

Boiler Servicing

- I. Thermodynamics
 - a. Heat Transfer
 - i. Load Calc Formula: $\text{BTU/hr} = \text{GPM} \times T \times 8.3333 \times 60 \times \text{SH} \times \text{SG}$
 - ii. Formula: $Q = A \times \text{LMTD} \times U$
 - iii. BTU's
 - iv. Surface Area
 - v. LMTD
 - b. Heat Transfer Coefficient
 - i. Conduction, Convection, and Radiation
 - ii. Velocity and Turbulence
 - iii. Separation Wall Resistance
 - iv. Types of Heat Exchangers
- II. Process of Combustion
 - a. Hydro-Carbon Fuels
 - i. Types of Fuels
 - ii. Sensible Heat Transfer
 - iii. Latent Heat Energy
 - b. Stoichiometric Combustion
 - i. Combustion Formula
 - ii. Air-to-Fuel Ratio
 - iii. Excess Air
 - iv. Psychrometry
 - v. Flue Gas Condensate
 - c. Boiler Efficiencies
 - i. Combustion vs. Thermal
 - ii. Exhaust Temperatures
 - iii. Firing Rates
 - iv. Affinity Laws and Turndown
 - d. Flue Gas Analyzation
 - i. Working the Analyzer
 - ii. Elevation Deration
 - iii. Fan Control
 - iv. Gas Control
 - v. Desired CO₂ or O₂ Levels
- III. Boiler Operation
 - a. Firing Sequence
 - b. Water-Side Sequence
 - c. Fire-Side Sequence
 - i. Combustion Air
 - ii. Gas

iii. Exhaust

d. Flue-Gas Analyzation

IV. Boiler Troubleshooting

a. Boiler Alarms

b. Common Alarms / Thing to Look For

c. Boiler Displays w/ Alarm Outputs

d. Addressing Common Alarms

e. Ladder Diagrams