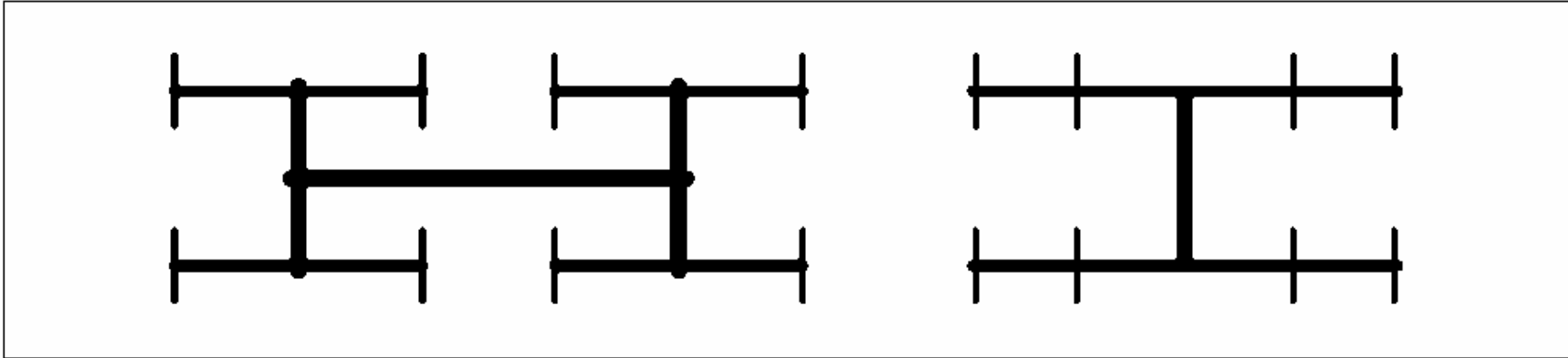
**D-7 Steel** – Exhibit the best abrasion resistance. but more difficult to machine than A-2 or D-2.

