**Title:** Fired Heaters / Combustion Technology

**Potential PDH:** 40 **Code:** BTT068

**Description:**

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

- Understand combustion basics and operating best practices
- Understand hardware and instrumentation of fired equipment
- Make rough calculations for trouble shooting of field problems
- Optimize/balance proper operation and thermal efficiency of fired equipment

**Outline:**

Combustion Theory
- Combustion of fuels
- Furnace efficiency calculations
- Flammability limit

Burners
- Burner types
- Operating characteristics
- Optimization

Atomization (for oil fired configurations)
- Atomizer types
- Operating characteristics
- Optimization

Low NOx Burners
- Formation of NOx and Solids
- Overview of NOx and Solids reduction techniques
- How to reduce the impact of combustion on the environment

Furnaces
- Purposes and process application
- Furnace scheme, components, and general lay-out
- Main parameters in furnace efficiency
- Transfer of heat from fuel to process (radiation/convection; gasfiring / oil firing)
- Two phase flow
- Causes of furnace tube overheating
- Effect of coke formation
- Different furnace types

Air Preheat
- Effects on efficiency
- SO3 Dew point corrosion
- Different types
- Operation / maintenance

Furnace Control and Safety
- Minimum stops:
  - Mechanical minimum stops
  - Active minimum stops
- Steam atomizers

- Fuel temperature and steam-oil delta p control
- Safeguarding
- Air/fuel ration control schemes
- Effect of variations in molecular weight
- Safeguarding types:
  - Flame detection
  - Low pressure trips

Furnace Draft
- Purpose of furnace stacks
- Pressure profiles of natural and forced draught systems
- To be able to calculate actual draught levels in combustion systems

Start-up and Operation
- Maintenance and inspection of burners
- Furnace Oxygen – and draft control
- Normal operation – “control knobs”

Furnace Tube Decoking
- Shot blasting
- High Pressure Water Jetting
- Spalling
- Steam-Air decoking
- Mechanical decoking aka Pigging

Refractory
- Integrity and drying
- Preparations
- Water requirements and bonding systems

Furnace Tube Failure
- Causes
- Prevention
- Detection
- Managing small verses large tube failures

On-Line Chemical Cleaning
- Fuel additives
- Radiant cell additives

Trial for Ignition Time
- Critical parameters
- Calculation of the safe time periods for purge/etc
- Trial-For-Ignition time restrictions for process safeguarding

Exercises applicable to discussed calculations / topics

**Instructor:**

Keith Austin has over 30 years’ experience in refinery operations, based on his long-term career with Shell Oil Company, Deer Park Refinery/Chemical Complex and as an independent consultant. His experience is focused on fired heaters and included research and development as well as large capital improvement projects related to fired equipment. Mr. Austin has provided operations support for over 65 process heaters and 7 large flares in a refinery, olefins and chemical plant as well as supporting hundreds of thermography inspections and heater improvement activities across North America. He has also participated in startup of a new power station which included two 1250 psi boilers, two steam

turbine 50 MW generators, de-mineralized water and condensate treatment, cooling water system and associated equipment.

Dirk Jan Treur is a Mechanical Engineer with 23 years of experience with design, construction, commissioning, start-up, and operation in heat transfer, and fired equipment in the oil & gas, energy, and power generation industries. He has provided asset, engineering, and project support in furnace design, process/technical safety, troubleshooting, burners and combustion, emissions, maintenance, inspections, turnaround, commissioning & start-up support as well as areas including energy & power, boiler, steam, condensate, feed water, heat transfer fluid systems, fuel systems, industrial gases, utility water treatment, cooling/chilling systems design.