TSC Schneider-PDI Agenda

- General Electrical Power Layouts and Equipment
- Single Phase UPS’s
- Three Phase UPS’s
- Trends In Data Center Power Distribution
- Data Center Cooling Trends and Products

Jim Tubbesing – Heath Wilson
APC/Schneider North Texas Rep
Tubbesing Solutions
TSC Biographies

Jim Tubbesing
Jim Tubbesing graduated from The University of Missouri in 1972 with both a BSEE and an MBA, and started his career with Ford Motor Company at the plant engineering level. He joined Bussmann Mfg. and in a 9 year span became a Regional Manager. He spent 1.5 years in product management and international sales with AB Chance Co., and in May of 1983 established Tubbesing Sales Corp. Jim, a registered PE, covers several key engineering and end user accounts, spends time in managing and directing both offices, and maintains relationships with the principals TSC represents. Jim is active in IEEE, IAEI, has served as an instructor at Texas A&M and Dallas area junior colleges. Besides spending time with his wife and 3 daughters, his interests include travel, skiing, golf, and church.

Heath Wilson
Heath Wilson graduated with a BS in Industrial Distribution from Texas A&M University in 1996. Heath joined TSC in 2012 after 10 years in electrical distributor sales. Additional experience includes sales for Square D and Cutler Hammer. A native Texan, Heath has lived in Dallas for 10 years. Heath is married with two children.
Electrical Distribution Equipment in Data Center Environments

January 2016
Introduction

This presentation will provide an overview of the functions, placement, and standards for key electrical distribution equipment in data centers.

Agenda

• Key Terminology
• Electrical Architecture Overview
• Component Level Details
Equipment found in Electrical Distribution Systems

Types of equipment

- Medium-voltage switchgear including MV/LV transformer
- Low-voltage switchgear/switchboard/automatic transfer switch (ATS)
- UPS system with input/output switchboard and UPS distribution switchboard
- Power distribution Units (PDUs) and remote power panels (RPPs)
- Busway
- Panelboard
- Rack PDUs (rPDUs)/outlet strips
Medium Voltage Switchgear

• **Location**
  • In electrical space of large capacity data center (>1MW IT load)

• **Function**
  • Typically fed directly from utility
  • Marks utility service entrance to building
  • If MV generator is present, also feeds MV switchgear

• **Consists of**
  • Meters, breakers, contractors, fuses, arrestors, earth switches for IEC equipment, voltage/current transformers, control protection relays and an overall control system

• **Details**
  • Voltage Ratings – 2 key ratings are Rated and Rated Lightning Impulse
  • Current Ratings – Specified by manufacturers
Due to safety distances at MV, typically each cubicle is limited to only one MV circuit

Consists of

- Incoming unit or main section
- Outgoing or feeder section (distributes three-phase power to primary upstream side of MV/LV transformer)
- Voltage metering unit
- Bus section or tie section/breaker
MV/LV Transformers

- **Location**
  - In electrical space of large capacity data center (>1MW IT load)

- **Function**
  - Step down medium voltage from the MV switchgear to low voltage for downstream power distribution equipment

- **Consists of**
  - Rated power, primary and secondary voltage, impedance

- **Details**
  - Available with and without enclosures
Low Voltage Switchgear

- **Location**
  - In electrical space of data centers <1MW

- **Function**
  - Responsible for disconnecting faults and controlling LV power distribution system
  - Marks the utility service entrance

- **Consists of**
  - Circuit breakers, meters, switches, surge arresters, relays

- **Details**
  - Voltage Ratings – 2 key ratings are Rated and Rated Lightning Impulse
  - Current Ratings – Specified by manufacturers
Consists of

- Incoming feeder from secondary side of the MV/LV transformer or LV
- Power Control Center (PCC, i.e. for downstream UPS)
- Motor Control Center (i.e. MCC for pumps) section
- Power factor correction/harmonic filter
UPS Assembly

• Location
  • In electrical space or IT space of data center

• Function
  • Provide uninterrupted power to the critical equipment

• Consists of
  • Input/output switches, bypass switches, static switches, power modules including the rectifiers and inverters, and their control and communication modules

• Details
  • Various types of UPSs
  • Batteries typically provide about 15 minutes of ride-through at full load, allowing back-up generators to start in utility failure event
UPS One Line Diagram

Consists of

- UPS input switchgear – feeds to UPS from power control center of upstream LV switchgear/switchboard
- UPS output switchboard – provides power from UPS output to downstream circuits, consists of the static bypass circuit breakers and maintenance bypass circuit breakers
- Distribution Switchboard - distributes power to the different PDUs
Static Transfer Switch (STS)

- **Location**
  - Stand-alone cabinets in electrical space or sometimes in IT space

- **Function**
  - Distribute, control and monitor the critical power from UPS

- **Consists of**
  - Same as PDU with *No Transformer*

- **Details**
  - Smaller Footprint
  - Up to 4 panelboards
  - Often fed from PDU sub-feed breakers
Downstream Distribution

Types of equipment

- Power distribution Units (PDUs)
- Remote Power Panels (RPPs)
- Busway
- Panelboard
- Rack PDUs (rPDUs)
Power Distribution Units (PDUs)

• **Location**
  • In the IT space

• **Function**
  • Distribute, control and monitor the critical power from UPS to IT Racks

• **Consists of**
  • Main input circuit breaker, branch circuit panelboard(s), power transformer, output power cables, surge arrestors, monitoring and communication modules
Remote Power Panels (RPPs)

• **Location**
  • In the IT space

• **Function**
  • Distribute, control and monitor the critical power from UPS to IT Racks

• **Consists of**
  • Same equipment as PDU with No Transformer

• **Details**
  • Smaller Footprint
  • Up to 4 panel boards
  • Often fed from the PDU sub-feed breakers
Busway

- **Location**
  - In the IT space

- **Function**
  - Distribute, control and monitor the critical power from UPS to IT Racks

- **Consists of**
  - Feed unit connected with an upstream LV electrical switchboard, power bus, plug-in units or tap off unit with over-current protective devices, connection fitting

- **Details**
  - Alternative to traditional use of PDUs and RPPs
  - Can be mounted under floor in IT space
Panelboard

• Location
  • In the IT space, mechanical space or electrical space

• Function
  • Distribute power to cooling equipment, lighting and security devices

• Consists of
  • Main electrical bussing, terminals for circuit breakers, neutral and ground wires

• Details
  • Panelboard is market nomenclature for wall mounted LV switch
Rack PDUs (rPDUs) / Outlet strips

• Location
  • Within the IT Rack

• Function
  • Distributes power directly to IT equipment in racks

• Consists of
  • Outlets, Surge arrestors, monitoring and communication modules

• Details
  • Three phase or single phase rPDUs selected on density needs
Conclusion

Electrical distribution equipment:
• Backbone of the data center
• Provides the power path to all data center equipment
• Ensures the safety of all personnel and equipment

IT professionals should have a general knowledge of a data center’s electrical system as outlined in this presentation.