



### Document Recipients

Action	Name	Company	Notes
For Review and Approval			
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### Revision Log

Revision Level	Revision Date	Page Affected	Description	Prepared by
0.0	11/30/2021	All	Document Creation	Meredith Cofer
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### Document Purpose

This document aims to provide general instructions for the project execution process of the Electrical Engineering Department.



Electrical Engineering (EE)  
**Work Instruction**  
Standard Operating Procedures

Document #  
Work Instruction Rev A

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## 1 Process Scope

Project execution for Electrical Engineering is separated into six stages:

- Solutions Development Stage
- Design Stage
- Development Stage
- Test and Installation Stage
- Commissioning Stage
- Close Out Stage

## 2 Acronyms

Acronyms	Meaning
EE	Electrical Engineering
RFP	Request for Purchase
FAT	Factory Acceptance Test
BOM	Bill of Material
RIO	Remote I/O
PDP	Power Distribution Panel
RSPL	Recommended Spare Parts List

## 3 Prerequisites

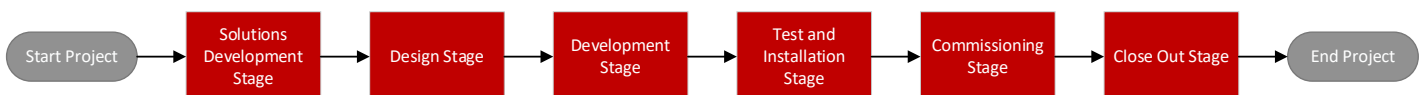
## 4 Flow Chart

This document covers project execution for Electrical Engineering. Electrical Engineering contains four significant stages in implementation.

### 4.1 ELECTRICAL ENGINEERING FLOWCHART

Electrical Engineering Project Execution Stage

Electrical Engineering Project Execution Stages





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## 5 Work Instruction



### 5.1 SOLUTIONS DEVELOPMENT STAGE

#### 5.1.1 Proposal Activities

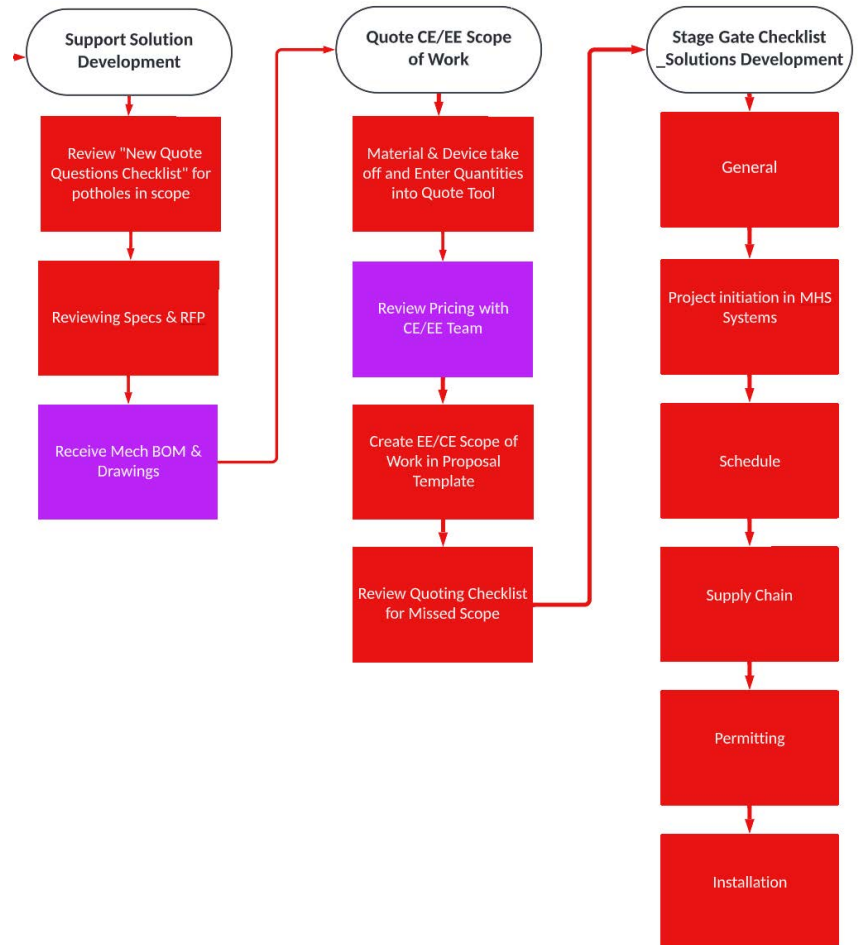
1. Review “New Quote Questions Checklist” for potholes in scope
2. Reviewing Specs & RFP
3. Receive Mech BOM & Drawings

#### 5.1.2 Quote EE/CE Scopes of Work

1. Material & Device take off
2. Enter APL quantities
3. Review Pricing
4. Create EE/CE Scope of Work in Proposal Template
5. Review Quoting Checklist for missed scope

