

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

---

### PART 1 - GENERAL

---

#### 1.01 OVERVIEW

- A. This Section includes design standards and requirements for electrical service and distribution. This is a design standard and is not intended to be used as a Specification.

---

### PART 2 - DESIGN CRITERIA

---

#### 2.01 GENERAL

- A. Provide primary electrical equipment infrastructure systems specifically designed and selected to minimize life-cycle costs and install this system and equipment 24-inches above the 500- year flood plain for flood mitigation purposes, to maximize the useful life expectancy of the equipment. Refer to the latest ASHRAE standards.
- B. Measurement devices shall be installed in new buildings to monitor the electrical energy use for each of the following separately:
  - 1. Total electrical energy
  - 2. HVAC systems
  - 3. Interior lighting
  - 4. Exterior lighting
  - 5. Receptacle circuits
- C. If tenant areas will be determined during detailed programming, they will be individually metered.
- D. The electrical energy use for all loads specified in 2.01 (B) shall be recorded a minimum of every 15 minutes and reported at least hourly, daily, monthly and annually. The energy use data shall be transmitted to the Building Automation System (BAS) and graphically displayed. The system shall be capable of maintaining all data collected for a minimum of 36 months. Wiring should be provided to minimize the number of monitoring locations.
- E. The following electrical power distribution components to be sized per projected loads (known loads, future loads, and design factors):
  - 1. Service transformers
  - 2. Busducts
  - 3. Feeders
  - 4. Power panelboards

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

5. Generators
  6. Paralleling Switchgear
  7. UPS
  8. Transfer switches
- F. The following electrical power distribution components to be sized per known loads only and design factors:
1. Distribution transformers
  2. Lighting and appliance branch-circuit panelboards
  3. Branch circuits
- G. The following shall be automatically controlled:
1. At least 50% of all 125V, 15 and 20A receptacles in all private offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, classrooms, and individual workstations. This is an ASHRAE 90.1 requirement.
  2. At least 25% of branch circuits installed for modular furniture not shown on the construction documents.  
  
This control shall function on:
    - a. A scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times – an independent program schedule shall be provided for control areas of no more than 5000 square feet and not more than one floor (the occupant shall be able to manually override the control device for up to two hours);
    - b. an occupant sensor that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
    - c. an automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.
  3. All controlled receptacles shall be permanently marked to visually differentiate them from uncontrolled receptacles and are to be uniformly distributed throughout the space. Plug-in devices shall not be used to comply with 2.01(G). Refer to the latest edition of ASHRAE for exceptions.
- H. Pay special attention to the size of electrical rooms, working spaces, and dedicated equipment spaces for the devices sized per known loads only as they may need to be replaced in the future with larger size components. Coordinate with the Owner and seek written approval for any deviation from this design requirement.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

### I. Normal Power Distribution

1. In MDACC facilities, the primary source of normal electrical power is obtained from public utility. While majority of the MDACC facilities are fed by 4160 volts utility source, some facilities at remote locations are fed by 480 volts. The A/E shall evaluate the degree of reliability required for a given project. Design issues such as separately routed primary feeders, transformer placement, and switchgear location all bear on the reliability issue.
2. Primary power for the facility shall be obtained from a local public utility usually at 4.16 kV. The primary system shall be dual fed, double ended. Two feeder circuits shall be routed to the project site feeding utility transformers. The two dual utility feeders shall be independently fed from two separate utility substations to preserve electrical reliability. Each of the utility feeders shall be sized to serve the entire facility should the other feeder fail. This requirement is project specific and where this cannot be achieved, an alternative approach needs to be discussed with the owner.
3. The double ended main-tie-main switchgear shall consist of connections for primary 4.16kV feeders, medium voltage vacuum circuit breakers, and 4160 – 480/277 V transformers. Branch feeder circuit breakers shall be draw-out mounted type capable of being withdrawn on rails for inspection and maintenance. The breakers shall be electrically operated. Surge arresters shall be provided at the main switchgears. Redundant/back up sources shall be kept physically separated until required, such as to the ATS.
4. Electrical distribution voltages for the project will be one of the following:
  - a. 480V, 3 phase, 3 wire will be distributed to motor control centers to serve concentrated motor loads.
  - b. 480/277V, 3 phase, 4 wire will be distributed to distribution panels to serve 277V lighting panels and step-down transformers to obtain 208Y/120V.
  - c. 208Y/120V, 3 phase, 4 wire will be distributed from branch circuit panelboards to serve receptacles and equipment.
5. Feeder Sizes: primary feeders shall be sized based upon transformer capacities and calculated demand load, including future growth. Feeders shall be sized for a maximum of 2 percent voltage drop.
6. Branch circuits shall be sized for a maximum of 3 percent voltage drop.
7. Minimum Panel Bus Sizes:
  - a. 277V Lighting Panels: - 125A
  - b. 120V General Receptacle Panels: - 100A
  - c. 480V Motor Control Center: - 400A
8. Panels shall be flush mount (where practical), per latest edition of the NEC.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

