SEAWATER SUPPLY PUMP

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Contents

Summary

This chapter deals with the design philosophy and construction requirements for sea water supply pumps in a desalination system.

Sea water supply pumps differ from circulation water pumps as they deal with a much wider range of operating conditions. The process design of these pumps in order to determine operating flow rate range is described.

Construction features are also given with respect to the requirement for easy operation and maintenance.

1. An Overview to Auxiliary Equipment

From an economical point of view auxiliary equipment represents a not negligible percentage of the desalination plant budget. This can vary from 25 to 35 per cent depending on the type of specification and materials that are requested for the evaporator, and on the quality of the materials prescribed.

The process pumps are the major contribution to the auxiliary equipment cost and could represent 10 per cent of the overall project cost.

Piping, valves, sponge ball cleaning system, vacuum system and chemical dosing stations follow the major process pumps in term of investment costs.

Independently of their investment cost, the auxiliary equipment is in all respects the dynamic heart of the desalination plant and the reliability of the entire plant depends on its safe and stable operation.

In addition, the operation of the auxiliary equipment directly affects the main desalination plant process parameters and, without a correct process input to the specification for the auxiliary equipment, the coordination between the various plant components and the evaporator as well as the successful operation of the desalination plant could be jeopardized.

This chapter uses not only a textbook approach, but also considers the operational experience gained by various plant owners in the field, and the experience fed back to the engineering department.

In this respect this chapter is aiming at analyzing the key interfaces that have to be considered in order to facilitate the development of the desalination project during its various phases.

The technical characteristics of auxiliary equipment might substantially differ from each other. Since the design of a pump or a sponge ball cleaning system involves disciplines completely different from the design of a vacuum system, it is difficult to group them together from a technical point of view.

Nethertheless the auxiliary equipment has some typical features in common which depends on how the supply is included in the overall procurement of the materials for the desalination plant, as well as on the development of the engineering.

These features are:

- Good interface with the subcontractor concerning the detailed engineering and material supply
- Allotting same time in the project schedule for their purchase
- Allotting same preconditions for the purchase specification
- Relatively long delivery time
- Recognizing strategic importance of the spare parts

Figure 1 shows the interfaces that contribute to a successful design of auxiliary equipment in a desalination plant.

A practical approach and good interaction between client, contractor and manufacturer are the key factors for a successful desalination project.

A practical approach is also essential especially as far as easy maintenance and simple operation is concerned which must be considered when the plant is specified.

Client experience and feed back on the evaporator design operation, however, is the basis for upgrading the specification and for improving the manufacturer's design.

As can be seen in Figure 1 the factors involved are:

1. Main contractor design data
2. Owner operational experience

3. Engineer operational and design experience
4. Manufacturer detailed engineering and construction expertise

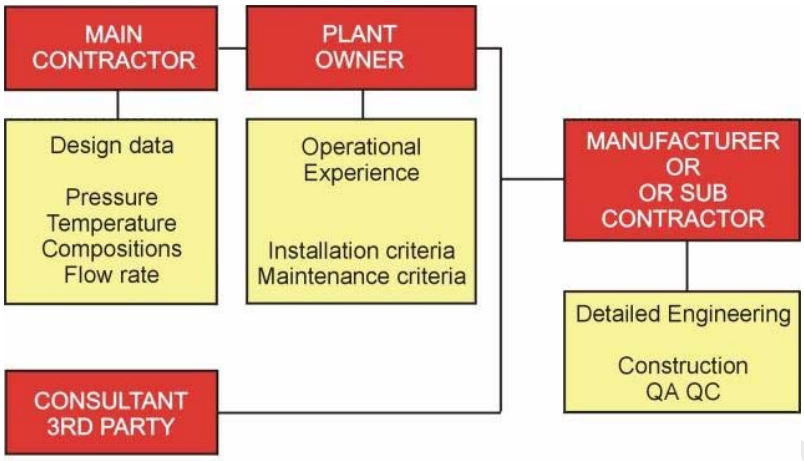

Figure 1. Coordination amoang the parties involved in a desalination project.

The design data can be grouped in terms of the information obtained at the end of the basic design phases which is carried out by the main contractor and which leads to the identification of the following parameters:

- Flow rates
- Temperatures
- Pressures
- Materials
- Fluid chemical composition and analysis

These parameters are entered in the technical specification which is the basic documentation submitted to the manufacturer.

In this respect the operational experience of the plant owner is very useful when basic data are discussed in order to detect any possible technical solution which could overcome the operational problems encountered previously.

