Sample of cooling design for a die-casting mold

(Conventional)
Wall thickness 15–20mm

(Cooling water)
Discharge
Supply

(With vacuum type cooler)
Wall thickness approx. 5mm

(Cooling water)
Vacuum type cooler
Supply

(No need to consider about possible heat crack at the cooled area and enable to enjoy increased cooling effect.)

With employing vacuum type Super Cool you can enjoy greater degree of Freedom in designing mold cooling system.

Outline specification of vacuum type Super Cool V

<table>
<thead>
<tr>
<th>Description</th>
<th>Type SCV-200</th>
<th>Type SCV-380</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling agent</td>
<td>City water</td>
<td>‘ditto’</td>
</tr>
<tr>
<td>Coolant volume(max) - Suction</td>
<td>100 lit/min.</td>
<td>190 lit/min.</td>
</tr>
<tr>
<td>Coolant volume(max) - Suction+Boost</td>
<td>140 lit/min. at 20KPa</td>
<td>240 lit/min. at 20KPa</td>
</tr>
<tr>
<td>Vacuum Pump</td>
<td>2.2kw 200V</td>
<td>3.7kw 200V</td>
</tr>
<tr>
<td>Vacuum</td>
<td>90–92KPa</td>
<td>‘ditto’</td>
</tr>
<tr>
<td>Reservoir (SUS)</td>
<td>100 Lit</td>
<td>250 Lit</td>
</tr>
<tr>
<td>Refill to reservoir</td>
<td>Automatic with 20A ball tap</td>
<td>‘ditto’</td>
</tr>
<tr>
<td>Outline dimensions</td>
<td>500 × 1300 × 1300</td>
<td>500 × 1900 × 1400</td>
</tr>
<tr>
<td>Die Cast M/c applied</td>
<td>less than 1250 ton</td>
<td>1250–3500 ton</td>
</tr>
</tbody>
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JFT Co., Ltd.
The head office 4-26-13 Kouda, Ikeda-shi, Osaka, 563-0043, JAPAN
Osaka office 2-1-4F Sakae-machi, Ikeda-shi, Osaka, 563-0056, JAPAN
TEL: 072-753-8895 Fax: 072-753-6130

Japan Foundry Technology
SUPER COOL V SYSTEM
(Vacuum <negative pressure> Type Mold Cooling System)
NEW SUPER COOL SYSTEM-V(Vacuum)
(A Die Cooling at Reduced Pressure)

Newly developed Super Cool System “SCV (Vacuum)” is engineered to run the cooling water through the cooling pipe system in a mold, where is kept uniformly at a reduced pressure <negative pressure>. This offers:
- To prevent cooling water leakage from sealed portion(s) and crack(s)
- To reduce dissolved oxygen level in cooling water which prevents sticking of foreign materials and rust to inside wall of the cooling pipe, and increases cooling effect considerably.

Such high vacuum <negative pressure> environment inside the cooling pipe system is generated by our newly developed vacuum pump installed at discharging point of the cooling water pipe system in a mold, and enables to flow more volume of cooling water through the system than other conventional vacuum cooling systems.

Applications: Diecasting (HPD), Low Pressure Casting (LPD), Gravity Casting (GDC), etc.

Outline features of the SUPER COOL V SYSTEM

1. Considerably increased cooling capability with introducing negative pressure environment through out the cooling pipe system.
   Scales sticking to the inner wall of the cooling pipe being removed by vaporization of cooling water which increases cooling efficiency.

2. Prevents water leakage, currently which is the most critical trouble for mold cooling by water.
   Negative pressure environment inside cooling pipe prevents cooling water leakage into cavity through crack(s).
   Such offers better quality and productivity through proper improvement in mold cooling system designing.

3. Status of heat transfer to cooling water
   Boundary film?
   Static water layer stayed on cooling pipe wall which is caused by viscosity of cooling water and/or adhered scales.
   Thermal transmission in static water depends on water thermal conductivity and is about 1/100 of that iron, namely the conductivity is very bad.

   Film heat transfer coefficient (h)?
   Heat transferred: Q=\(h A (T_s - T_f)\); \(h=K/\delta\);
   K: Heat conductivity of water
   \(\delta\): Thickness of the film

   How to increase heat transmission?
   Minimize film thickness, increase film heat transmission.

4. Expected effect of negative pressure environment to reduce film thickness
   ① Prevent build-up of scale and water stain
   Reduce dissolved oxygen in cooling water
   \(20 \text{ (dissolved oxygen in water)} = O_2 \text{ (Oxygen gas in atmosphere)}\)
   \(\text{Atmosphere} \quad \text{In water} \quad \text{Disolved oxygen atom} \quad \text{Oxygen} \)

   ② Reduced film thickness under negative pressure environment
   Vaporization of water agitates cooling water which effects to reduce film thickness.

   Negative pressure environment enables to increase efficiency of heat transfer.

   Oxygen atom in water exists in equilibrium with oxygen gas in atmosphere.
   When atmosphere pressure reduces, oxygen atom in water change to oxygen gas and transfer to atmosphere, which reduce concentration of oxygen atom in water.