9. Motor Control Centers will contain combination fused disconnect starter units, 120V control transformer, control devices on front cover and push-to-test pilot lights.
10. Distribution equipment such as switchgears, switchboards, panelboards, and distribution boards shall be housed in dedicated conditioned electrical rooms. Electrical rooms shall be designed in such a way that meets NEC requirements of working space, headroom, dedicated spaces above electrical equipment, entrance and exit doors. The size of dedicated electrical rooms shall accommodate the initial installation of core and shell as well as anticipated final installation of build-outs. 480V feeder conduits and/or plug-in copper bus duct risers will be routed from the substations to the building electrical rooms to serve distribution panel boards or distribution switchboards.
11. Non-linear loads and IT closets and server rooms will be served through high efficiency harmonic mitigating dry-type transformers and electronic grade branch circuit panel boards. Provide phase shift calculation and projected harmonic cancellation.
12. Provide power factor correction capacitors or at the main switchgear where inductive loads (such as low to medium pf ballasts, computer equipment, medical equipment and motors not controlled by VFD's) will be significant. Use 18 pulse VFD's for large motors, above 50hp.

### J. Emergency Power Distribution

1. In MDACC facilities, the emergency electrical power is obtained from locally installed diesel or natural gas engine generator(s) at 4160 volts or 480 volts. The A/E shall evaluate fuel source and generator supply voltage that is suitable for equipment being supported. The A/E shall also analyze the cost associated with emergency generator(s) at different voltages, whether at 4160 volts vs. 480 volts. Design issues such as avoiding possibilities of fumes entering exhaust into the building (or an adjacent building's) ventilation system, and unpleasant exhaust odors in the building, shall be taken into consideration. Wind tunnel testing needs to be done to prevent these from entering the building. Consideration should be given to the physical separation of the main feeders of the emergency electrical system from the normal wiring of the facility to prevent possible simultaneous destruction as a result of a local catastrophe.
2. Emergency generator(s) should be installed on the second floor or above or outside, 24-inches above the 500-year flood plain. The location shall allow easy access for maintenance.
3. Emergency generators shall be connected to paralleling switchgear, where there is more than one generator. This switchgear will serve the emergency distribution panels in the building. Automatic transfer switches with maintenance bypass shall be utilized to connect to the emergency source based upon a pre-set priority if the normal source of power fails. Transfer switches shall be located near the normal source unit substation. ATS shall be closed transition type. A permanently mounted load bank shall be provided to allow for the required routine maintenance testing of generators, if the generator(s) is installed on a floor above the first floor and utilizing portable load bank is not feasible. A/E is responsible to coordinate with the utility company for closed transition ATS requirements and meet the rules outlined in Chapter 25 of the Public Utility Commission of Texas (PUCT). The contractor should coordinate with the engineer in filing the

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

appropriate forms with the utility associated with closed transitioning of the ATS. A/E to do this as an additional service.

