Furnaces: Safe Operation & Optimization

Application using dynamic simulator (CORYS IndissPlus)

4 days **FURNSOO-EN-P**

Overview

LEVEL

Skilled

PURPOSE

This course provides in-depth knowledge of furnace operation in the petroleum and petrochemical industries. The course covers also the safety and reliability constraints.

LEARNING OBJECTIVES

Upon completion of the course, participants will be able to:

recognize the main operating and material constraints for an optimal, safe and reliable furnace operation,

describe industrial combustion phenomena and calculate the air/fuel ratio for optimum combustion,

identify bad-quality combustion from flue gas analysis and flame study, and implement corrective steps,

list and apply the main steps of a furnace start-up procedure.

WAYS AND MEANS

Use of a dynamic simulator to understand the impact of operating conditions on thermal performance and furnace operation.

Use of case studies and exercises based on industrial situations.

Special emphasis on safety issues and abnormal situations that can lead to accidents.

The course content can be tailored to different types of furnaces and includes specificities linked to some processing units such as the steam reformer or steamcracker.

LEARNING ASSESSMENT

Quiz at the end of the training session.

PREREQUISITES

To have a 1 month of proven professional experience in the refining or petrochemical industry.

Agenda

FURNACE CONSTRUCTION & OPERATING CONDITIONS — 0.75 d

Different types of furnace and operating conditions. Scope and limitations for improving furnace efficiency.
Construction of heat exchange areas and refractory materials: tube bundle arrangement, insulation, type of material used and operating limits.

COMBUSTION - BURNERS - DRAFT — 1.25 d

Combustion conditions: liquid and fuel gas characteristics, liquid spray.
Burners: fuel and air supply and mixture. Conventional and low NO_x burners operation.
Combustion quality: analysis of the oxygen and the unburned material in the flue gases, control of combustion air flowrate and air/fuel ratio.
Combustion safety: flame detection, control and safety devices.

Air and flue gas circulation: natural draft, forced draft, pressure differential control, automatic safety devices. Damper or induced draft fan role.
Application:
Natural and forced draft pressure profile drawing. Review of draft constraints.
Different types of burners and spraying systems.

HEAT TRANSFER & FURNACE OPERATION

2 d

Heat transfer to the tube coil: control parameters. Impact of internal or external fouling.
Heat control: process fluid outlet temperature, fuel flowrate control.
Most important furnace temperature and constraints: skin temperature, bridgewall temperature, limits and risk of overcoming.
Application: furnace temperature profile and heat recovery distribution as a function of fuel burned and combustion air excess.
On-stream furnace operations: monitoring of combustion and heating. Modifying operating conditions. Analysis of disturbances. Key points for safe operation.
Start-up and shutdown: preparation, safe ignition procedures, ignition after a short shutdown, normal shutdown, emergency shutdown.
Incidents.
Troubleshooting. Prevention.
Application:
Case study of furnace accidents.
Start-up procedure study.