**Nickel** or **Chrome** surface treatment (0.01 to 0.05mm) to resist rusting and pitting.










# Runner Design

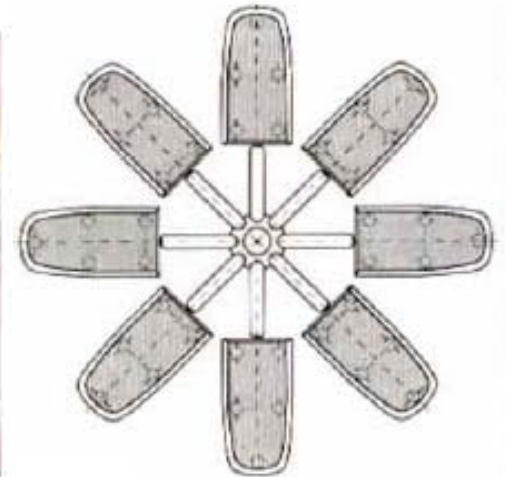


**Balanced**

**Unbalanced**

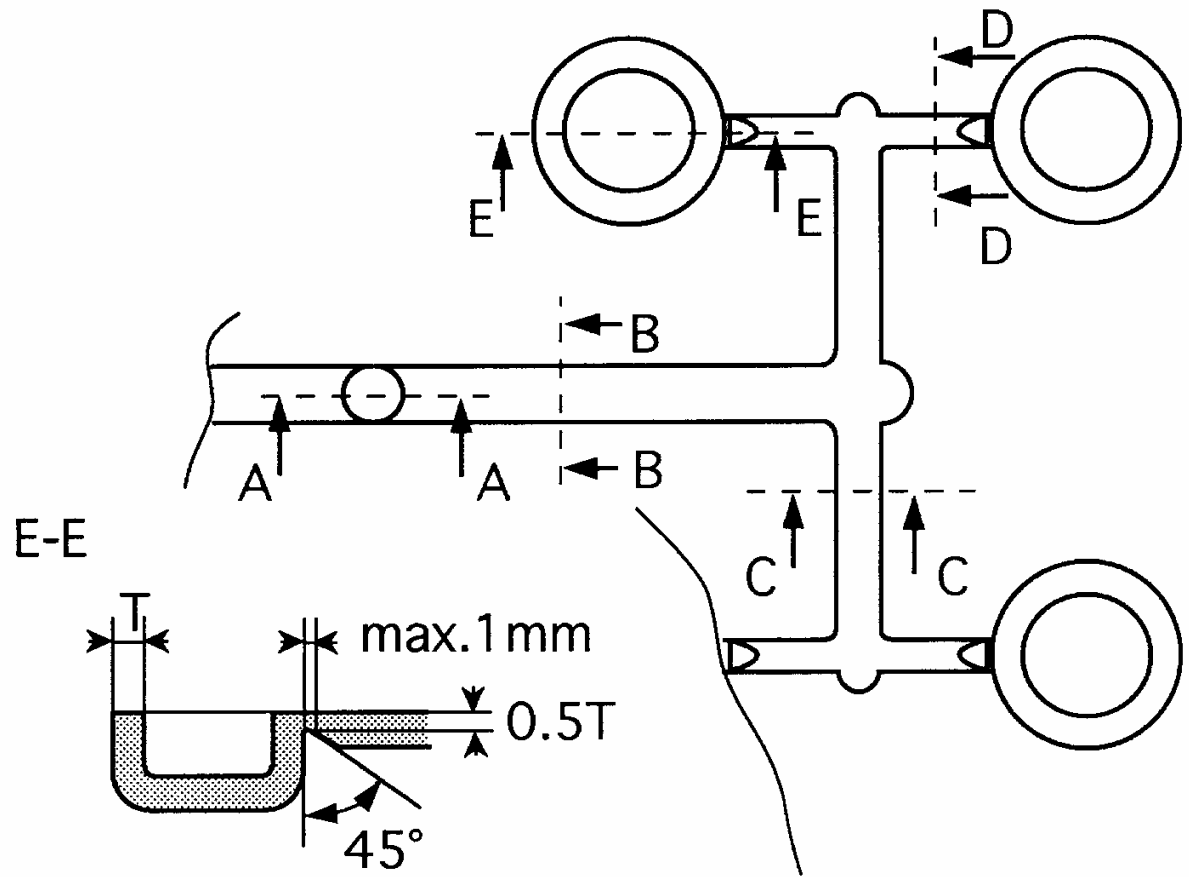
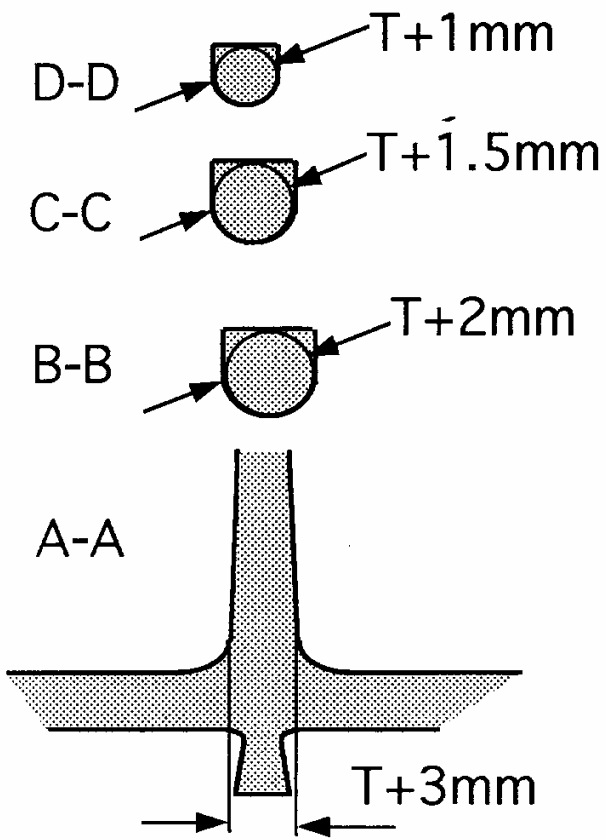
## Runner cross section

				
rectangu- lar	half-moon	trapezoid	round- trapezoid	round
unfavourable		better		best

