

# Building Data Centers: Understanding Critical Systems and Key Construction Considerations

## Course Overview:

This course is designed to equip participants with a solid foundation in data center fundamentals, including an understanding of the critical mechanical and electrical infrastructure that powers and cools these facilities. It addresses common construction challenges to watch for and provides insights into how data centers operate. The course also covers recent trends and best practices in data center construction, making it valuable for team members at all stages of their careers.

## Learning Outcomes:

Gain a solid understanding of mechanical and electrical infrastructure in data centers.  
Learn how to identify common construction deficiencies and areas to focus on.  
Understand redundancy, maintainability, and reliability concepts.  
Stay updated on modern methods and practices for data center construction.  
Learn about key systems and equipment in data centers, such as cooling, power, fire protection, and monitoring.

## Module 1: Introduction to Data Centers

Section 1: Purpose and Importance of Data Centers  
Section 2: What are Critical Systems in a Data Center?  
Section 3: Key Terminology and Definitions  
Section 4: Facility Life Cycle

## Module 2: Critical Systems in Data Centers

Section 1: Introduction to Mechanical Systems in Data Centers  
Section 2: Overview of Cooling Systems  
Section 3: Mechanical Redundancy and Backup Systems  
Section 4: Introduction to Electrical Systems in Data Centers  
Section 5: Uninterruptible Power Supply (UPS) Systems  
Section 6: Generators and Transfer Switches

Section 7: Electrical Redundancy  
Section 8: Batteries and Other Backup Power Solutions  
Section 9: Bringing It All Together

## Module 3: Principles of Redundancy and Reliability

Section 1: Understanding Redundancy and Why It's Essential for Avoiding Downtime  
Section 2: Explanation of N+1, 2N, and 2N+1 Configurations  
Section 3: Real-World Examples of Data Center Failures Due to Poor Redundancy or Design  
Section 4: How Design and Construction Choices Impact Data Center Reliability  
Section 5: Best Practices for Designing Reliable Data Centers  
Section 6: Bringing It All Together

## Module 4: Electrical Systems Fundamentals

Section 1: Introduction to Electrical Concepts in Data Centers  
Section 2: Power Factor  
Section 3: Three-Phase Power  
Section 4: Power Quality  
Section 5: Power Distribution Units (PDUs)  
Section 6: Static Transfer Switches (STS)  
Section 7: Emergency Generators and Fuel Systems  
Section 8: Automatic Transfer Switches (ATS)  
Section 9: Uninterruptible Power Supply (UPS) Systems  
Section 10: Bringing It All Together

## Module 5: Cooling Systems

Section 1: Overview of Data Center Cooling Systems  
Section 2: Design Considerations for High-Efficiency Cooling  
Section 3: Types of Cooling Solutions: CRAC, Chillers, Liquid Cooling  
Section 4: How Redundant Cooling Systems Prevent Overheating  
Section 5: Recap of Key Cooling Principles

## Module 6: Fire Protection in Data Centers(Canadian Focus)

Section 1: Importance of Fire Protection in Data Centers  
Section 2: Overview of Preaction Fire Suppression Systems  
Section 3: Overview of Gaseous Fire Suppression Systems (FM200, Inergen) in Canada

Section 4: Integration of Fire Protection Systems with Data Center Infrastructure in Canada  
Section 5: Design Considerations for Fire Protection in Canadian Data Centers  
Section 6: Bringing It All Together (Canadian Market Focus)

## Module 7: Testing and Commissioning (Canadian Focus)

Section 1: What is Commissioning?  
Section 2: Importance of Commissioning in Data Center Construction Projects (Canadian Context)  
Section 3: Electrical System Commissioning Process in Canada  
Section 4: Mechanical System Commissioning Process in Canada  
Section 5: Best Practices for Ongoing Testing and System Maintenance in Canadian Data Centers  
Section 6: Bringing It All Together (Canadian Market Focus)

## Module 8: Incident and Maintenance Management (Canadian Focus)

Section 1: Introduction to Incident Management in Canadian Data Centers  
Section 2: What to Do When Things Go Wrong in a Data Center  
Section 3: Understanding Failover Systems and Real-Time Monitoring  
Section 4: Regular Maintenance Strategies for Avoiding System Breakdowns  
Section 5: Preventive Maintenance Best Practices for Canadian Data Centers  
Section 6: Bringing It All Together

## Module 9: Capacity and Energy Efficiency (Canadian Focus)

Section 1: Introduction to Capacity Planning in Canadian Data Centers  
Section 2: Planning for Mechanical and Electrical Systems Capacity  
Section 3: Overview of Energy-Efficient Designs for Canadian Data Centers  
Section 4: Implementing Green Technology in New Data Center Builds (Canadian Context)  
Section 5: Bringing It All Together

## Module 10: Common Construction Deficiencies (Canadian Focus)

Section 1: Introduction to Common Construction Deficiencies in Canadian Data Centers  
Section 2: Common Construction Deficiencies in Critical Systems  
Section 3: Checklist of Construction and Commissioning Issues (Canadian Standards)  
Section 4: Best Practices for Site Management in Canadian Data Centers  
Section 5: Communication and Coordination Between Trades  
Section 6: Bringing It All Together

## Final Module: Data Center Construction Trends (Canadian Focus)

Section 1: Introduction to New Construction Methods in Canadian Data Centers  
Section 2: Prefabrication of Mechanical and Electrical Systems  
Section 3: Modular Data Center Design  
Section 4: AI-Powered Monitoring Systems and Autonomous Energy Management  
Section 5: Integration of Renewable Energy Sources in Canadian Data Centers  
Section 6: Bringing It All Together