LINK TO POWER STATION

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Keywords : Parameters, Auxiliary lines, electrical cables, Discharge culverts

Contents

Summary

Aspects of the desalination plant design which are related to the interfaces with the power plant yard are described.

The criteria which have to be taken into account in order to optimize the layout of the major process and the auxiliary pipes are given, as well as the factors which have to be considered in the mutual arrangement and location of the desalination and power plant yard.

Aspects related to the electrical and I&C connections are also considered and some of the typical arrangements selected in the major power stations have been shown in order to evaluate the advantages and disadvantages that the selected arrangement can bring.

1. Introduction

Criteria of optimization and proper matching have to be considered in the coupling of a desalination and power plant.

These criteria may involve the choice of the proper routing or the arrangement of the site layout in order to provide all the facilities, which can involve easy operation and maintenance.

Basic guidelines are presented for the designer in order to carry out the matching of power and desalination plant taking into account the layout and thermodynamic interrelation occurring between the two yards.

2. Basic Considerations

The layout of desalination plant is the result of the overall plant arrangement, site conditions, and customer requirements; nevertheless the configuration of the linkage to

the power station is a key factor for the overall plant economy. The affected economy aspects are both investment and operational.

In general, a direct dependence between the two aspects occurs. Consequently, layouts which foresee long and irrational routings of the key process lines also imply, in addition to the hardware direct cost (piping, structures, etc.), an uneconomical operation of the plant.

The relative position of the desalination plant and the power station must be designed bearing in mind that the following connections between the two yards are met:

1. Process lines.
2. Auxiliary lines.
3. I&C and electrical cables.
4. Discharge culverts.
5. Access roads.

The routing of process lines is to a great extent the main design criteria which needs to be considered in order to optimize the linkage between the desalination and power plants. The flow charts in Figures 1a, b schematize the possible interconnections of the process lines which can be classified as follows:

1. Low pressure steam (LP): from steam turbine extraction to brine heater.
2. Medium pressure steam (MP): from steam turbine extraction or HRSG to vacuum system.
3. High pressure steam (HP): from boiler or HRSG to HP-LP and HP-MP steam reducing stations.
4. Steam condensate: from brine heater to deaereator or condensate tanks.
5. Bleeding water: from boiler feed water pumps to HP-LP and HP-MP stream reducing stations.
6. Distillate high purity: from distillate header to demineralization plant.
7. Condensate/steam from various sources: condensate from steam traps or hot steam spillages condensed for warm up purposes.

According to the type of process adopted and customer requirements several patterns can be implemented, consequently some of the interconnections shown in Figure 1 can also not be provided.

Nevertheless the overall plant arrangement is governed by the routing of the low pressure steam lines because of larger diameter and because, in order to allow thermal expansion, bends can be required as result of the stress analysis for the pipework during operating conditions.