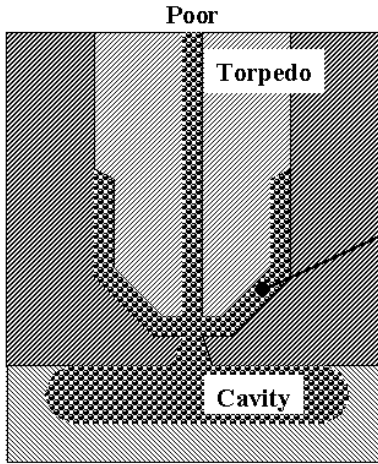




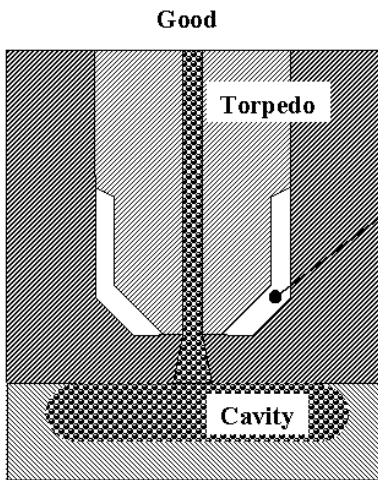
# Runner Design



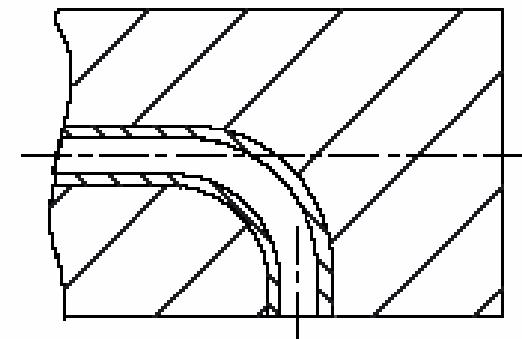
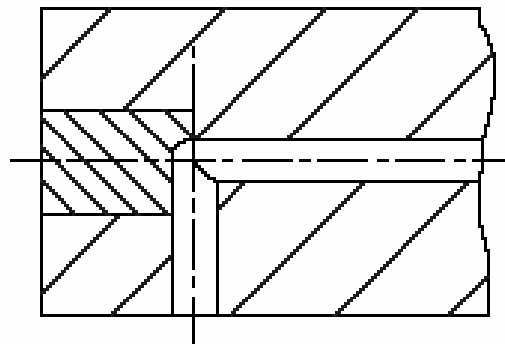
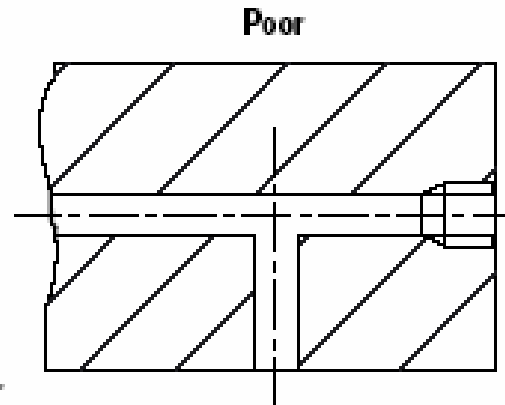
# Hot runner design



Torpedo is thermally insulated from the mould by the polymer. Degradation starts which causes gases, mould deposit and black spots.



Torpedo is thermally insulated from the mould by an air channel.

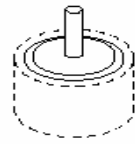


Ideal Flow path

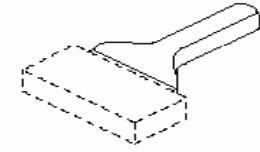
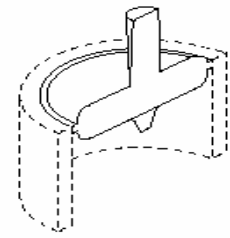


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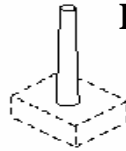
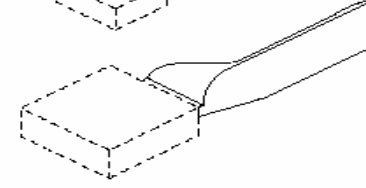
# Types of Gates



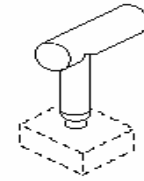
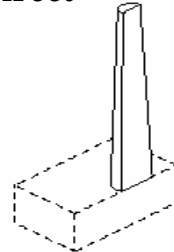
**Diaphragm**



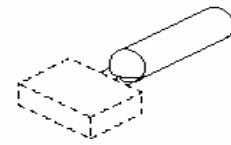
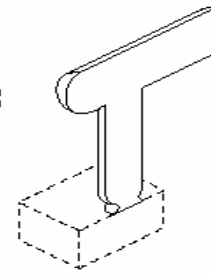
**Fan**



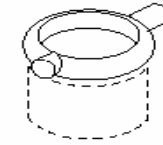
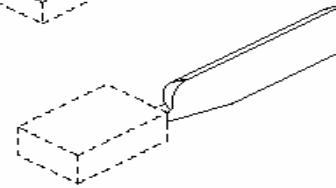
**Direct**



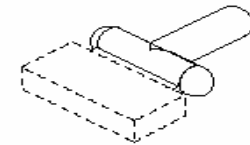
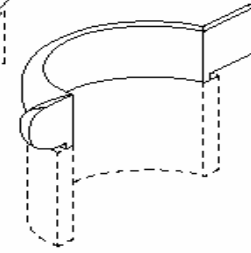
**Pin Point**



