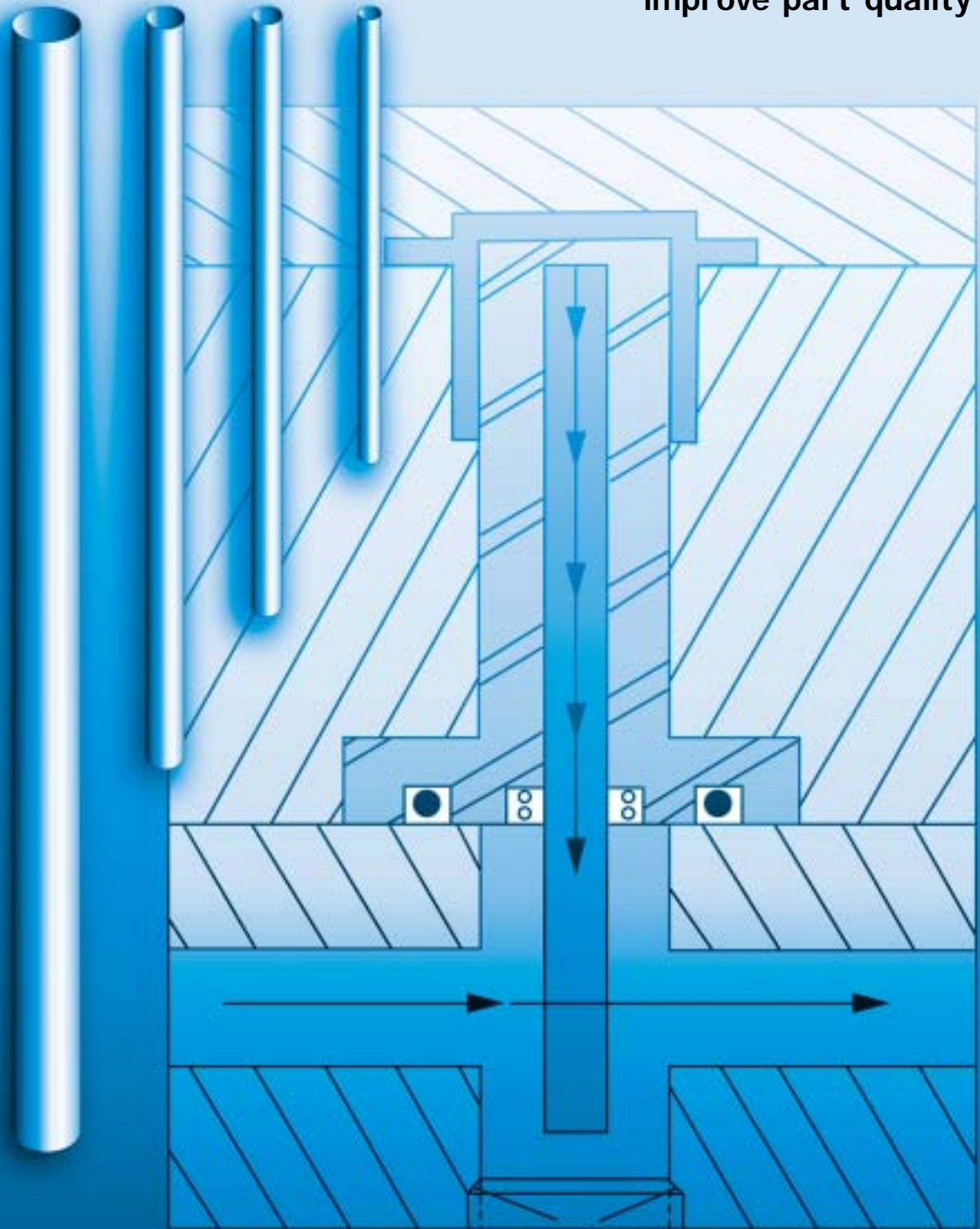


D-M-E STANDARD HEAT PIPES

Reduce cycle time and
improve part quality



D-M-E Standard Heat Pipes

- Reduce cycle time
- Improve part quality
- Simplify mold and die design
- Reduce operating and maintenance costs
- Upgrade existing molds and dies
- Salvage damaged molds and dies