4. Emergency power shall backup UPS systems (only centralized UPS systems shall be used) that support Life Safety, BAS system, IT, CCTV's, security, DDC and other critical systems. A comprehensive study and design shall be initiated early in the design phase dealing with prioritization of startup sequence upon the loss of normal power. The A/E shall submit such design for Owner's review no later than the end of Design Development phase and obtain approval from the Owner.
5. Building floor plans shall indicate location of dedicated remote annunciator panel in a 24-hour monitored location and required conduit and circuit connectivity. Connect annunciator to Building Automation System (BAS) for monitoring by MD Anderson Facility Operation Center. An independent 24-hour monitoring system such as Monico, is required for healthcare facilities.
6. Failure of the normal source of power shall be sensed by devices in each automatic transfer switch. Upon detection of power failure, a signal will be sent to the generator switchgear, which will send a start signal to all active generators. The first generator, which achieves proper voltage and frequency, will connect to the emergency switchgear bus. The remaining generator(s) will synchronize with the first generator prior to connecting to the bus. The automatic transfer switches will connect to the emergency bus when the voltage and frequency reach the correct levels. ATS shall be closed transition type.
7. A load sensing system shall be provided such that if one generator can carry the emergency load requirement, the remaining generator(s) can be shut down. Conversely, if the switchgear senses the operating generator is becoming overloaded, a signal shall be sent to start a second generator.
8. When the normal source returns and after a preset time delay (to establish that the presence of the normal source is not temporary), the transfer switch shall connect the load to the normal source. After removal of the load from the engine generator, the unit shall continue to run for a preset cool-down time period before stopping.
9. As a minimum, and when applicable, the following demand factors of emergency power for various systems are to be used to calculate the total emergency power requirements for the building:
  - a. Lighting: 25% of total lighting load.
  - b. General Power: 10% of total general power.
  - c. Lab Power: 25% of total lab power.
  - d. Fire Alarm & Security: 100% of total fire alarm & security power.
  - e. UPS: 100% of the total UPS capacity.
  - f. Specialized Lab and Medical Equipment: Emergency power will be provided for the following applicable loads: chemical fume hoods, ducted (type B1 & B2) bio-safety cabinets, freezers, CO2 incubators, LN2 room O2 monitoring systems, cryovent heaters

# Element D Services

## Electrical

## D5010 Electrical Service and Distribution

and environmental rooms. The need of emergency power for following equipment is to be determined on case-by-case basis: water purification, glass wash, electric boiler, autoclave, and other user-provided lab equipment.

- g. HVAC Equipment: Emergency power will be provided for the following applicable loads (only critical system HVAC equipment is required to be on emergency power): chilled water pumps, heating hot water pumps, process cooling water pumps, condenser water pumps, boiler circulating pumps, boilers, boiler feed water pumps, condensate pumps, fuel oil pumps, chillers, air-cooled condensers, cooling towers, air-cooled chillers, Computer Room Air Conditioning (CRAC) units, building automation system, laboratory tracking systems & room air pressurization monitors and related controls, control air compressors, air dryers, AHUs, FCUs, HEPA filter units, exhaust fans, stair pressurization fans, (only critical system) air terminal units, lab air valve, critical isolation room, etc.
  - h. Plumbing Equipment: Emergency power will be provided for the following applicable loads: all AC-powered faucets/flush valves in critical areas, elevator pit sump pumps, storm and sewage sump pumps, fire pumps, medical/lab vacuum pumps, medical/lab air compressors, medical/lab gas/vacuum alarm panels and switches, medical/lab cylinder manifolds, fire protection system flow switches, domestic/fire water surge tank level controls and alarms, and other critical equipment identified by other project documents.
- 10. Provide a centralized UPS system.
  - 11. For additional emergency power requirements, refer to the project's Facility Program document and individual mechanical and plumbing Design Guideline Elements.
  - 12. Emergency power shall be provided for one elevator in each bank of elevators in high-rise buildings as defined by the National Fire Codes. A keyed selector switch shall be located on the ground floor allowing rescue personnel to select any elevator in the bank.
  - 13. Essential Electrical Systems:
    - a. The Essential Electrical systems for hospitals shall comply with the Type 1 system as defined in NFPA 99 and shall consist of the emergency system and the equipment system.
    - b. The emergency system shall consist of two separate branches – The Life Safety Branch and Critical Branch, which shall provide power to the selected functions listed in NFPA 70 and 99. Life Safety Branch:
  - 14. Life Safety Branch:
    - a. Refer to NFPA 101-99 and NFPA 110 for life safety branch requirements.
    - b. Storage rooms, electrical rooms, mechanical rooms, and other areas not part of the defined Means of Egress are not allowed to be connected to the Life Safety Branch. When emergency lighting is required for these areas, they are to be connected to Critical Branch.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

### 15. Critical Branch:

- a. Refer to NFPA 110 and NFPA 99 for critical branch requirements.
- b. The critical branch shall supply power for task illumination, fixed equipment, selected receptacles, and special power circuits serving the following areas and functions related to patient care in addition to the ones required per the latest edition of NFPA and NEC:
  1. Blood, Bone, Eye and Tissue Banks: Task illumination, selected receptacles and refrigerators.
  2. Cardiac Catheterization Laboratories and Rooms: Task illumination, isolated power units, and Cath X-ray unit.
  3. Hemodialysis Rooms: Task illumination and one receptacle for each dialysis unit PBP.
  4. For telephone and equipment rooms and telecommunications closets, see MD Anderson "Communications and Computer Services Premises Distribution System Standard" referenced within Design Guideline Element Z, General Design Requirements.
  5. Respiratory Care Beds: PBPU; when PBPU is not provided, task illumination and two (2) receptacles for each bed.