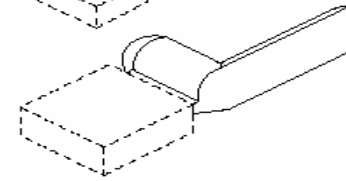
**Edge**



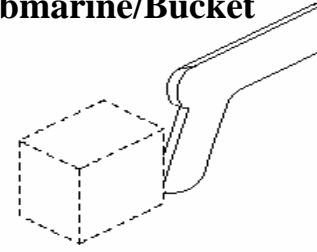
**Ring**



**Flash**



**Submarine/Bucket**

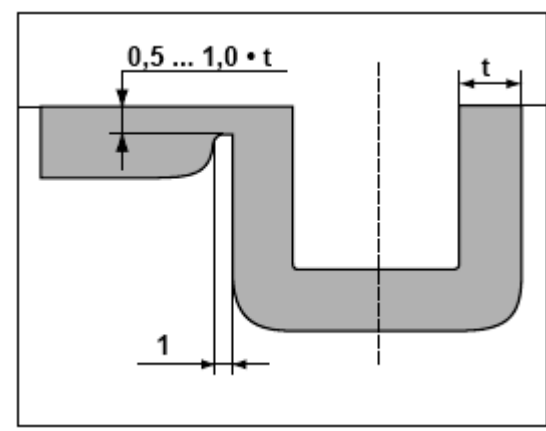
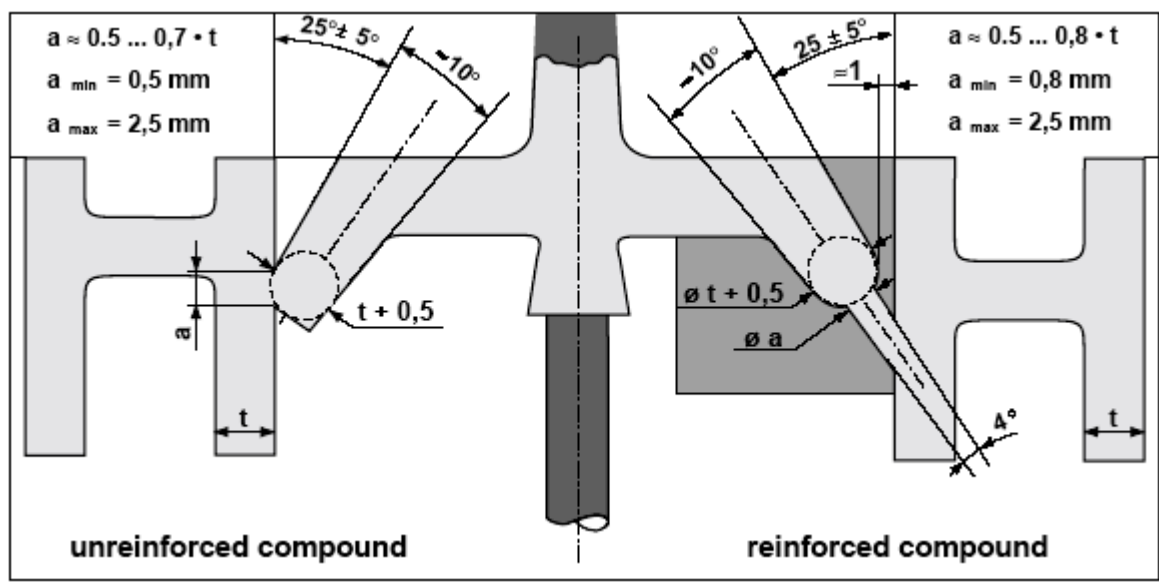
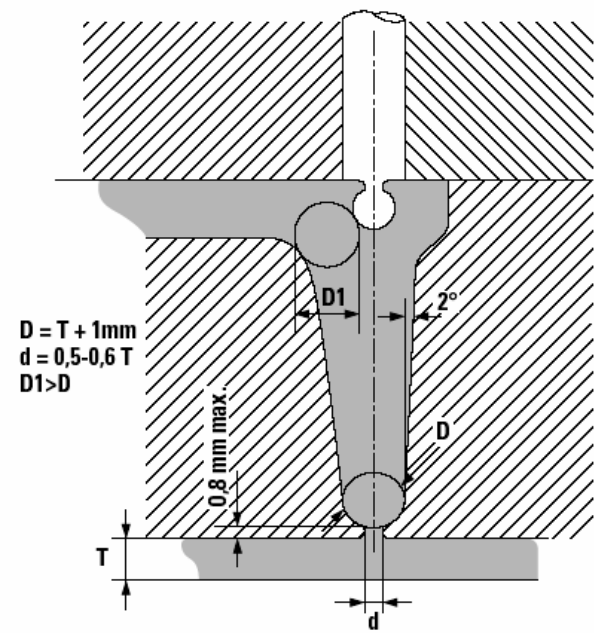
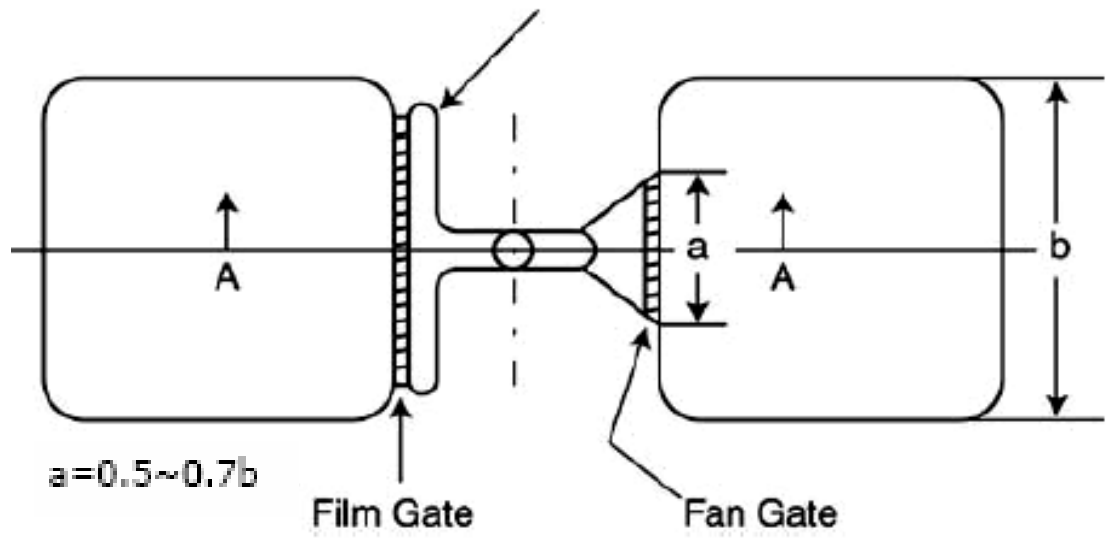




