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BASF SONATRACH PropanChem S.A.

Hydraulic & Thermal Study & Simulation of the Cooling Water System in the PDH Plant

Master thesis presented by Robert Cherta Roig
to obtain the Master's Degree in Chemical Engineering
from the Universitat Rovira i Virgili

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NOMENCLATURE

ACC: Air-Cooled Condensers

BSP: BASF SONATRACH PropanChem S.A.

CT: Cooling Tower

CS: Cooling System

CWS: Cooling Water System

CW: Cooling Water

DM: Dynamic Model

FCC: Fluidized bed Catalytic Cracking

FGRP: Fiberglass Reinforced Plastic

HEX: Heat Exchanger

HM: Hydraulic Model

PDH: Propane Dehydrogenation

P&ID: Piping and Instrumentation Diagram

PFD: Process Flow Diagram

PG: Pressure Gauge

PRF: Partial Recirculation Filter

PVC: Polyvinyl Chloride

RTD: Resistance Temperature Detectors

SS: Steady State

TOC: Total Organic Carbon

WSAC: Wet-Surface Air Cooler

SUMMARY

This work presents a hydraulic and thermal analysis of the cooling water system of a propane dehydrogenation plant, with the aim of improving the understanding of its current behavior and to support future technical decisions. For this purpose, a dynamic simulation model has been developed in Aspen HYSYS, based on real data obtained by means of specific instrumentation installed during the project.

The construction of the model required the identification and classification of cooling water consumers, the installation of pressure gauges at strategic points and the collection of operating parameters from process data and technical documentation. Once validated against field measurements, the model has made it possible to simulate different operating scenarios, identify critical areas such as high head losses or flow imbalances, and evaluate local improvement measures.

Among the proposed interventions, the cutting of pump impellers or the implementation of bypass lines, which have proven to be effective in reducing hydraulic imbalances, stand out. In contrast, other alternatives involving complex reconnections have been discarded because of their limited technical benefit. Overall, the model has provided the plant with a reliable and versatile tool for performance analysis, optimization studies and scenario evaluation.

Despite its high degree of fit, the model still presents certain limitations derived from the absence of some low-flow secondary lines and the limited availability of real-time instrumentation, which could generate small deviations under certain conditions. Nevertheless, the results obtained constitute a solid basis for future developments, such as the extension of the model, the incorporation of new instrumentation or a possible integration with control systems to reinforce the diagnostic and decision-making capacity.

To obtain access to the full version of this project please contact Pere Gabarra (pere.gabarra-girones@basf.com) or Robert Fortuny (robert.fortuny@basf.com).