This can refer for instance to the selection of a material which under long term operational experience, has revealed its deficiencies, or to the definition of particular items that can have a cost impact on the supply. These can be grouped in the data as construction and installation criteria and can be, as an example:

For pumps:

- Requirement for spacers to easy maintenance
- Type of mechanical equipment
- Type of coupling
- Requirement for pull out solutions to be employed for vertical type pumps
- Criteria of installation

For chemical dosing system:

- Storage time and preparation cycles
- Dilution
- Criteria of installation

The last factor to be considered is the detailed design of the equipment.
In this respect, the manufacturer's expertise is the leading factor since this kind of design is individual to each manufacturer.

The manufacturer's capability to perform and adapt its machines to the desalination plant environment is a target which can be obtained only after a very careful coordination between all the parties involved, and often this is a difficult target to achieve.

This fact will, in turn, affect the correct sequence of document preparation which has to be prepared prior to the definition of the specification of the auxiliary systems, and which must circulated after the order to the subcontractor has been issued.

The schematic flow diagram in Figure 2 gives an idea of the documentation which must be frozen from the engineering point of view before starting the detailed activity relevant to the procurement of the auxiliary equipment.

This could be important in order to avoid rectifying an engineering order or supply caused by additional requests or project change.

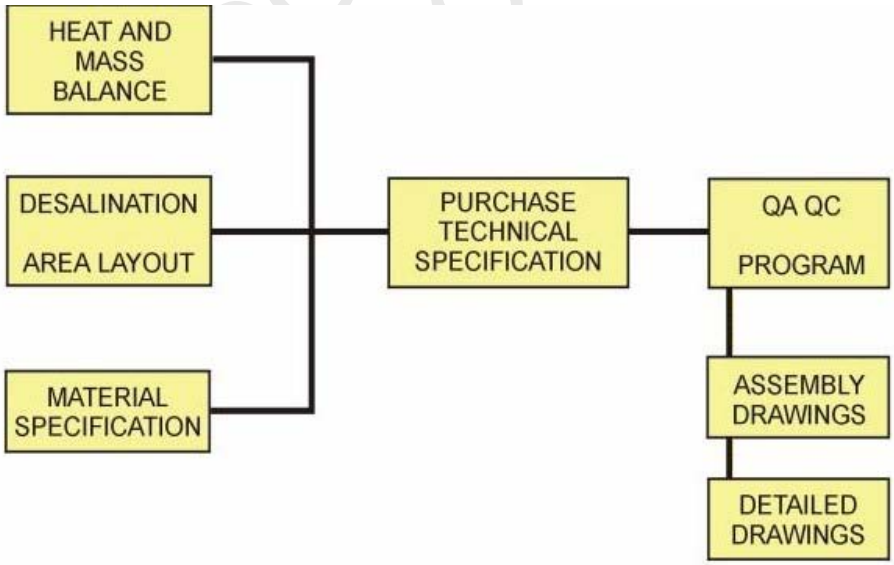

Figure 2. Schematic engineering activities sequence for auxiliary equipment procurement.

Another important factor which has to be considered to optimize technically and economically the design of auxiliary equipment is that during the last decade components inside the desalination plant, such as pumps and piping, have been subject

to enormous development either in the technology of construction or in the selection of materials.

Besides the improvements listed above, the operational experience of about twenty years of industrial operation in large-scale plants has led to new concepts in the basic design criteria of these equipments.

For instance, the over design in the selection of the pump head is no longer considered a beneficial margin for equipment but a danger which can be a cause of cavitation and subsequent erosion downstream in the control valve due to excessive throttling of energy.

The development in the technology relevant to the auxiliary equipment in the future decade is likely to be very interesting and should lead to important goals such as:

- Reduction in the specific power consumption
- Reduction in the specific chemical dosage
- Reduction in the equipment overhauling
- Reduction in the specific steam consumption
- Reduction in the storage and purchase of strategic spares

The benefits of this targets for the plant owner are self evident.

Another aspect which has to be considered is that, if on one hand the design of a process pump or a vacuum system for a desalination plant does not differ substantially from the design of a similar equipment, for example for a power station, however, the range of process conditions that have to be considered is completely different.

For example, the seawater supply pumps for a desalination plant could look quite similar to the circulating water pumps for power plant condenser. Nethertheless, the range of operating conditions for seawater supply pump is much wider and can be subject to throttling in accordance to the requirements of the plant.

A target for the desalination community in respect to handling the matter of auxiliary equipment is to prepare a predefined frame of operating situational patterns as well as providing standardized information which would have to be coordinated and be taken into account in the various steps of the project.

Standards are often not applicable, or very generic if referred to desalination plants, therefore, all the coordination cycle often has to be initiated or reinvented at the beginning of a new project.

The aim of this chapter is basically to enlighten all the parties involved of what is upstream or downstream of their own work.

Such understanding will mean that no aspect of the design or any coordinated information would be overlooked, and ensure that any plant owner has a standardized level of quality in the design and the supply of desalination plant auxiliary equipment.

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