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## Gate designs

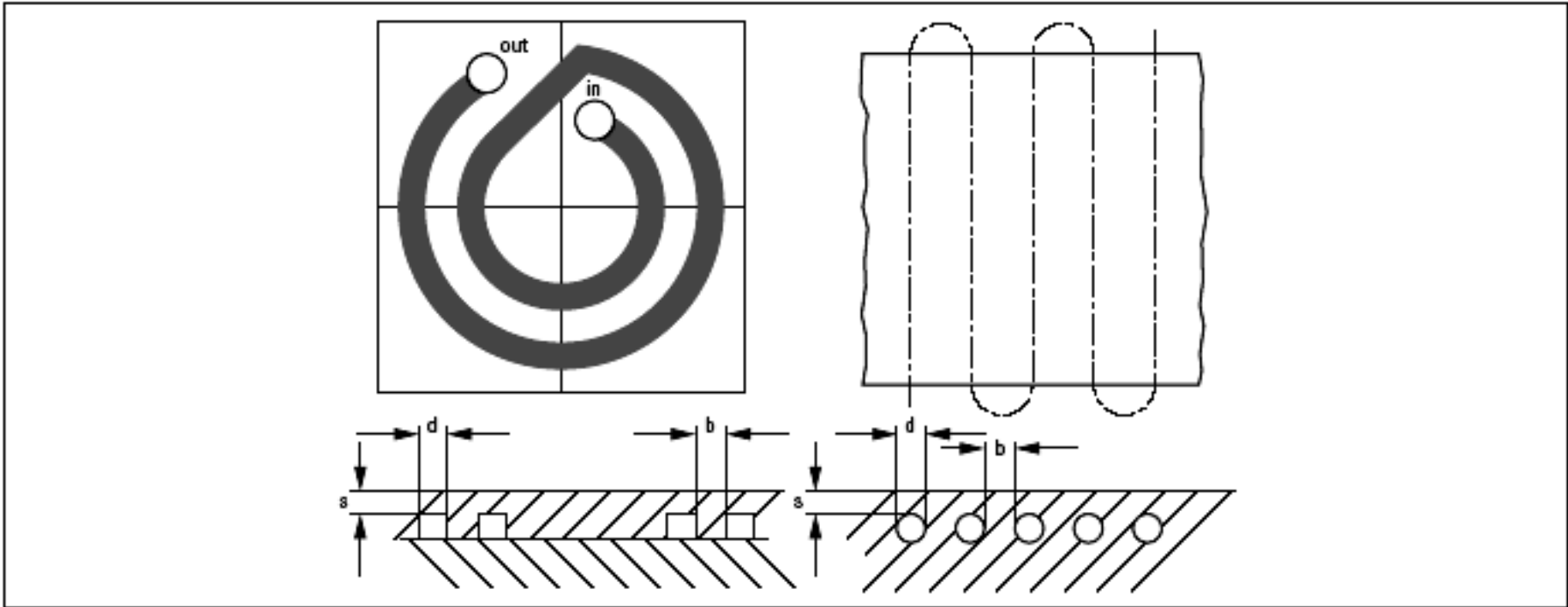




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# Temperature control for Flat parts

