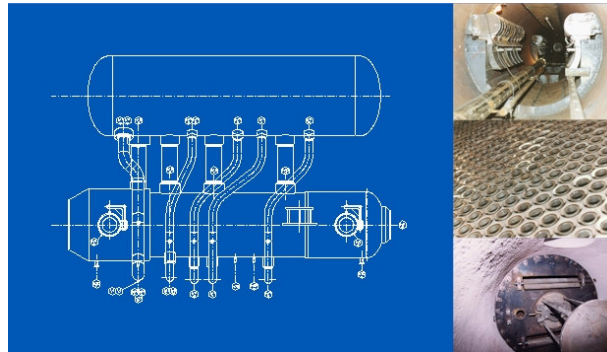




## Firetube Waste Heat Boiler Training Course



### Day One

#### Introduction to Waste Heat Boilers

- General description of waste heat boilers
  - Process applications
  - The role of the WHB
  - Types of waste heat boiler
  - Waste heat boiler configurations
  - Water-tube vs fire-tube
- Identification of major components
  - Tubesheet/tube bundle
  - Channels
  - Bypass
  - Shell
  - Steam drum/risers/downcomers

#### Thermal Design of Waste Heat Boilers

- Introduction to the thermal design of WHB
  - Heat balances
  - Temperature profiles
  - Heat transfer and pressure drop
  - Maximum heat flux limitations
  - Steam drum and water circulation
  - Fouling

#### Control of Waste Heat Boilers

- Waste heat boiler control
  - Control requirements
  - Bypass control arrangements

### Day Two

#### Waste Heat Boiler Materials

- Requirements of high temperature operation
  - Oxidation
  - Hydrogen attack
  - Nitriding
  - Metal dusting
- Selection of materials
- Use of refractory lining and internal insulation materials
- Use of ferrules

#### Mechanical Design of Waste Heat Boilers

- Tubesheet design
- Tube-to-tubesheet joints
- Tube length considerations

#### Inspection, Maintenance and Repair

- Access for inspection and maintenance
- Inspection and maintenance procedures
- Typical failure types
- Repair procedures
  - Tube-to-tubesheet joints
  - Tube plugging
  - Tube replacement
  - Bundle replacement
  - Post-weld heat treatment
  - Refractory repair and replacement