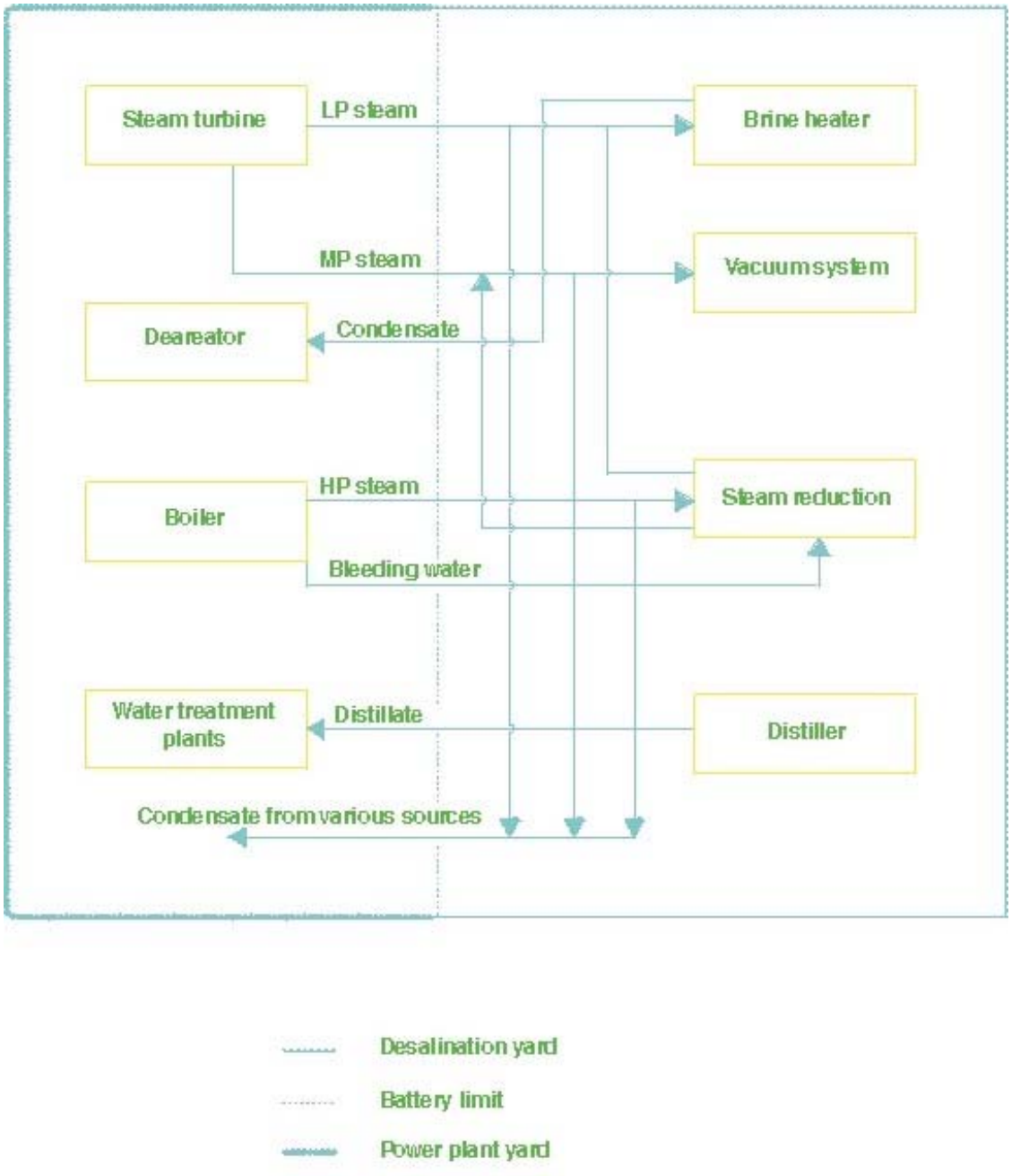

Figure 1. (a) Typical link to steam turbine power plant.

If on the one hand, the thermal elongation represents a problem also for MP and HP stress line as well as condensate and bleeding water, on the other hand the smaller size of these lines allows either the possibility to design loops or more tortuous routings which would otherwise be not practical and/or economical for LP steam line.

As a consequence of this, it can be stated that, for those power generation processes, where the energy input to desalination plant is only via MP steam the configuration of the linkage between the two yards is much more flexible.