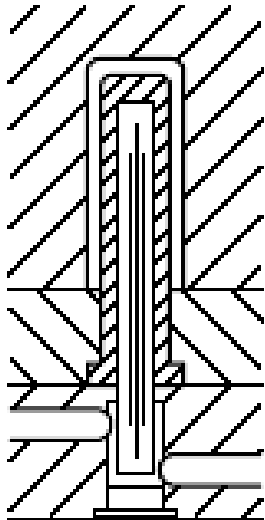


Wall thickness of the molding	Channel diameter or width (d)	Distance (s)	Channel spacing (b)
up to 2 mm	8 mm	4 mm	$\sim 1 d$
up to 4 mm	10 mm	7 mm	$\sim 1 d$
up to 6 mm	12 mm	9 mm	$\sim 1 d$

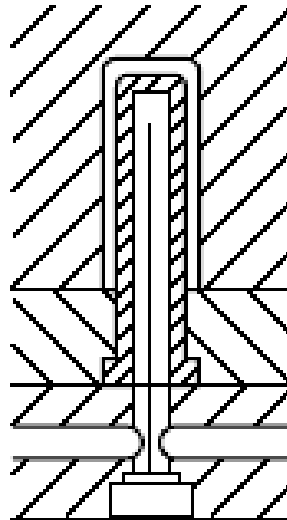


**Distrupol**

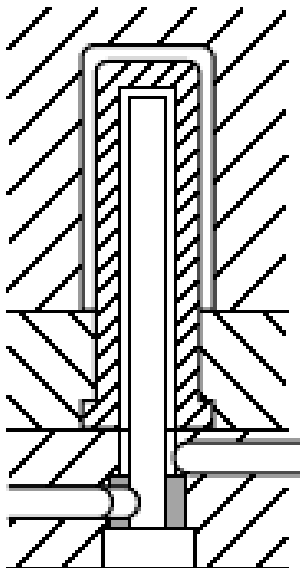
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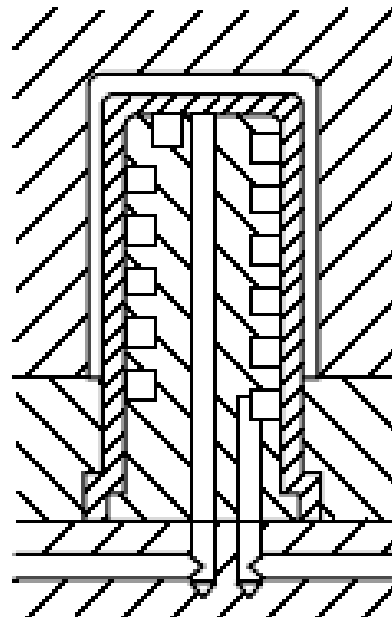
Head conducting pin