STANDARD TYPES AVAILABLE

FOR INJECTION MOLDING

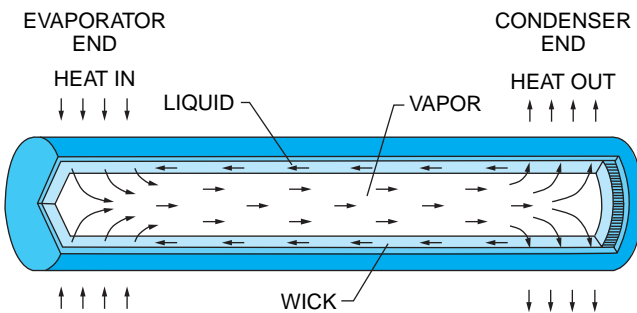
The standard line of Heat Pipes for injection molding includes both a low temperature (TPL) and a high temperature (TPH) series. The TPL Series works most efficiently between the temperatures of 40° and 200°F with a coolant temperature of approximately 60° to 80°F, and the TPH Series between 150° and 400°F with a coolant temperature of approximately 90° to 110°F. The sealed end of each heat conductor is color-coded (BLACK for the TPL Series and WHITE for the TPH Series). Selection of the appropriate series is based on the application's melt, mold surface and coolant temperatures to which the Heat Pipe will be subjected.

FOR DIE CASTING

For die casting applications, Heat Pipes in the TPDC Series provide an operating temperature range of 150° to 600°F with a coolant temperature of as high as 190°F. The sealed end of each TPDC Series heat conductor is color-coded RED. The TPDC Series should always be used for die casting because of the higher shot, die surface and coolant temperatures involved.

HOW AND WHERE HEAT PIPES WORK

The D-M-E Heat Pipe is a heat transfer device specifically designed for optimal performance in plastic injection molds and dies for the die casting industries. The D-M-E Heat Pipe consists of a vacuum-tight copper tube containing a wick and a non-toxic working fluid. The two ends of the Heat Pipe perform distinct functions – one end is an evaporator, the opposite end is a condenser. Thermal energy is gathered at the evaporator end, vaporizing the working fluid. This vapor then travels through the Heat Pipe to the condenser end. At the condenser end the vapor condensates back into a liquid, giving up its latent heat in the process. To complete the cycle the condensed liquid then travels along the wick, via capillary action, back to the evaporator section. This process repeats itself continuously, transferring heat many times faster than pure copper.

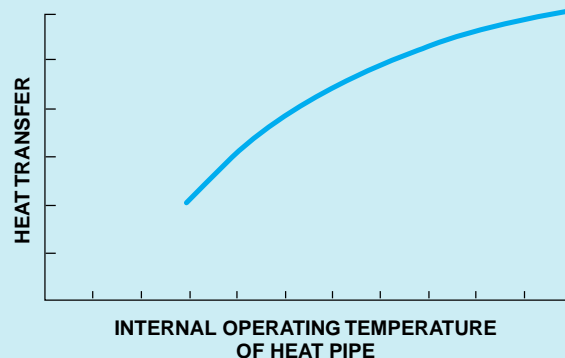


HOW HEAT PIPES ARE USED

Available in a variety of standard lengths and diameters, D-M-E Heat Pipes are used in cores, core slides, cavities and other areas of a mold or die requiring cooling or controlled temperatures. Commonly used in place of bubblers, baffles, fountains or blades, Heat Pipes transfer heat rapidly to the coolant, rather than requiring the coolant to flow into the heated area. They are also used to transfer heat to a cooler portion of the mold (which serves as a heat sink) or to open air, thereby permitting cooling of otherwise inaccessible areas and eliminating potential coolant leakage.

MAXIMIZING EFFICIENCY WITH WARM COOLANT

Heat Pipes work best when the coolant is between 60° and 110°F, and sometimes higher. (Die casters can set the temperature of the coolant as high as 190°F.) The graph below illustrates how the Heat Pipe's heat transfer capability is dependent upon its internal operating temperature. It is best to start with the coolant temperature high, then reduce it if necessary.