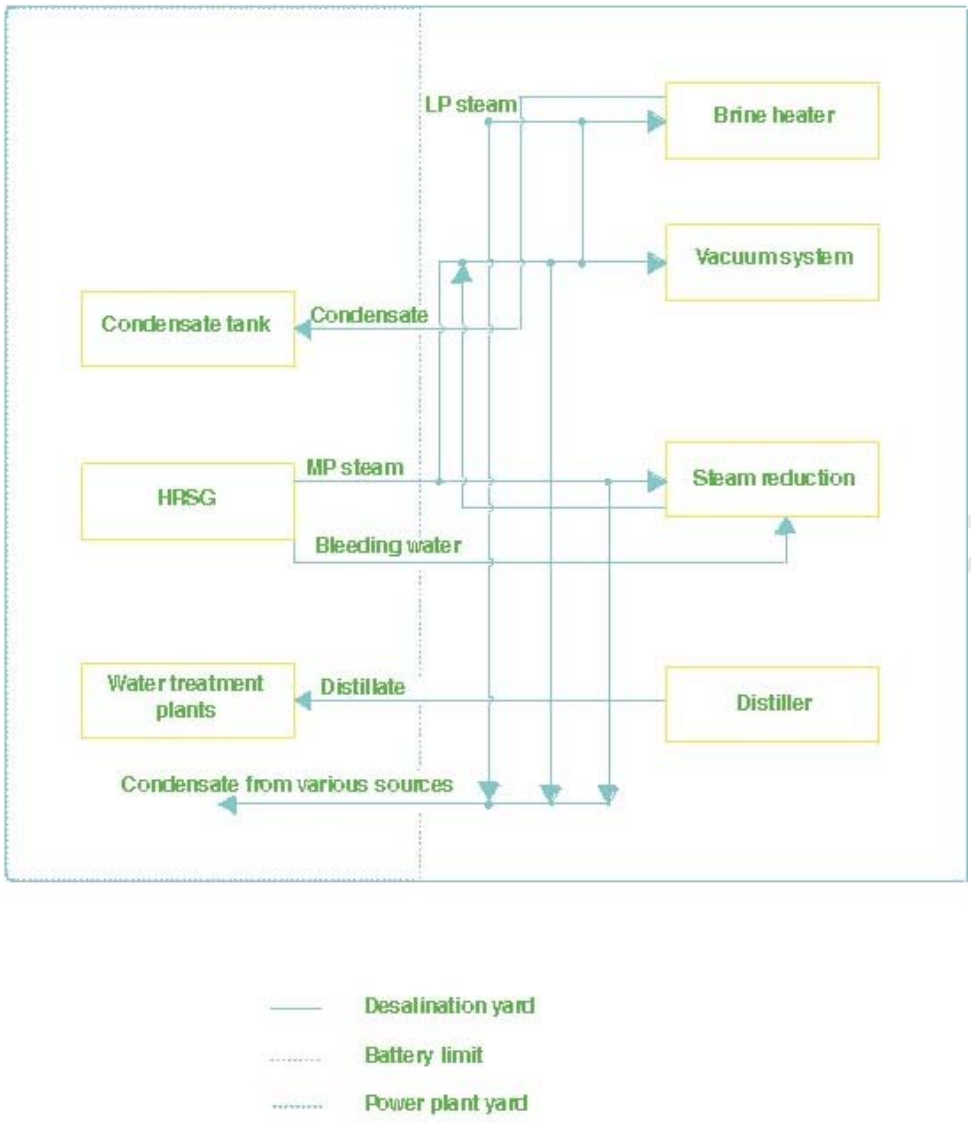

Figure 1. (b) Typical link to HRSG power plant.

Another important factor which governs the interconnecting lines arrangement between the desalination and power plant yards is the position of the brine heater with respect to the evaporator. This can be typically arranged in two ways:

1. With a brine heater in front of distiller.
2. With one or two brine heaters beside the evaporator.

This last configuration, which can be imposed by thermodynamic or structural reasons, brings few disadvantages that might arise by the increasing the brine recirculating piping.

In fact, this kind of pipework, which is connected to the brine heater tube side, typically is of very large diameter and comprises expensive materials such as copper alloyed clad steel.

In general it can be stated that the typical parallel configuration schematically represented in Figure 2 is the most convenient in terms of pipework organization.