Divided tube



Fountain



Internal core with spiral channel

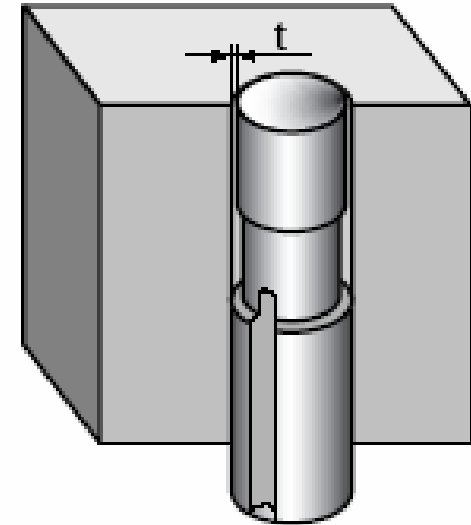
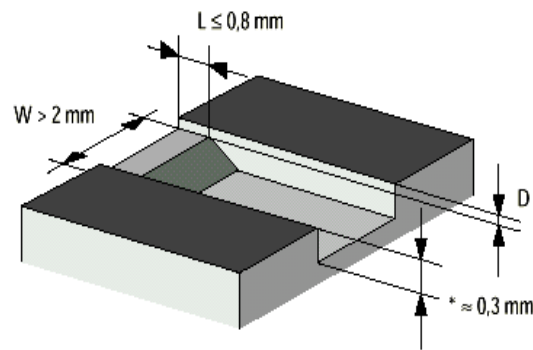
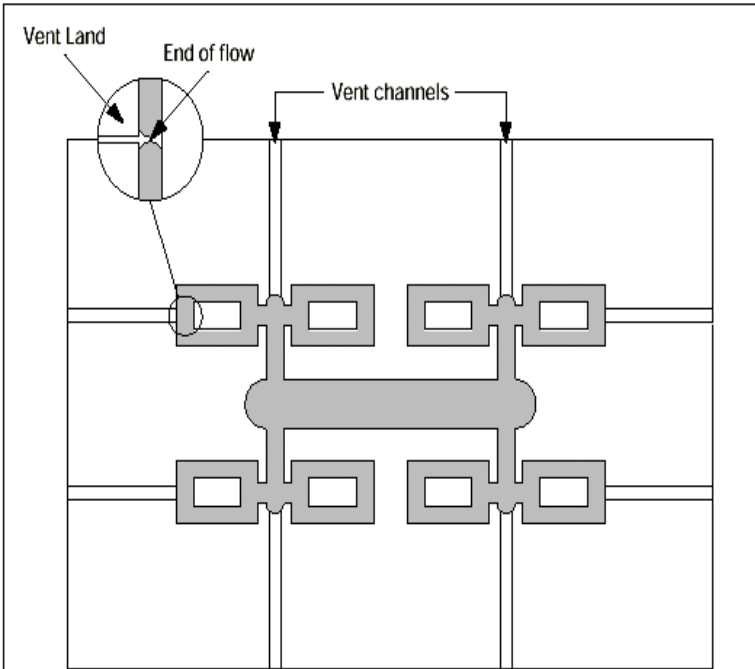
**Possible methods of cooling cores**



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## Venting



GR Nylon	D < 0.03 mm
Ionomer	D < 0.03 mm
LCP	D < 0.01 mm
Nylon	D < 0.02 mm
PBT	D < 0.03 mm
PET	D < 0.02 mm
POM	D < 0.03 mm
PP	D < 0.025 mm
PPA	D < 0.015 mm
PPS	D < 0.01 mm
TPU	D < 0.02 mm
TPV	D < 0.025 mm

