

## DESIGN PROCEDURES

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### SUMMARY

The purpose of this document is to provide guidelines to assist the electrical engineer and electrical designers during the design and submittal process by establishing standard practices that achieve uniformity and quality designs.

### GETTING STARTED

#### **Standards:**

The Facilities and Infrastructure (F&I) department maintains a set of Electrical Standards on the Port Internet site. The Standards are in specification format and contain both design guidelines and specific product and installation data. Please download and review the Standards prior to commencing design.

- All projects shall comply with the STIA Electrical Standards. Deviations from the Standards are allowed only with F&I approval, and only on project specific basis.
- The Electrical Standards are located at: <https://www.portseattle.org/page/design-standards>
- The Electrical Standards are a living document and are updated regularly. The designer should download the electrical standards at the beginning of each new project and review for changes.
  - An excel file titled "Standards Tracking Update.xlsx" lists all of the standard sections and standard detail with a date of the most recent change. Changes in standards are indicated with the 'Track changes' vertical bar, to help the designer quickly identify the changes.
- Pier 69 maintains Master Specifications. The engineer/designer shall use the Pier 69 Master Specifications as a starting point for project specifications and shall edit them to comply with the STIA Standards and with project-specific requirements. Project specifications will use the POS Master Spec headers and footers and number formatting.
- The Standards are not meant to relieve the Engineer of Record from the responsibility of preparing a complete and comprehensive set of construction documents.

#### **As-built Information:**

The Port of Seattle maintains an Engineering Archive of record drawings for all projects constructed at the airport. F&I maintains electronic versions of schedules for most of the electrical panels in the passenger terminal buildings. F&I can also provide some one-line information available in AutoCAD format and in compiled PDF record drawings.

- Electrical designers may request access the Engineering Archive from the Port Project Manager (PM). The documents are available in pdf format; AutoCAD versions are available upon request.
- Designers may request panel schedules and one-line information from F&I via the Port PM.
- **Important:** Record drawings, panel schedules, and one-lines are not guaranteed to be accurate. It is the responsibility of the designer to verify existing conditions.

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### Site Investigation:

*Thorough site investigation is extremely important when doing work at SeaTac Airport. The airport is a large facility, comprised of many systems and spaces. The facility was originally constructed in 1944 and has been undergoing modifications since that time. Some areas are very congested, with power and telecom raceways competing for space with mechanical ducts, steam pipes, sewer lines, etc.*

- *The consultant must bring his/her own ladder and remove ceiling tiles to observe conditions above ceilings. Any obstructions to conduit routing will need to be documented on the drawings. Conduit pathway must be shown on the drawings.*

Electrical designers will need an electrical escort to observe the electrical panels that will be utilized for the project. The electrical escort is a Port electrician who will help locate panels and will open panel covers.

- When verifying availability of spare circuits, it is necessary to have the Port electricians remove the panel dead-front. Breakers may be labeled as spare, but have wires landed on them. Breakers may be in the 'on' position, but may not be connected to wires. Schedules posted in panels are not always accurate.
- In addition to field verifying the panelboard or other source of power for the project, the conduit/feeder routing must be field verified.

The request for escort needs to be submitted by the Port PM to the Electric Shop with a minimum of 5 days advance notice. Be mindful of deadlines and plan ahead!

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#### Drawing Requirements:

The Port reviewers typically review half-sized drawings. Please make sure that the line weights and fonts show correctly when the drawings are printed at half size.

Drawings shall clearly show the location(s) of the panel(s) and the location(s) of the load(s).

Conduit routing from panel to load must be shown on drawings. Homerun symbols are not allowed. As noted above, some areas are extremely congested, and it is necessary to determine viable conduit pathways during design.

- *Failure to identify conduit routing can -and does- result in costly change orders and delays.*

Drawings shall include load summary using 30-day metered load data or calculated load (if all loads are identified and verified). One-line diagram shall be included when adding new panels. When circuits are modified in an existing panel, one-line diagram must show the next panel upstream.

#### Panel schedules:

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Include schedules for all panels used on the project in Port Standard Excel format. Show new work in bold. In the Remarks section at the lower right of the schedule, include the project number, list of modified circuits, and the below that the date.

Panel schedules should be included in the drawings or in the specifications. If included in the drawings, ensure that the bold text denoting new work appears bold at half size, or include notes which show which circuits have been modified.

Provide accurate descriptions for new circuits which include load type and location. "New load" or "receptacle" are not acceptable load descriptions. The load location should include the POS door number, if available, or the closest building column number.

- Architects create room numbers for the duration of the project, which are typically changed after the project is complete. If the final POS door numbers are not available during design, instruct the contractor to update the as-built panel schedule with the correct door number upon project completion.
- The STIA panel schedule Excel template is available on the Port internet site with the Electrical Standards under section 262416.
- Electronic versions of specific panel schedules may be available upon request from F&I via the Port PM.

**Specifications:**

Specifications shall incorporate all information from the Electrical Standards relevant to the specific project.

The Port provides standard guide specifications for use by designers on all airport projects. Electronic copies of the guide specifications are available at the Port Procurement and Roster Management System website, located here: <https://www.portseattle.org/page/master-guide-specs-2004>. The Port Master Specifications should be edited to comply with the STIA Electrical Standards.

