Hydraulic study, Basic and Detailed Design Cooling water system

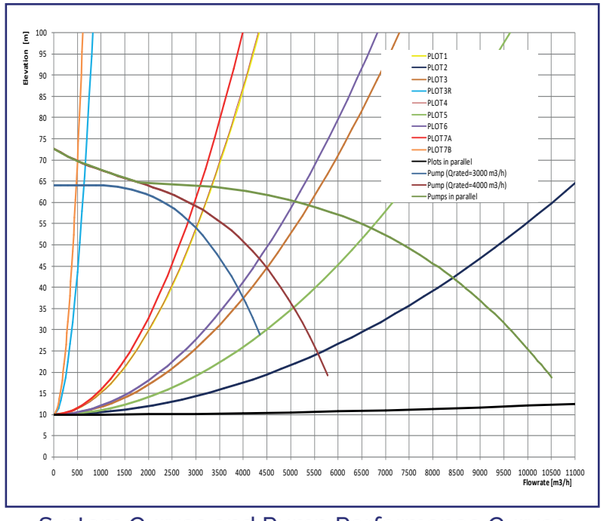
Objectives

The scope of the present document is to describe all the activities carried out for the design and the study of a cooling water system i.e.:

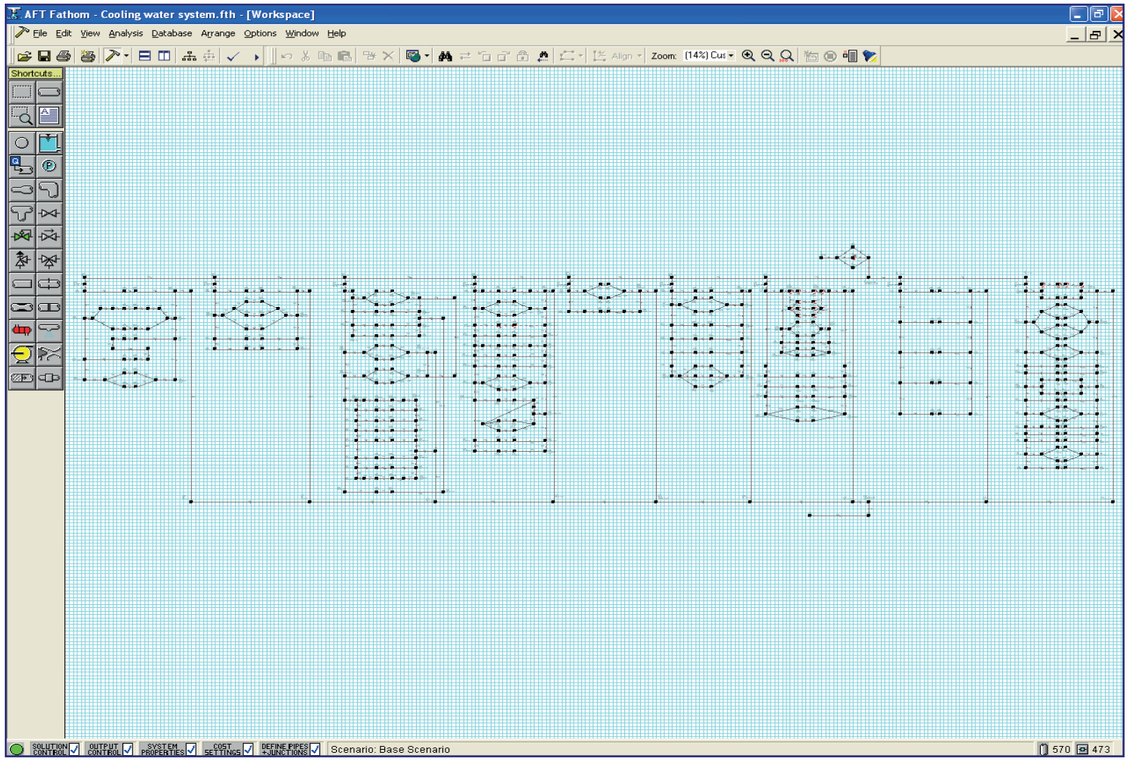
1. Hydraulic study of the existing cooling water system (2013-2018);
2. Basic Design of a new cooling water system or new manifolds (2015-2016);
3. Detailed Design of a temporary rapid solution (2014);

CWS 6 Celle Bis - Hydraulic study

The first CWS Hydraulic Analysis (2013) carried in Sannazzaro, refers to a plant named “6 celle bis”. The water cooling system (3 pumps, 112 heat exchangers, 473 nodes, 570 pipes, having the diameters of 2”: 36”, 1 cooling tower) has been modelled throughout the SW AFT Fathom. The scopes of the work were to assess the potentiality of the existing system estimating pipes/heat exchangers fouling due to scaling, organic and sand deposits.