BENEFITS OF HEAT PIPES

COOL MOLDS FASTER AND REDUCE CYCLE TIME

The Heat Pipe's ability to cool molds faster and thus reduce cycle time is due to a number of factors. First, waterlines throughout the entire mold can be larger in diameter, permitting a higher coolant velocity, which transfers heat faster. Second, the larger volume of fluid flowing through the waterline results in a lower overall coolant temperature rise, so that the last Heat Pipe in the system will transfer heat as efficiently as the first. Third, the extension of the Heat Pipe into the waterline promotes turbulent flow, which transfers heat faster than laminar flow. Fourth, the ability to transfer heat away from inaccessible areas improves the overall cooling rate and reduces cycle time, even if extension into a remote waterline is impractical or impossible.

IMPROVE PART QUALITY

As the Heat Pipe transfers heat to the coolant, air or mold component, it also dissipates heat evenly along its entire length. This isothermal action provides faster and more uniform cooling, thus eliminating hot spots, which cause sink marks, pulling and spotting.

SIMPLIFY MOLD DESIGN AND LOWER COSTS

With Heat Pipes, waterline design is greatly simplified since coolant flow into the heated area of the mold is not required. In addition, the ability to locate heat conductors in areas inaccessible to other cooling devices can further simplify the overall mold design. In most cases, the machining and construction time required for the mold is reduced, lowering moldmaking costs.

REDUCE MAINTENANCE AND OPERATING COSTS

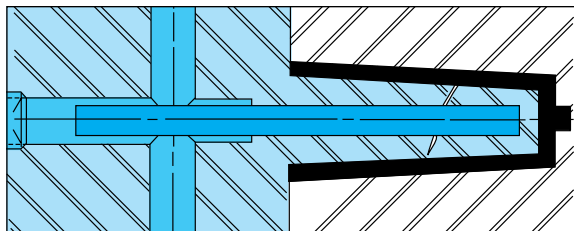
The increased waterline diameter, coolant velocity and heat capacity effectively eliminate scale formation, calcium deposits and the plugging up of small waterlines and ports. In addition, Heat Pipes operate in any coolant without corroding.

UPGRADE EXISTING MOLDS AND DIES

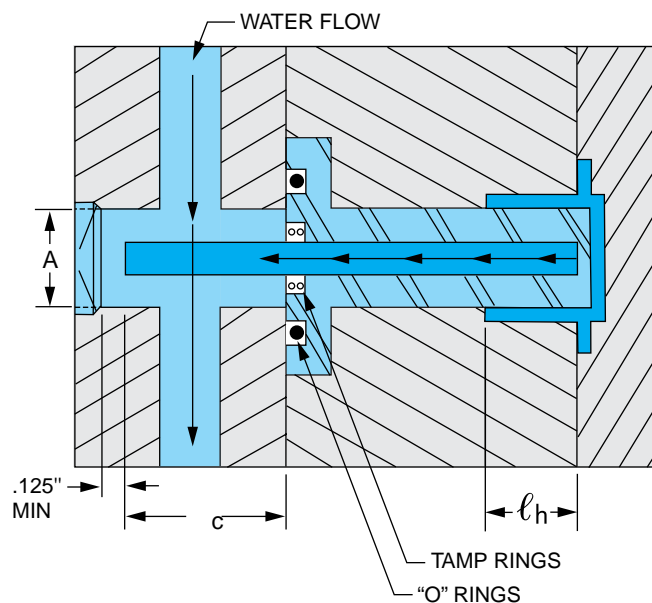
Heat Pipes effectively solve cooling, cycle time or part quality problems in existing molds. They can be retrofitted as replacements for bubblers or baffles and to provide heat transfer in previously uncooled areas.

SALVAGE DAMAGED MOLDS AND DIES

In certain applications, Heat Pipes can even be used to salvage or repair molds that would otherwise have to be scrapped or extensively reworked. The figure below is a typical example.



D-M-E Standard Heat Pipes



GENERAL DESIGN GUIDELINES

The following guidelines provide the basic information necessary for most applications. The variables described below (such as size, shape, location and coolant temperature) all have an effect on overall performance. Consequently, a change in one variable can be used to offset the inability to meet the specifications of another.

MAXIMIZING HEAT INPUT AND OUTPUT

1. Use the largest diameter Heat Pipe possible without weakening the core. The "A" diameter of the water channel at the base of the Heat Pipe should be .125" larger in diameter than the Heat Pipe to provide good turbulent flow.
2. The Heat Pipe should be installed as far into the core as possible, while maintaining the structural integrity of the core.
3. The Heat Pipe should extend well into the waterline. Ideally the length of the Heat Pipe in contact with coolant l_c will be at least 25% of the length of the Heat Pipe in contact with the heat source l_h .
4. D-M-E Heat Transfer Compound should be used to minimize air gaps between the insert and Heat Pipe.