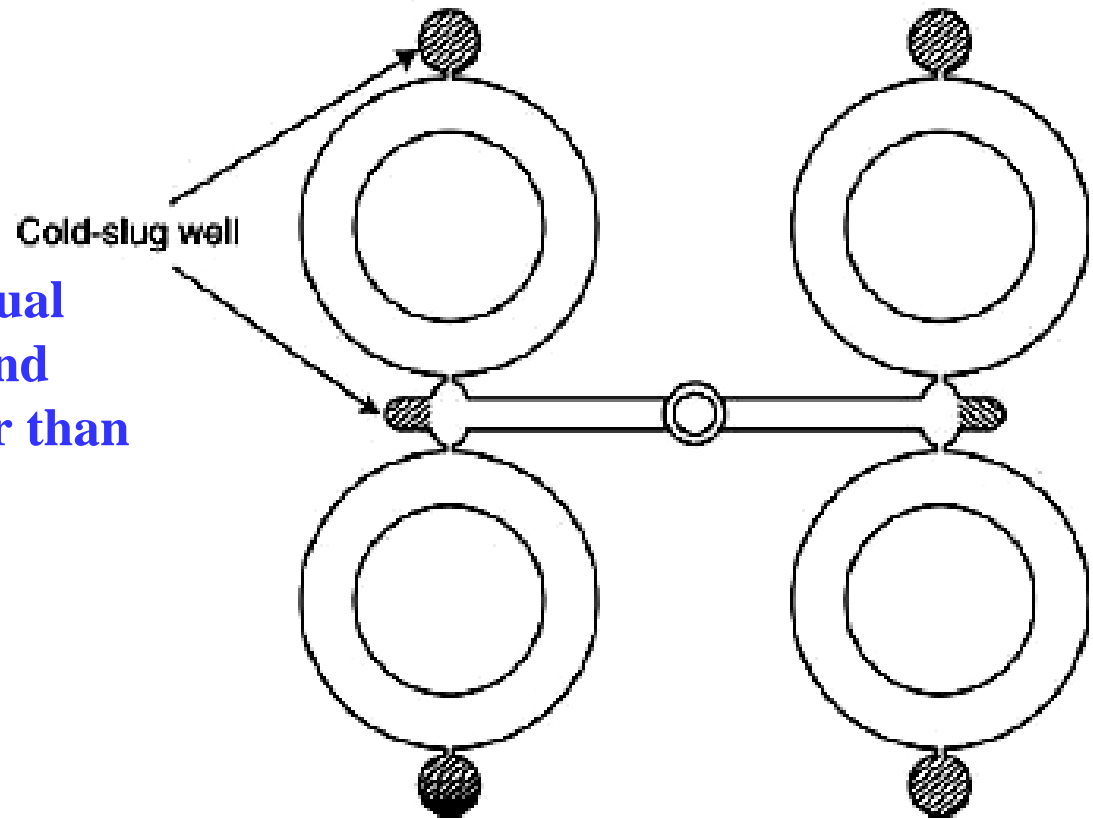


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## Cold-slug well

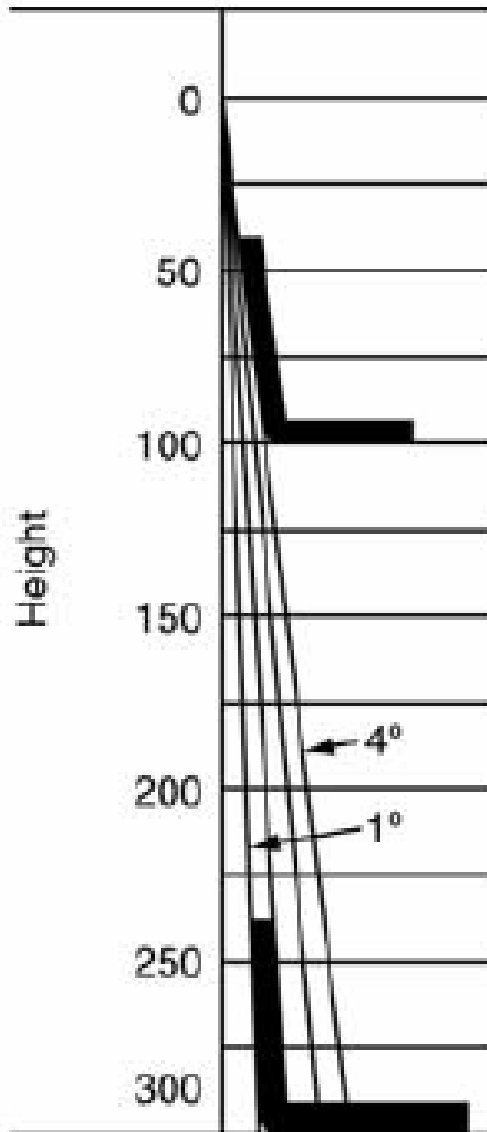
At the end of the Sprue (size equal or greater than the diameter) and Runner (length equal or greater than the diameter).





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## Tapers – Draft angles

<b>ETPV</b>	<b>1° – 2°</b>
<b>Ionomer</b>	<b>2° – 3°</b>
<b>LCP</b>	<b>0.2° – 0.5°</b>
<b>MPR</b>	<b>0.5° – 2°</b>
<b>PA</b>	<b>0.25° – 1°</b>
<b>PBT/PET</b>	<b>0.5° – 1°</b>
<b>PC</b>	<b>1° – 2°</b>
<b>POM</b>	<b>0.5° – 1°</b>
<b>PP</b>	<b>0.5° – 1°</b>
<b>PPA</b>	<b>0.5° – 1°</b>
<b>PPS</b>	<b>0.25° – 1°</b>
<b>TPC-ET</b>	<b>0.5° - 2°</b>



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## Shrinkage values

ABS	0.6 to 0.9%
BDS	0.6 to 0.9%
EVA	0.2 to 0.8%
GPPS	0.4 to 0.6%
LCP	-0.07 to 0.5%
PA 6.6	1.2 to 1.6%
PA 6.6-30%GR	0.3 (flow) 1.1% (across flow)
PBT	1.5 to 1.7%
PBT-30%GR	0.3 (flow) 1.1% (across flow)
PC	0.5 to 0.7%
PE	1 to 3%
PET-30%GR	0.2 (flow) 0.8% (across flow)
POM	1.9 to 2.2%
PMMA	0.4 to 0.7%
PP	1 to 2%
PP-GR	0.5 to 0.9%
PPA-35%GR	0.1 (flow) 0.7% (across flow)
PVC-F	2 to 3%
SAN	0.4 to 0.6%

Based on test bars, **not exactly** translatable to other components. Mould shrinkage is depend on such factors as,

**Mould temperatures**  
**Hold pressure**  
**Hold pressure time (HPT)**  
**Gate size**  
**Part thickness**