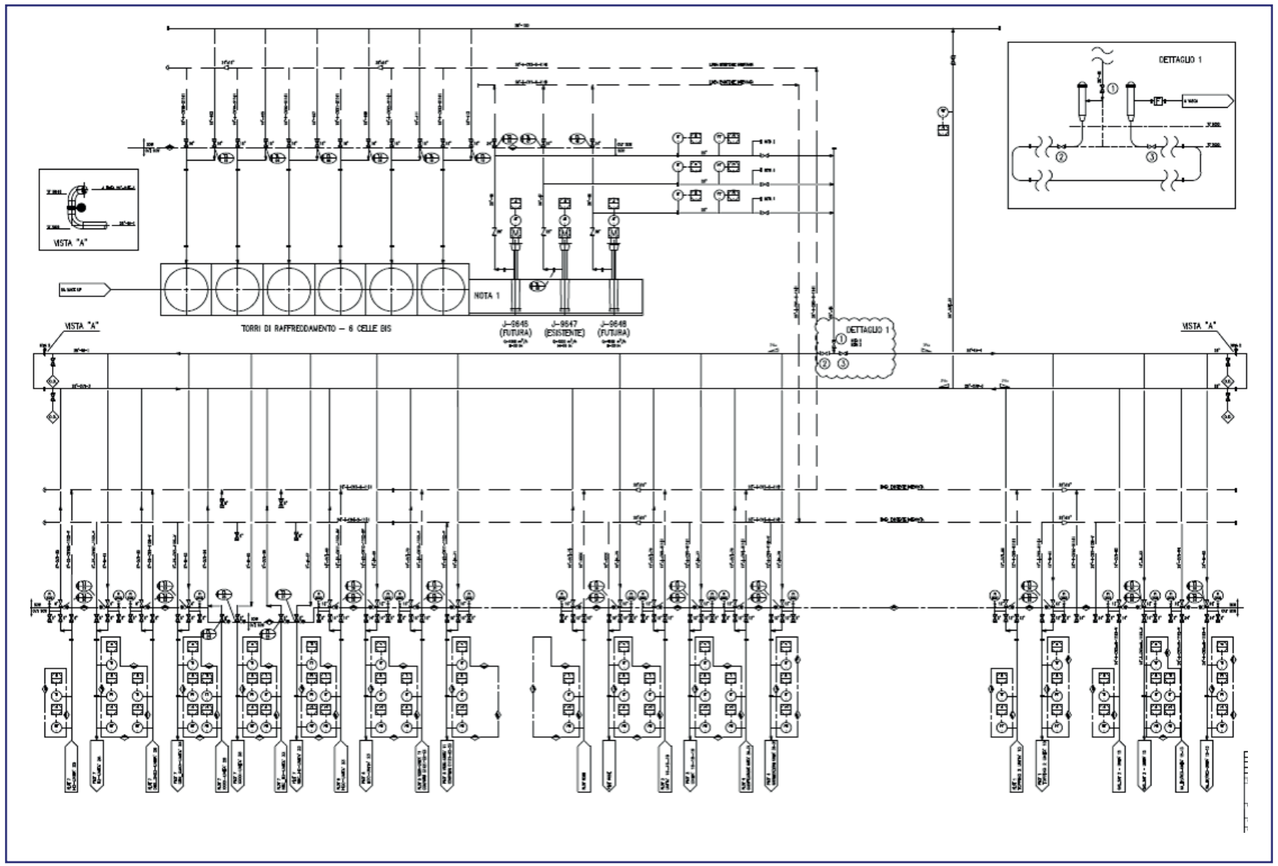


System Curves and Pump Performance Curves



CWS 6 Celle Bis - Feasibility Step

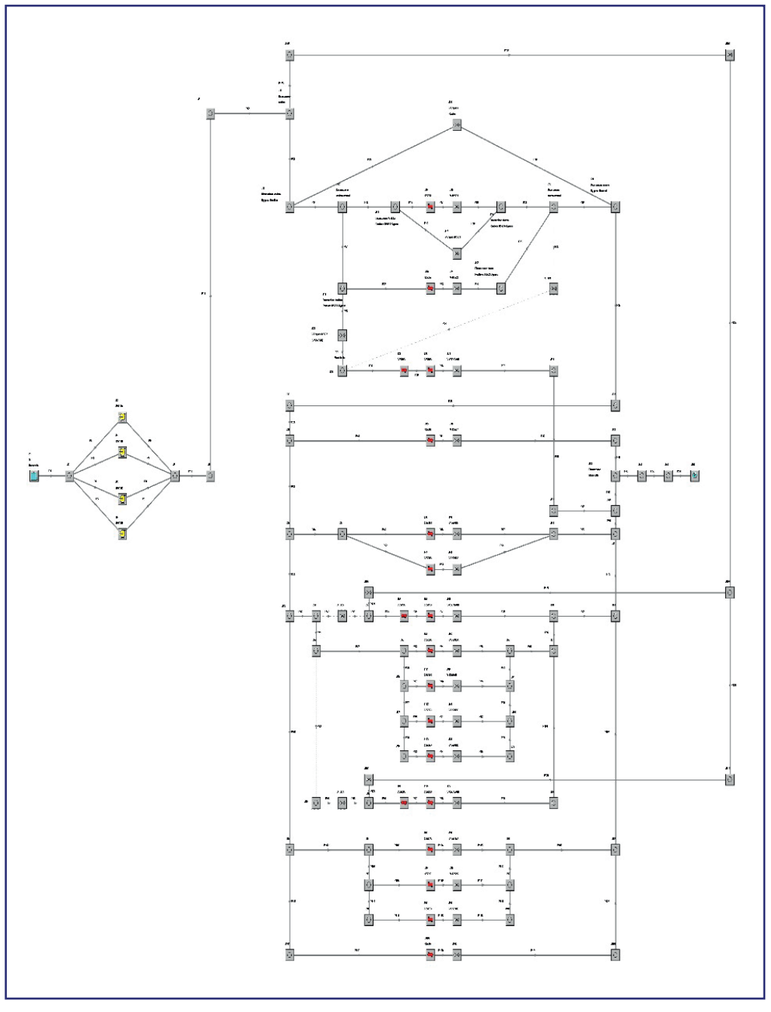
By way of the hydraulic study, it has been possible to suggest new modifications of the network in order to optimise the flowrates. The feasibility analysis (2017) determined the change of the manifolds and pumps.



In 2014, a second Study was carried on a different CW System.

However, this time the Job had a wider scope: in addition to the hydraulic Study several engineering activities were required.

Hydraulic study



SCOPE