D-M-E Standard Heat Pipes

SELECTING THE RIGHT SIZE, SHAPE AND TEMPERATURE RANGE

The standard diameters, lengths and temperature ranges of TPL, TPH and TPDC Series Heat Pipes will satisfy most applications.

NOTE: Heat Pipes cannot be used as ejector pins and parts cannot be molded or cast against them. Also, Heat Pipes cannot be cut, machined, bent or plated. If a special size is required, contact D-M-E to discuss your application.

TPL, TPH and TPDC SERIES	TOLERANCES
Diameter (O.D.)	±.004
Length	±.020

TPL AND TPH HEAT PIPES FOR INJECTION MOLDING

For low-temperature Heat Pipes (40°-200°F) use TPL (color-coded WHITE) as a prefix in front of catalog number in the chart below. For high-temperature Heat Pipes (150°-400°F) use TPH (color-coded BLACK) as the prefix. Examples: TPL8-600; TPH6-500.

LENGTH (INCHES)	TPL & TPH DIAMETER & CATALOG NUMBER					
	1/8	3/16	1/4	5/16	3/8	1/2
3	4-300	6-300	8-300	10-300	12-300	16-300
4	4-400	6-400	8-400	10-400	12-400	16-400
5	4-500	6-500	8-500	—	—	—
6	4-600	6-600	8-600	10-600	12-600	16-600
7	4-700	6-700	8-700	—	—	—
8	4-800	6-800	8-800	10-800	12-800	16-800
10	—	—	—	10-1000	12-1000	16-1000
12	—	—	—	—	—	16-1200

TPDC HEAT PIPES FOR DIE CASTING

The internal operating temperature range for TPDC Heat Pipes (color-coded RED) is 150°-600°F. Use Copper Heat Transfer Compound for die casting applications.

LENGTH (INCHES)	TPDC DIAMETER & CATALOG NUMBER		
	1/4	5/16	3/8
4	TPDC8-400	TPDC10-400	—
5	TPDC8-500	TPDC10-500	TPDC12-500
8	TPDC8-800	TPDC10-800	—
10	TPDC8-1000	TPDC10-1000	—
12	—	TPDC10-1200	TPDC12-1200



SILVER HEAT TRANSFER COMPOUND* FOR TPL AND TPH SERIES HEAT PIPES (Catalog No. HTC-06S)

Contains micronic particles of silver to provide a thermal resistance of 4.75°Cin/watt. The compound is supplied in a 5cc plastic syringe. (D-M-E recommends the Silver Heat Transfer Compound because it has eight times lower thermal resistance than the copper equivalent.)

COPPER HEAT TRANSFER COMPOUND* FOR TPL, TPH AND TPDC SERIES HEAT PIPES (Catalog No. HTC-30C)

Contains micronic particles of copper to provide a thermal resistance of 38°Cin/watt. The compound is supplied in a 5cc plastic syringe.

* For .125" diameter Heat Pipes, do not use applicator tube supplied with Heat Transfer Compound. Apply desired amount of compound directly into core hole.

TAMP RING SETS

Each set includes 32 silver alloy tamp rings (enough for installing 16 Heat Pipes) and one hollow tamping tube. Select the required tamp ring set by its I.D. to match the O.D. of the Heat Pipe being used.

CAT. NO.	TARS-04	TARS-06	TARS-08	TARS-10	TARS-12	TARS-16
Ring I.D.	1/8	3/16	1/4	5/16	3/8	1/2

<p>Quantity Discounts Discounts for all Heat Pipe sizes and series apply to current net prices.</p> <p>8 to 20.....Less 5% 21 to 35.....Less 10% 36 to 60.....Less 15% 71 or more ... Quoted by request</p>	<p>Quantity Discounts (Heat Transfer Compounds) Discounts apply to current net prices.</p> <p>2 to 5.....Less 5% 6 to 9..... Less 10% 10 or more... Less 15%</p> <p><i>Quantities of silver and copper compound may be combined for discounts.</i></p>
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