Polyvinylpyrrolidones (PVP) for Metal Quenching Applications

Luvitec® grades help to make the metal quenching process better – it combines metallurgical advantages of oil and environmental advantages of water based quenching fluids
Luvitec® Grades for Metal Quenching Applications

Metal Quenching

In the steel and alloy manufacturing process rapid cooling (quenching) of hot steel and alloy parts is necessary to achieve high quality standards in terms of hardness. Thorough quenching avoids soft constituents in steel and alloys. Traditionally, oil based quenching fluids are widely used.

Water based Quenching Fluids

Water based quenching formulations offer advantages in several categories.

Technical and production advantages:
- Water based quenching fluids have almost twice the heat capacity of quenching oils.
- Quenched components do not require intensive cleaning before further processing.
- Contamination of the quench bath with water is less critical than for oils. In case of mineral oils traces of water will lead to the formation of soft spots, distortion and cracking problems associated with it.

Environmental and safety advantages:
- Water based quenchants are non-flammable. Due to elimination of the fire hazard risk, capital investment for fire protection systems and insurance premiums are much lower.
- The working environment is much cleaner and safer.

PVP based Quenching Fluids

Among water borne systems, polyvinylpyrrolidone (PVP) based quenching fluids are by far superior since they combine the metallurgical advantages of oil and environmental advantages of water based systems – most notably one can achieve oil type quenching characteristics with aqueous PVP quenching formulations!
Advantages of Luvitec® K

Since more than 10 years BASF markets a broad range of PVP grades for metal quenching applications under the trade name of Luvitec®.

- Luvitec® based quenchants perform at a relatively broad temperature range.
- A broad range of cooling rates can be achieved by varying the Luvitec® type, its concentration, bath temperature and agitation.
- Luvitec® is suitable to both high- and low alloy steels, aluminium and titanium.
- Quenched components may not require cleaning before tempering because Luvitec® films will decompose at high temperature without leaving any residuals.
- Luvitec® based quenchants have a lower viscosity than quenching oils and therefore drag out is low; clogging of quenching equipment does not occur as sometimes seen with polyglycols.
- Luvitec® is compatible with all popular filtration options, such as screens, fibre filters and filter aid backwash systems.
- Contamination of the quench bath with salts is not critical because Luvitec® tolerates higher salt levels than e.g. polyglycol.
- Luvitec® is compatible with many polymers and maybe therefore added to many existing quench formulas without compromise of quench ability.
Luvitec® Grades for Metal Quenching Applications

Luvitec® K 60, K 90 and K 115 are well established in metal quenching formulations for many years. For ease of use, these products are available as aqueous solutions.

They cover a broad range of molecular weights and viscosities. Hence, a great flexibility of quenching characteristics is possible through selection of the Luvitec® type, polymer concentration, bath temperature and degree of agitation.

new Trend

Luvitec® VPC 55 K 65 W shows a optimized smooth quenching characteristic

<table>
<thead>
<tr>
<th></th>
<th>Solid content (%)</th>
<th>Viscosity Brookfield RVT (mPa·s)</th>
<th>K-value⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luvitec® K 60 solution (approx. 35%)</td>
<td>34.0–36.0</td>
<td>2,000–20,000²</td>
<td>52.0–62.0</td>
</tr>
<tr>
<td>Luvitec® K 90 solution (approx. 20%)</td>
<td>19.0–21.0</td>
<td>10,000–40,000³</td>
<td>90.0–98.0</td>
</tr>
<tr>
<td>Luvitec® K 115 CQ solution (approx. 11%)</td>
<td>10.5–11.5</td>
<td>2,000–5,000⁴</td>
<td>114.0–130.0</td>
</tr>
<tr>
<td>Luvitec® VPC 55 K 65 W (approx. 30%)</td>
<td>19.0–21.0</td>
<td>1,000–3,000⁵</td>
<td>62–68</td>
</tr>
</tbody>
</table>

¹ The K value of Luvitec® K 60, K 90 and VPC 55 K 65 W is determined in 1 % aqueous solution; 0.1% concentration is applied for Luvitec® K 115 CQ.
² Spindle 6/50 rpm/23°C, approx. 35% strength aqueous solution.
³ Spindle 7/100 rpm/23°C, approx. 20% strength aqueous solution.
⁴ Spindle 6/100 rpm/23°C, approx. 11% strength aqueous solution.
⁵ LVT, Spindle 4/50 rpm/23 °C, approx. 20 % strength aqueous solution.

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