The aim of the work was to carry an hydraulic study and identify the reasons which cause a general water flowrate reduction in the Alkylation unit.

METHODOLOGY

The first step of the work regarded the study of the water network through the representation of the system and pumps characteristic curves.
Following, it has been modelled the system by means of AFT Fathom. Every device has been detailed in the software, i.e.:

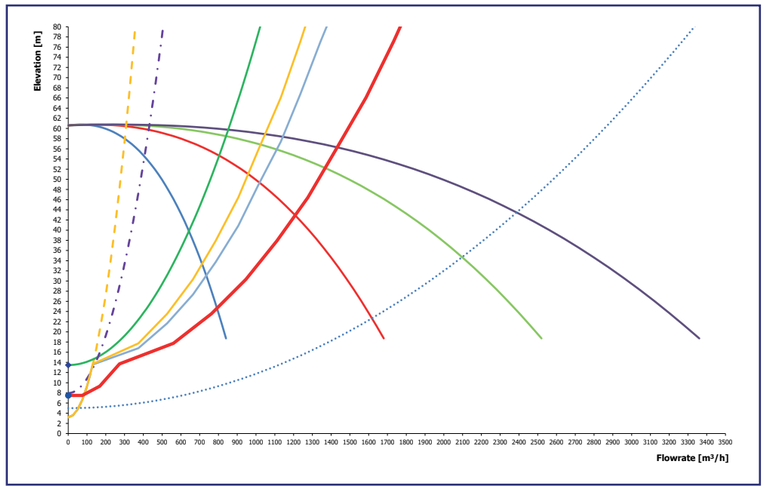
- Pumps;
- Pipes (Material, diameter, length, fittings);
- Heat exchangers/Reactors (Material, passes number, length, thickness, OD);
- Valves (type, CV);
- Water basin and cooling tower simulated as two pressure nodes.