**Breaker Reservations:**

Once the designer has determined which existing circuits will be used on the project, the circuit breakers or breaker spaces must be reserved. The designer shall submit a list of circuits to be reserved to the Port PM. The PM will submit a Breaker Reservation Request to the Electric Shop. The Port electricians will place a sticker with the project number and the request date on the panel adjacent to the breaker being reserved.

- There are numerous concurrent projects at the airport. If breakers are not reserved for each project, other projects may use the needed breakers. This will result in cost overruns and schedule delays.

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**Equipment Space Reservation:**

If new equipment, such as panels, transformers, switches, meter cabinets, etc, will be installed as part of a project, the physical space in the facility must be reserved for the new equipment. This prevents concurrent projects from designing equipment in the same space.

The designer shall perform a site walk with an AVM Electrician and an F&I Electrical Engineer and determine the proposed location(s) for new equipment. The designated equipment space will be marked on the wall and/or floor with blue tape, and a sticker shall be affixed to the wall indicating the project number and name, the name of the project manager and the date that the sticker was affixed.

**Electrical Design Review Meetings:**

The Electrical Design Review committee includes F&I staff and Port electricians. At least one Electrical Design Review meeting will be required during the design process. PEST meetings typically last 30 minutes. The purpose of the design review meeting is for a progressive review of the design at 30%, 60%, 90% and/or 100% as determined by the Manager of the F&I Electrical group. During the meeting, Port personnel will ask questions about the design and provide feedback, answer questions and provide direction.

- Small projects may only need to be presented at 60% and 90%, or at 90% only. This shall be coordinated with the F&I Electrical Manager.
- For complicated issues and large projects, meetings can be scheduled for longer than 30 minutes.

**Application for Electrical Connection:**

An Application for Electrical Connection is required for every panel to which load is added. The Application must be completed by the designer and submitted by the Port PM. No connections to the electrical system are allowed without an approved Application. The following supporting documentation must be submitted with the Application:

- Panel schedule in Port Standard Excel format on an 8.5"x11" sheet (can be shown on a drawing as long as the load summary section is included). New loads should be clearly indicated with descriptions as they will appear on panel schedule posted in the panel.
  - The STIA panel schedule Excel template is available on the Port Internet site with the Electrical Standards in section 262416.
  - Electronic versions of specific panel schedules may be available upon request from F&I via the Port PM.
- 30-day metered load data (7-day readings are allowed for preliminary approval during the initial design phase)
  - The POS Project Manager may request load readings from the AV Maintenance Electrical Shop Manager or from a third-party electrician.

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- Meter readings are valid for a period of one year from the day of reading. When past recordings are used, the designer must factor in additional load that may have been added from the time of the reading and the proposed design.
  - The Tenant Design Team (TDT) may contact POS PM for copy of existing load readings of the selected load centers or panels if available.
  - Calculated load may be used if the design engineer is able to identify all existing loads.
- Load summary for 30-day recorded loads (existing load + 25% NEC Safety factor-removed load (if applicable) + new load = new total load).
- Layout showing the following:
  - Location of panel
  - Location of load
  - Conduit routing showing conduit type and size and wire size and quantity
- One-line diagram if new panel is being added or the name of the upstream panel if an existing panel will be modified.
- If panel is added, the Application must be submitted for the switchboard or panel feeding the new panel, not for the new panel itself.
- If revenue or utility meter is required, include the following:
  - For new meter installation, provide meter details in accordance to F&I Standards.
  - For connection to existing Multipoint metering setup, specify the model/part numbers for meter module and CTs on the drawings
- *Applications submitted without the supporting documentation listed above will be returned as 'Revise and Resubmit.'*

The Application for Electrical Connection is available on the Port Internet site, at the same link as the Standards, under the tab "Applications for Utilities Connections."

**Power System Studies**

Per NEC requirements, all panelboards must be rated for the available fault current and must have a label indicating the Arc Flash Hazard level. If the project is modifying an existing panel that does not have an arc flash sticker indicating the hazard level, the engineer of record is responsible for calculating the arc flash hazard level and providing a sticker in the Port standard format. The calculation requirements may be discussed with the PEST committee at the PEST meeting.

**SUBMITTAL REQUIREMENTS**

Submittals shall be in accordance with the following POS A/E Design Submittal requirements. Design submittals shall include the following electrical requirements for each design phase:

**Conceptual Design (30%)**

- Basis of Design Narrative.

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- Preliminary load calculations.
- Preliminary One-line diagram with power sources identified.
- Power meter indicated on drawing, identified as new or existing.
- Source panel located in plan.
- New panel(s) and transformer(s) located in plan, if applicable
- General notes, symbol legend.