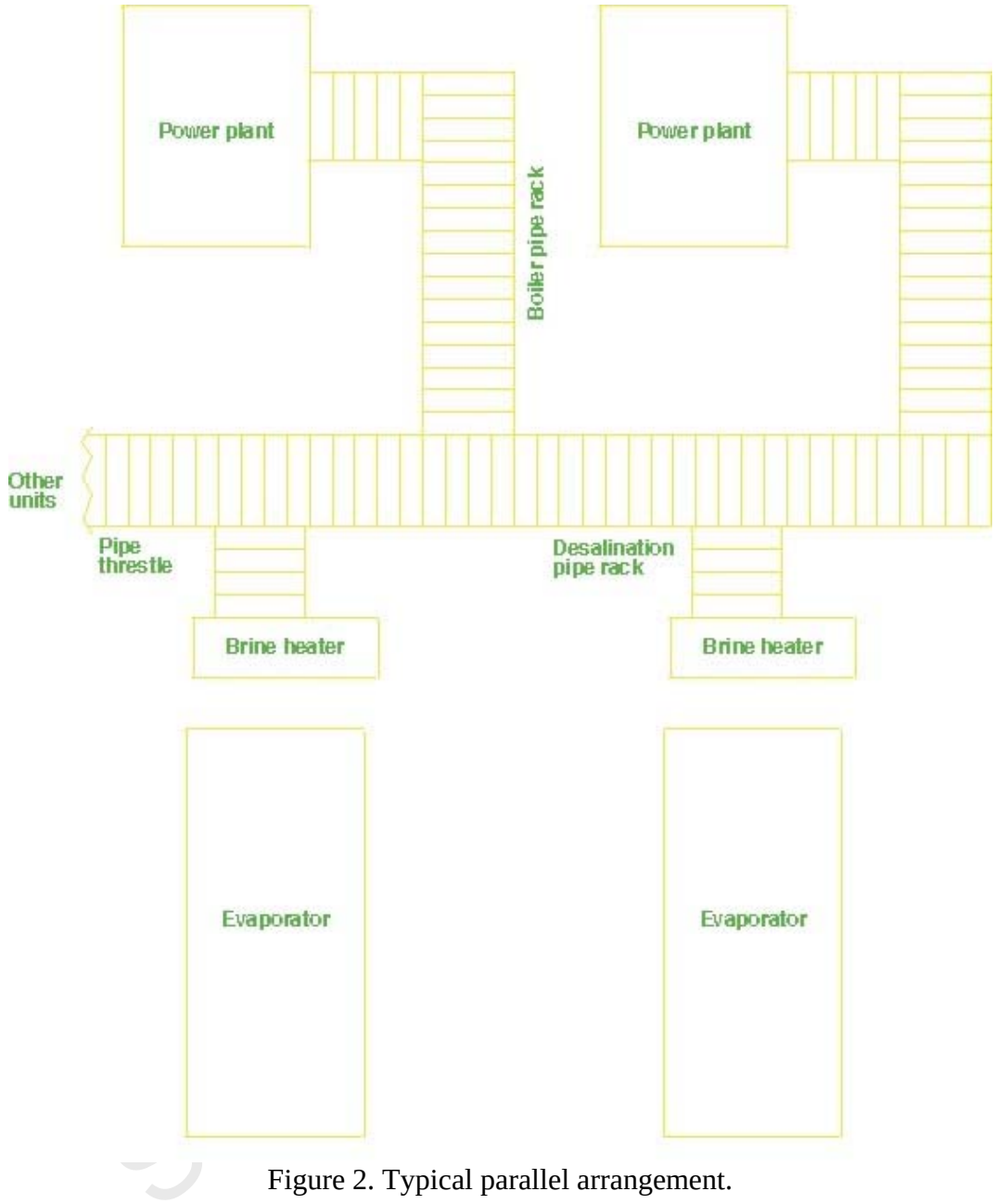

Figure 2. Typical parallel arrangement.

The configuration, moreover, allows an easier possibility of extension in a second stage of other units, which may be otherwise not advisable with the perpendicular arrangement schematized in Figure 3, in view of the main pipe rack load limitations and space availability.

The routing of the auxiliary lines is of less importance for the basic assessment of the linkage between power and desalination plant. Nevertheless it must be considered in the basic layout and in the auxiliary structure design that extra space should be available for these lines.

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