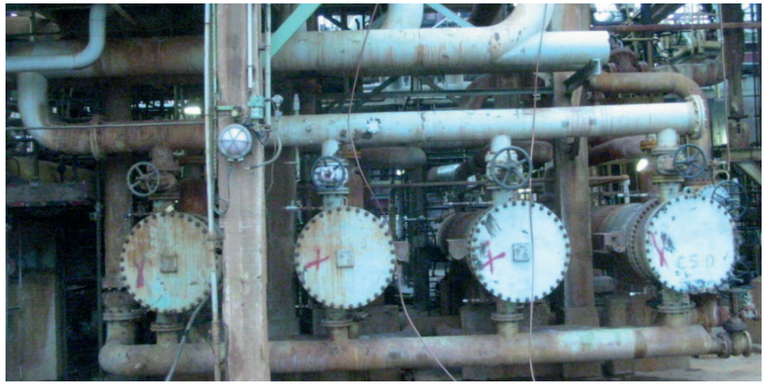
RESULTS

The first step allowed to:

- Understand the behaviour of the existing circuit as it is but in new&clean conditions;
- Identify the hydraulic problem, in terms of:
    - Pumps configuration;
    - Heat exchangers/Reactors asset.

Detailed Design of a temporary rapid solution





SCOPE

The second step of the work was to investigate the feasibility of a temporary solution having the scope of improving the water supply especially in the reactors.

METHODOLOGY

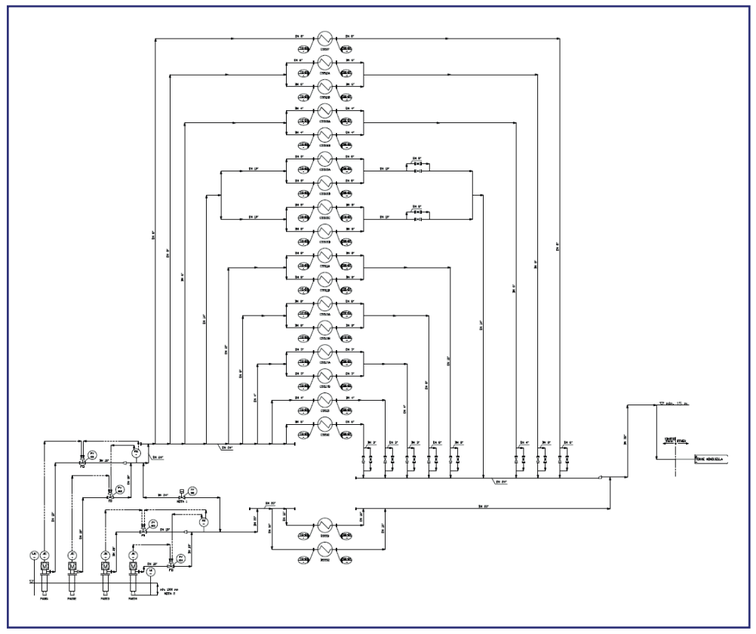
The second step of the work has been carried out through the following phases:

1. A benchmark between flowrate, temperature and pressure measures along the water's circuit and the simulation results. In that way, it has been validated the software model enabling to detect the heat exchangers/reactors having the main hydraulic problems;
2. A detailed design of two new connections in order to change the existing alignment;
3. A commissioning procedure of the new configuration activation during the normal operations in order to avoid a temporary emptying of each device.

RESULTS

The start of the temporary solution has enhanced the water distribution. Clearly this system have not totally eliminated the problem, but it permits to work with a more suitable productivity during the project development of the new cooling water system.

Basic Design of the new CWS



SCOPE

The last step of the project considered the design of a brand new cooling water system, in terms of new pumps, pipes and regulation system in order to reach the flowrate design in each device. The aim of the work does not included the replacement of the existing heat exchangers/reactors.

METHODOLOGY

The basic design has been carried out through the following steps:

1. Preliminary lines sizing;
2. Preliminary pumps design;
3. Representation and analysis of the preliminary system and characteristic curves;
4. Preliminary system regulation design;
5. Simulation of the new hydraulic network through the SW AFT Fathom;
6. Verify the achievement of devices' design flowrate for the worst cases (different fouling degree);
7. Verify the system regulation behaviour in each operative case;
8. Conclusive optimisation of new pipes diameters/lengths, pumps performance and system regulation.

RESULTS

According to the simulation results, Plot plants, P&IDs, Calculation Report, Equipment List, D/S and Cost list (± 30%) have been issued.