



## ***Chilled Water Plant Design***

### ***Detailed Topic Agenda***

#### **DAY 1**

- 7:30      *Registration/Check-in*
- 8:00      Welcome and Overview
- 8:15      Determining the Need for Chilled Water
- Why Chilled Water & Chilled Water Options
  - Central Plant vs. Individual Units
- 8:45      Load Determination and Evaluation
- Load Definition
  - Load Evaluation
- 9:15      *Break*
- 9:30      Chiller Overview (until 1:45)
- Chiller Types
  - Refrigerant Circuit Overview
  - Compressor Types: Scroll, Screw, Centrifugal
  - Compressor Operation: Lift, Surge
  - Starter Types: Constant Speed, Variable Speed
  - Chiller Efficiency: Efficiency Standards, How Chiller Design Affects Efficiency
  - Chilled Water System: Variable Primary Flow, Heat Recovery, Free Cooling, Thermal Storage
- 11:00      *Break*
- 11:15      Chiller Overview continued
- 12:00      *Lunch*
- 1:00      Chiller Overview continued
- 1:45      Industry Trends
- System Efficiency: ASHRAE, System Design
  - Harmonics & IEEE 519
  - Refrigerants Changes & Regulations
  - Electrification & Decarbonization
  - Inflation Reduction Act
- 2:45      *Break*

- 3:00 Pump Basics
- Hydraulics
  - Centrifugal Pump Fundamentals and Configurations
  - System Curves
  - Pump Curves
  - Pump and System Curve Interaction
- 3:30 Pumping Schemes
- Condenser Water Pumping Schemes
  - Chilled Water Pumping Schemes
- 4:00 Class Problem Workshop
- 5:00 *Daily Adjournment*

## **DAY 2**

- 8:00 Cooling Tower Basics (until 10:15)
- Principles of Operation & Components
  - Selection Parameters
  - Tower Types & Heat Transfer Surfaces
  - Capacity Control
  - Water Losses & Water Quality
- 9:30 *Break*
- 9:45 Cooling Tower Basics continued
- 10:15 More Cooling Tower Design Issues
- Factors Influencing Performance: Location, Wind Direction, Noise Issues
  - Make-up Water Requirements
  - Free Cooling
- 11:00 *Break*
- 11:15 Thermal Energy Storage
- Chilled Water
  - Density-depressed Chilled Water
  - Ice Systems: Harvesting, Ice on Coil, etc.
- 11:45 Class Problem Review
- 12:00 *Lunch*
- 1:00 System Design Issues
- Delta Temperature
  - Supply and Return Temperatures
  - Effects of Supply Temps and Delta T
  - Other Chiller Issues
- 2:30 *Break*

- 2:45 Plant Siting Issues
- Building Construction & Aesthetics
  - Utility Infrastructure & Noise Issues
  - Modular Plants
  - Central Plant General Arrangements & Phasing

4:00 Class Problem Workshop

5:00 *Daily Adjournment*

### **DAY 3**

8:00 Class Problem Review

- 8:30 Piping and Distribution Systems
- Configuration Options & Sizing
  - Hydraulic Modeling & Gradients
  - Installation Options: Direct Buried, Shallow Trenches, Tunnels
  - End Users (Buildings, Etc.): Direct Connected, Indirect Heat Exchangers, Interface Options

9:30 *Break*

- 9:45 Instrumentation and Controls
- Control Valve Fundamentals
  - Pressure Independent Control Valves
  - Control Schemes and Optimization

10:45 *Break*

- 11:00 Code and Certification Issues
- Code Requirements & Machine Room Design
  - Energy Efficiency

- 11:30 Chilled Water System Costs
- Capital Costs & Operation Costs

12:00 *Course Adjourns*