### 16. Equipment Branch:

- a. The equipment system shall supply power to major electrical equipment, necessary for patient care, listed in NFPA 70 and 99.

### 17. Non-Delayed Priority #1 Automatic Connection:

- a. The following loads shall be priority #1 (no delay):
  1. Lighting
  2. Fire Pump
  3. Critical Branch Loads
  4. Life Safety Branch Loads.
  5. Smoke Control and Stair Pressurization.

### 18. Delayed Automatic Connection: If applicable to the Project, arrange the following equipment for delayed-automatic connection to the automatic connection to the alternate power source:

- a. Central Suction Systems: Vacuum pumps and oral evacuation pumps serving medical and surgical functions including control

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

- b. Sump pumps, sewage pumps, and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms
- c. Compressed Air System: Medical and dental air compressors, serving medical and surgical functions including controls
  - 1. Systems noted as “a” through “c” above may be connected to the critical branch. Discuss this with the Chief Engineer at the facility.
- d. Kitchen Hood Supply and/or Exhaust Systems: If required to operate during a fire in or under the kitchen hood.
- e. Elevators.
- f. Heating Equipment:
  - 1. Operating Suites, Recovery, Intensive Care, Coronary Care, Infection and/or Isolation Rooms, Emergency Treatment Spaces and General Patient Rooms.
  - 2. Under certain conditions, NFPA 99 may not require heating of General Patient Rooms and Infection Isolation Rooms.
- g. Equipment and Control Systems for each Bank of Elevators: Design control systems to operate at least one elevator at a time and designate one elevator to serve the Surgical Suite during emergencies.
- h. Jockey pump or make-up pump for water-based fire protection systems.
- i. HVAC for Surgical Suites, Intensive Care, Coronary Care and Emergency Treatment Spaces.
- j. Supply return and exhaust ventilating systems for Infection Isolation Rooms, Protective Environment Rooms and exhaust fans for laboratory fume hoods, nuclear medicine areas where radioactive material is used, ethylene oxide evacuation, and anesthesia evacuation. These systems are permitted on delayed automatic system only and shall not be served via manual system. Some systems may be placed on Critical Branch. Coordinate with MD Anderson.
- k. Automatic operated doors not used for building egress.
- l. Autoclaving equipment.
- m. Controls for equipment listed in this article.
- n. Administrative Areas: Task illumination and selected receptacles in the hospital Director's, Engineering, and Security and Communications Suites.
- o. Closed-loop water chilling equipment for linear accelerator.
- p. Domestic Water Pumps: Equipment, control system, light fixture and receptacle near the pump.



# Element D Services

Electrical

## D5010 Electrical Service and Distribution

- q. Electric tape for heat tracing of chilled water and condenser water piping exposed to weather requiring freeze protection.
- r. Exhaust fans serving Autopsy Rooms, reagent grade Water Treatment Rooms, Orthotic Laboratory special exhaust systems, battery charging areas, flammable Storage Rooms and Illustration Rooms (Medical Media).
- s. Heating, ventilating and air-conditioning (HVAC) systems:
  - 1. Air-conditioning equipment, lubricating oil pumps for centrifugal compressors, control air compressors, air dryer and absorption machine refrigerant pump to draw down lithium chloride before crystallization (omit for machines accomplishing this manually).
  - 2. Chillers, chilled water circulating pumps, fans, and controls for surgical suites, recovery rooms, intensive care, and coronary care units.
  - 3. HVAC equipment for Bone Marrow Transplant (BMT) areas.
  - 4. HVAC equipment for Magnetic Resonance Imaging (MRI) Suites and Computerized Topographic (CT) Scanners.
  - 5. HVAC equipment serving emergency areas in outpatient clinics.
  - 6. Back-up HVAC equipment for Telephone Equipment Rooms and Telecommunications Closets.
  - 7. Computer Room HVAC Systems.
- t. Hot Water Circulatory and Steam Condensate Return Pumps: Equipment, controls, and light fixture and receptacle near the pumps.
- u. Hot Water Generator: Equipment, controls, and light fixture and receptacle near the generator.
- v. Kitchen Area: Task illumination, minimum equipment to feed patients during extended outage as defined by MD Anderson, frozen storage lockers and food refrigerators.
- w. Laboratory Air Compressors and Vacuum Pumps: Equipment, controls, and light fixture and receptacle near the compressors and pumps.
- x. Mortuary Refrigerator or Cold Room: Refrigeration Equipment and task illumination.
- y. Radiology Suite: Task illumination, one automatic X ray film processor, and one X ray unit.
- z. Refrigerated Medical Storage: Refrigeration Equipment.
- aa. Sewage Pumps: Equipment, controls, and light fixture and receptacle near the pumps.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

bb. Supply, Processing, and Distribution (SPD):

