April 23rd 2012 ~ Monday Morning Minutes:

**Cooling Tower Pumps and Piping – Part 3**

*Where cavitation begins.*

By Norman Hall

Last week the R. L. Deppmann Monday Morning Minute defined $NPSH_R$, and ended with the *Hydraulic Institute (HI)* definition as the absolute pressure that will cause the total head of the pump to be reduced by 3%, due to flow blockage from cavitation”. Of importance is the fact that it does not say that $NPSH_R$ is where cavitation begins.

The place where cavitation begins is called incipient cavitation and can be from 2 to 20% greater than the $NPSH_R$ reported on the pump curve. In addition, $NPSH_R$ is a tested value, the test is with clear un-aerated water; not dirty, highly aerated, tower water and pumps have manufacturing tolerances. The $NPSH_R$ can also vary with the system fluid conditions.

So to reduce the chance of damage to the pump from cavitation, we need to use a larger number than the pump net positive suction head required. A few years ago HI defined some margins to apply to the published pump $NPSH_R$ with different systems and pump types. The margin depended on the application and the SUCTION ENERGY of the pumps. For cooling tower applications, the recommendation was to use a multiplier to $NPSH_R$ of 1.3 for low energy pumps, 1.5 for high energy pumps, and 2.0 for very high energy pumps.

**SO HOW DO WE DETERMINE WHICH MARGIN TO USE?**

The suction energy of a pump depends on a number of variables but it can be approximated by the formula:

\[
\text{Suction Energy} = D \times n \times S \times 10^{-6} \quad \text{or} \quad (\text{RPM} \times Q^{0.5}) \div NPSH_R^{0.75}
\]

Now you use the result to choose the margin using this chart.

<table>
<thead>
<tr>
<th>Suction Energy</th>
<th>Pump Type</th>
<th>Margin for Cooling Towers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 150-220</td>
<td>Low Energy</td>
<td>1.3</td>
</tr>
<tr>
<td>Between 150-220 and 250-380</td>
<td>High Energy</td>
<td>1.5</td>
</tr>
<tr>
<td>Over 250-380</td>
<td>Very High Energy</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Next week we use an example and complete this discussion of Margin applied to NPSHR.

*Click here to request a copy of the Xylem Bell and Gossett Cooling Tower Piping technical bulletin TEH-1075*

**Disclaimer:** R. L. Deppmann and it’s affiliates can not be held liable for issues caused by use of the information on this page. While the information comes from many years of experience and can be a valuable tool, it may not take into account special circumstances in your system and we therefore can not take responsibility for actions that result from this information. Please feel free to contact us if you do have any questions.