OPTION CHECKLIST NO. 3: PUMPS & PUMPING SYSTEMS

• Operate pumps near best efficiency point (BEP).
• Ensure adequate NPSH at site of installation.
• Modify pumping system and pumps losses to minimize throttling.
• Ensure availability of basic instruments at pumps like pressure gauges, flow meters.
• Adapt to wide load variation with variable speed drives or sequenced control of multiple units.
• Stop running multiple pumps - add an auto-start for an on-line spare or add a booster pump in the problem area.
• Use booster pumps for small loads requiring higher pressures.
• Increase fluid temperature differentials to reduce pumping rates in case of heat exchangers.
• Repair seals and packing to minimize water loss by dripping.
• Balance the system to minimize flows and reduce pump power requirements.
• Avoid pumping head with a free-fall return (gravity); Use siphon effect to advantage.
• Conduct water balance to minimise water consumption, thus optimum pump operation.
• Avoid cooling water re-circulation in DG sets, air compressors, refrigeration systems, cooling towers feed water pumps, condenser pumps and process pumps.
• In multiple pump operations, carefully combine the operation of pumps to avoid throttling.
• Provide booster pump for few areas of higher head.
• Replace old pumps by energy efficient pumps.
• In the case of over designed pump, provide variable speed drive, or downsize / replace impeller or replace with correct sized pump for efficient operation.
• Optimise number of stages in multi-stage pump in case of head margins.
• Reduce system resistance by pressure drop assessment and pipe size optimization.
• Regularly check for vibration trend to predict any incipient failures like bearing damage, misalignments, unbalance, foundation looseness etc.

方案列表3：泵和抽水系统

• 使泵接近最佳效率点工作。
• 在安装时要确保泵具有足够的NPSH值。
• 调整泵和抽水系统损耗，以减少降压。
• 为水泵配备压力表、流量表等基本的器具。
• 通过变速驱动或连续控制适应大的负荷变化。
• 停止使用多级泵，在有问题的地方增加自起动器或增压泵。
• 用低荷载的增压泵来获得高压。
• 增加流体温度差，以降低换热器的泵浦速率。
• 修理封焊和填充处，以减少滴漏损失的水。
• 平衡系统，从而降低流速，减少泵的电能需求。
• 利用虹吸作用，防止水头自由落体回流（重力作用）。
• 引导水平衡，以减少水损耗，从而优化泵的运行。
• 防止DG型多级离心泵、空气压缩机、制冷系统、冷却塔给水泵和工艺过程用泵中的冷却水二次循环。
• 在多级泵的运行中，要仔细整合泵的运行，以免发生扼流作用。
• 在特殊区域或需要更高水头的地方，使用增压泵。
• 用节能型泵代替旧的泵。
• 对于设计时考虑过大的泵，为了提高其运行效率，可安装变速驱动装置，或缩小/替换叶轮，或者更换为尺寸合适的泵。
• 如水头高度超过了多级泵的极限，可增加级数。
• 通过压降分析和管道尺寸优化，降低系统阻力。
• 定期检查振动趋势，以预测任何早期的损坏，如轴承损坏，轴心不重合，失去平衡，基础松动等。