1. Task illumination and selected receptacles in the following areas: core, sterile storage, non-sterile storage, preparation, and decontamination.
2. One (1) ultrasonic cleaner.
3. One (1) steam sterilizer.
4. One (1) washer sterilizer.
5. One (1) gas generator.
6. Equipment in warehouse areas needed to preserve subsistence drugs and X-ray film materials that may be subjected to damage from infestation, humidity, or temperature.

cc. Ventilation and control equipment for electrical equipment rooms.

dd. Ventilation, cooling and control equipment for elevator machine rooms.

- K. Provide a separate panelboard for high density electrical utilization equipment spaces where the power requirements exceed 18 poles and locate the panelboard near the entrance to and within the space.
- L. Do not mount panelboards in hallways, behind doors of electrical rooms, or other public spaces, unless the project Facility Program includes specific panelboard location requirements. Do not mount panelboards in fire rated walls.
- M. Do not design floor slab encased conduit runs for the branch circuitry except slab on grade. The other exception may be for the lighting grid in the parking deck areas of a parking garage.
- N. Provide five (5) spare  $\frac{3}{4}$  inch conduits from every flush mounted panel to an above ceiling accessible area for future use.
- O. Provide as minimum, 10 percent spares and 10 percent spaces in all panels. If this causes a panel to exceed 42 spaces, add an additional panel, or install feed through lugs in panel and provide physical space for additional panel.
- P. The electrical engineer is responsible for coordinating maximum transformer weights and anticipated floor loading with the project structural engineer.
- Q. Transformers installed in electrical rooms shall be designed and sized in coordination with architect and door dimensions. If possible, the maximum transformer size shall be limited to 112½ kVA. No transformers are allowed to be wall mounted or suspended above ceilings.
- R. Branch circuit panelboards shall not serve loads on more than one level of a building. Circuits from branch circuit panelboards shall not cross 'building lines'.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

- S. Switchgear, floor mounted transformers and motor control centers shall be placed on a 4-inch housekeeping pad with chamfered edges.
- T. Equipment and its controller shall be served from the same riser of power source. The origin of power source for the controllers shall be clearly indicated on drawing.
- U. Equipment of mechanical and other building support systems should be evenly served from different risers of power sources minimizing the impact due to power interruption to a single riser.
- V. The integrity of mechanical and other building systems must be satisfied for continuous support of the operation in the event of power interruption. For example, the dependent exhaust and supply fans functioning as a system and their associated controllers shall be fed by the same riser of power source.
- W. Wiring devices consisting of general and special purpose receptacles shall be provided where required by building program and as follows:
  - 1. Corridors will be provided with duplex receptacles at not more than 50 feet on center and not greater than 25 feet from the end of the corridor. Electrical circuits serving these receptacles shall serve no other loads.
  - 2. Mechanical and electrical equipment spaces within the building shall be provided with receptacles located within 25 feet of the equipment for maintenance use. Provide normal and emergency power receptacles in main electrical rooms, if available.
  - 3. Mechanical equipment exterior to the building shall be provided with ground fault receptacles with weatherproof covers located within 25 feet of the equipment for maintenance use.
  - 4. Conference and meeting rooms shall be provided with at least one receptacle per wall, and a floor box with a receptacle and phone/data connections in the middle of the room.
  - 5. Receptacle located within 6 feet of water sources in any type of space shall be of the ground fault interrupting type.
  - 6. Janitor's closet shall have one GFCI receptacle.
  - 7. Restrooms shall be provided with at least one duplex GFCI receptacle.
  - 8. All receptacles in elevator equipment room shall be GFCI type.
  - 9. Provide temper proof receptacles where required per the NEC.
- X. Dedicated circuits shall be provided to the equipment indicated in the Facility Program Document and to the following equipment:
  - 1. Refrigerators
  - 2. Freezers