Design Development (60%)

- Demolition drawings.
- One-line diagram – indicated available fault current if new panel is being installed.
- Load summary including existing load + 25% NEC safety factor + new load = new total load.
- Power meter shown on drawing, new or existing. If new, provide installation details.
- Voltage drop calculations.
- Electrical panel(s) and transformer(s) shown in plan view.
- Conduit routing to new panel(s).
- Panel schedules with AIC ratings.
- Preliminary lighting layout with emergency lights indicated.
- Lighting controls layout.
- Light fixtures schedule.
- Receptacle and device layout.
- Mechanical and kitchen equipment connection connections.
- Mechanical and kitchen equipment schedules.
- Penetration/firestopping detail.
- If new panel is being added:
  - Source panel schedule
  - Panel door-in-door detail
  - Phenolic label detail with all text accurately shown for all labels
- Specifications

Construction Documents (90% or 100%)

- Demolition drawings.
- One-line diagram – indicated available fault current if new panel is being installed.
- Load summary including existing load + 25% NEC safety factor + new load = new total load (or total calculated load).
- Meter shown on drawing, new or existing. If new, provide installation details.
- Voltage drop calculations.
- Electrical panel(s) and transformer(s) shown in plan view.
- Conduit routing to new panel(s).

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- Panel schedules with AIC ratings, feeder sizes and calculated load.
- Lighting layout with emergency lights indicated.
- Circuiting for light fixtures.
- Lighting controls layout.
- Light fixtures schedule.
- Receptacle and device layout.
- Circuiting for all receptacles and devices.
- Mechanical and kitchen equipment connections with circuiting shown.
- Mechanical and kitchen equipment schedules.
- Penetration/firestopping detail.
- If new panel is being added:
  - Panel door-in-door detail
  - Phenolic label detail with all text accurately shown for all labels
- Specifications
- All review comments addressed.
- Application for Electrical Connection.

**OTHER DESIGN CONSIDERATIONS:****Adding load to a panel:**

- The Port requires electrical meter readings of panels that have a load increase due to a proposed project and where an engineered calculation for all existing loads is not available. This applies to Tenant panels and Port panels. This is also an NEC requirement.
- 7-day meter readings may be adequate for additional loads of 20 Amps or less on 20A, 120V circuits. Any higher loads will require a 30-day meter reading.
- Meter readings are valid for a period of one year from the day of reading. Previous readings less than one year old may be used, but the designer will need to include any load that was added after the time of the reading.
- Please note that copies of the reading's summary sheet are required for each Application for Connection to Electrical Systems. If graphic summaries are used, the submitted copy shall be in color.

**Electrical Utility Shut-downs**

Many of the Power Centers at the airport have very high arc flash hazard levels, so working on them while energized is not an option. In order to shut down an electrical panel, all loads fed by that panel must be identified and the affected parties must be notified of the impending shutdown. Depending on the size of the panel and the accuracy of the panel schedule or distribution board circuit breaker labels, preparing for a shut-down can take many hours.

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The shut downs are coordinated through the, Port Construction Manager, Port Resident Engineer, Port Electrical Maintenance Manager, Port Electrical General Foreman and the Operations staff. The electrical designer should identify which panels will require a shut down during construction and provide some indication in the drawings of the scope involved in the shut-down, to allow the contractor to include hours for this work in the bid.

**UL Listing and Labeling**

All electrical equipment shall be listed and labeled by Underwriters Laboratories, Inc. or by an agency approved by the Department of Labor & Industries (L&I) Electrical Division unless specifically waived by L&I or unavailable (e.g., medium voltage liquid-filled pad-mounted transformer and medium-voltage pad-mounted vacuum interrupter switchgear). Electrical equipment subassemblies must have a UL label.

**CONSTRUCTION PHASE:**

Typically the design engineer is contracted during the construction phase for submittal reviews, RFI Responses, preparation of Design Bulletins, and for a Punch List inspection. Coordinate construction phase requirements with the Port PM.

**INFO FOR CONTRACTORS:****Electrical Permitting:**

The contractor is responsible for obtaining an electrical permit. Electrical Permits are issued by the Washington State Department of Labor & Industries (L&I).

**Demolition and Remodel:**

Keep shutdowns to a minimum.

All shutdowns require coordination and approval of stakeholders. Identification of loads impacted by a shutdown takes time. Panel schedules may not be accurate or available, and distribution board breakers and switchgear breakers may not be accurately labeled. Allow ample time for investigation prior to the scheduled shut-down.

Contractor shall update existing panel schedules with field verified data. All updates shall be done using electronic Excel format panel schedules obtained from F&I or by using the template included in the Electrical Standards. Contractor shall post accurate as-built panel schedules in Port Standard format and shall submit electronic excel versions to F&I upon project completion.

Remove abandoned conductors and remove raceways of abandoned circuits where accessible. Where not accessible, tag both ends of the raceway with the location of the opposite end, the associated project number, and the date the tag is applied.

Coordinate electrical power to be used during construction. Submit an Application for Electrical Connection for temporary construction power.



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Identify on-site or off-site recycling opportunities.

**CONCLUSIONS**

The Port PM and F&I are here to help with any design or procedure questions. While F&I does not have comprehensive records of the electrical systems, many panel schedules and some one-line information are available from F&I upon request. F&I staff have familiarity with the archived drawings and may be able to assist in identifying relevant record drawings.

End of Section

Revision History:

9/15/20 – Added requirement for reservation of space for new electrical equipment.