NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

BEST PRACTICE GUIDE

Steam and process heating

Steam can be used for indirect heating or it can be applied directly to a process. Steam is advantageous because it transfers heat at constant temperature and has a high heat content per unit volume. Steam is generally produced in a single boiler house on-site and is then distributed to points of need. This can have advantages for centralisation, and disadvantages relating to long pipe runs; and the generation of steam of higher quality than required for the process. These features should be considered when planning to install a new system. The evaluation should include decentralised heat supply, particularly if it is not required at high temperature.

Here we consider steam distribution and use, and not steam generation.

CONSIDERATION	GOOD PRACTICE
Systems approach	• Analyse both the supply and demand to ensure that they fully integrate as a system, including efficiency, reliability and performance; which are all closely related. • Consider implementing an energy management system (EnMS) such as used for ISO 50001.
Condition of steam lines, pipe fittings, heat exchangers and insulation	• Walk along each branch of the distribution system. • Note where there are sources of heat loss (refer to the section below) and draw up a schedule for regular checks.
Steam pressure	• Use the pressure appropriate to the equipment in the system. • High pressure has financial advantages for large distribution systems. However, this must be balanced against higher energy loss for leaks and flash steam. • It is more economical to divide between high and low-pressure steam generators, should the plant require this. • If a pressure reducing valve is used, consider whether a turbine could be inserted at this point. It would create useful energy for some other application and decrease the loss created by a PRV.
Pipe sizing	• Pipe sizing relates to steam pressure (see previous point). • Undersized pipes: Higher pressure requirement, and higher leakage losses. • Oversized pipes: Higher surface losses, and increased capital cost.
Pipe drainage	• An accumulation of condensed steam in the pipes reduces steam flow. • Water hammer and equipment failure can result. • Ensure that the lines drain to sumps and that these are correctly trapped for the return of condensate.
Heat transfer	• The high heat transfer rate of steam can be significantly reduced if there is air and or condensate on the heat exchange surface. • Fit air vents at points where air is accumulated. • Scale, resulting from poor water, on the heat exchanger surface also acts as an insulator. This can be removed by periodic cleaning.

Trapping	• Steam traps remove condensed steam, i.e. water, and air from the system while preventing steam from escaping. • Ensure that traps are not 'waterlogged' as this not only can damage the system, but can also prevent heat from being transferred. • Traps should be regularly checked and maintained against steam leaks and build-up of dirt.
Leaks	• Steam leaks are a direct energy, and financial loss. • As with traps, institute a regular check on these and prioritise repairs.
Insulation	• The high temperature of steam lines makes the thickness and integrity (continuity, airtightness, and waterlogging) of thermal insulation of great importance. • Consider increasing insulation thickness if the price of fuel is greater than when it was first installed. • Cover open hot liquid surfaces. • Insulate condensate lines.
Condensate	• Condensate contains much of the heat that was put into the steam by the fuel and should be returned to the steam generator. • Note whether the condensate is being returned from all heat exchangers and not merely running to waste.
Flash steam	• Flash steam is a way of extracting energy from the steam by allowing the condensate into a vessel at a lower pressure than the steam. Some of the condensate will 'flash' into lower pressure steam which could be usefully employed.
Blow down	• Only the minimum amount necessary for good water quality should be blown down. • Consider whether heat recover from the blow down water is feasible.
Maintenance	• A regularly maintenance plan will capture the deficiencies mentioned above, i.e. trap leaks, pipe leaks, and poor insulation. • Regular water chemistry checks are equally important for good heat transfer. • Ensure that air heaters are clean and free from corrosion.