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

3. Copiers
  4. Vending machines
  5. Equipment requiring an isolated ground
  6. Equipment requiring an outlet rating of 20 amps or above
  7. Motors
  8. Microwaves, coffee makers, ice makers, and other kitchen/break room equipment.
- Y. Tamper-resistant receptacles are to be provided in areas prescribed per NEC, such as business office corridors, waiting rooms, clinics, outpatient facilities, waiting transportation, gymnasiums and auditoriums.
- Z. Animal Holding Facilities:
1. For animal holding facilities, emergency power shall be provided for HVAC system equipment so that normal operations can be continued in the event of normal power failure. Emergency power shall be provided by a generator sized to maintain operation of animal room lighting, air supply, air exhaust, and data gathering system and primary major equipment. The capacity of the generator fuel supply shall be discussed with Animal Facility Director, High Voltage Group and VetMed team to determine an appropriate time level of the electrical backup.
  2. Lighting and alarms associated with the life safety requirements will be provided with emergency power by the same generator.
  3. Each animal room shall be supplied by emergency power as per project Facility Program document.
  4. At least one of each type of equipment (e.g., tunnel washer, cage/rack washer, bulk autoclave) shall be connected to the emergency power system.
  5. All electrical outlets for ventilated cage racks need to have emergency power supply.
  6. Conduits in animal facilities shall be concealed.
  7. Surface-mounted conduits in washdown areas shall be intermediate metallic conduit (IMC) or rigid galvanized steel with threaded couplings.
  8. Conduits in animal facility areas shall be sealed with conduit sealer such as Duxseal at each device/junction box.
  9. Surface metal boxes shall be cast metal.
  10. Conduits entering or leaving device boxes, junction boxes, pull boxes, and so forth shall be sealed at each box with a non-hardening sealant such as Duxseal. An alternative is to use seal-off fittings in conduits penetrating animal facility walls. A potting compound shall be poured into the fitting after the wires are installed.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

11. Surface metal raceway with snap-on covers shall not be used in an animal facility because of the requirements for washdown cleaning.

---

### PART 3 - SPECIAL CONTRACT DOCUMENT REQUIREMENTS

---

#### 3.01 GENERAL

- A. Electrical Engineer shall show equipment room layout, drawn to scale, indicating location of equipment and busway routing for interconnection.
- B. Electrical Engineer shall provide, a preliminary Coordination Study, Load Study and Arc Flash Analysis per Design Guideline Element D5000 Load Calculation Criteria. Provide all load calculations on the drawings/plans. The preliminary coordination study shall identify those areas where the incident energy is greater than 40Cal/cm<sup>2</sup>. The design shall try to mitigate the incident energy to below 40Cal/cm<sup>2</sup>. The study and analysis shall include all power distribution systems.
- C. The Coordination Study and Arc Flash Hazard Analysis shall be updated, when a major modification or renovation takes place. The design team shall obtain the existing study and associated files from MDACC and update the study. The following changes, but not limited to, shall constitute the necessity of mandatory updates.
  - 1. A change by the utility or change of generator(s) by size or configuration
  - 2. A change in the primary or secondary systems configuration
  - 3. A change in the transformer size (kVA), impedance (Z%), addition or deletion
  - 4. A change in feeder conductor lengths, sizes, or raceway type
  - 5. A change in the motors connected to the system
  - 6. The Coordination Study and Arc Flash Hazard Analysis shall be prepared as per ODG Element D5000 to account for changes in the electrical distribution system.

---

### PART 4 - PRODUCTS

---

#### 4.01 GENERAL

- A. High voltage switches shall be High Voltage Drawout type (HVDO) metal clad vacuum circuit breakers.
- B. Secondary switchgear shall be low voltage draw out type (LVDO) solid state with adjustable trip.
- C. Power distribution transformers shall be dry type, air cooled high efficiency, NEMA TP-1 transformers. Transformers serving loads with high harmonics (such as IT closets and server rooms) shall be harmonic mitigation type.

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

- D. All products used and specified in Division 26 must be UL approved and must meet all applicable ANSI, NFPA, IEEE, EIA/TIA standards as indicated in the appropriate sections of this design standard.
- E. Refer to Owner's Master Construction Specifications. These are available on the Owner's Design Guidelines website: <http://www2.mdanderson.org/depts/cpm/standards/specs.html>

**END OF ELEMENT D5010**

# Element D Services

Electrical

## D5010 Electrical Service and Distribution

### PART 5 - DOCUMENT REVISION HISTORY

Issue	Date	Revision Description	Revised By
	20190301	Original Issuance	
Rev. 1	20220121	Revised to include natural gas as fuel source	George Gabino, FPDC