#### 5.1.3 Stage Gate Checklist for Solution Development

1. General
2. Project Initiation in MHS Systems
3. Schedule
4. Supply Chain
5. Permitting
6. Installation





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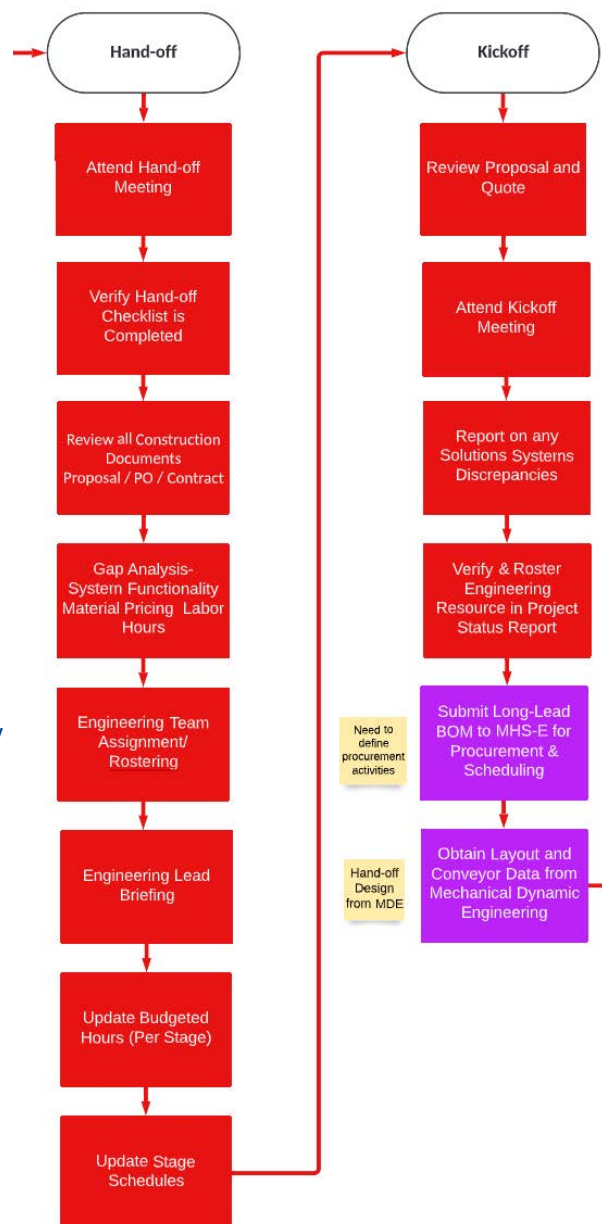


## 5.2 DESIGN STAGE



### 5.2.1 Handover/Handoff Meeting

1. Attend Handoff Meeting
  2. Verify Handoff Checklist is Completed
  3. Review all Contractual Documents Proposal/PO/ Contract
  4. Engineering Team Assignment/Rostering
  5. Engineering Lead Briefing
  6. Update Budgeted Hours (Per Stage)
  7. Update Stage Schedules
- Handoff Checklist
    - a. Can you provide us with a blank and populated handover checklist?  
[DAS] I think the checklist has to be created
    - b. What is the handover meeting about and why is it important?  
[DAS] Sales provides information to Engineering Managers
    - c. What do you need for this meeting?  
[DAS] to be determined with other disciplines
    - d. Who all attends this meeting?  
[DAS] to be determined with other disciplines. Sales/ Program & Project manager/ Engineering Managers
    - e. Is there anything you would like to add to this task to improve efficiency?  
[DAS] to be determined with other disciplines
    - f. Is there anything we are leaving out?  
[DAS] can't think of anything



### 5.2.2 Kickoff Meeting

1. Review Proposal and Quote
2. Attend Kickoff Meeting
3. Report on any Solutions Systems Discrepancies
4. Update Budgeted Hours (Per Stage)
5. Verify and Roster Engineering Resource in Project Status Report
6. Submit Long -Led BOM to MHS-E for Procurement and Scheduling
7. Obtain Layout and Conveyor Data from Mechanical Dynamic Engineering

Resource Notes ONLY

- Read the Proposal
  - a. Can you describe this task and the importance?  
[DAS] Read the proposal to determine the scope of work as it was sold.
  - b. Is this a group meeting?  
[DAS] this is a task, not a meeting
  - c. If you find issues in the proposal, what do you do?  
[DAS] log the issue for discuss at kick-off
  - d. Are there any forms or templates required for this task?  
[DAS] no
  - e. If a requirement is not clear, what do you do?  
[DAS] log the issue for discuss at kick-off
  - f. Is there anything you would like to add to this task to improve efficiency?  
[DAS] Read the Proposal and Quote
  - g. Is there anything we are leaving out?  
[DAS] no
- Review the Purchase Order/Contract
  - h. Who all is involved with this review?  
[DAS] similar to reading the proposal/quote
  - i. If you find issues during the review, what do you do?  
[DAS] log the issue and discuss at kick-off
  - j. Why is this important?  
[DAS] to determine scope of work as it was sold
  - k. What is the purpose?  
[DAS] to determine scope of work as it was sold
  - l. What do you do once you complete the review?  
[DAS] Assign a EE Lead Engineer and provide them with notes before kickoff
  - m. Are there any templates involved or checklists?  
[DAS] no
  - n. Is there anything you would like to add to this task to improve efficiency?  
[DAS] no
  - o. Is there anything we are leaving out?  
[DAS] no

**1. Review Proposal & Quote**

- a. Prior to the kickoff activities, the proposal and quotes must be reviewed. Is there a template for this?  
[DAS] yes, there is a template for the “Kickoff” meeting that should be started during this task.
- b. If there is a template(s), where are they located and can you send me a blank template in pdf format or its native format?  
[DAS] template is located in MHS\_D+F\_Engineering | ENG Electrical Engineering > DF EE Standards > Document Templates.  
  
Copy provided in Teams: MHS D&F Eng Internal Projects | IR000086 DF Engineering Processes > Dept Resource Docs > EE called “A.YY.XXXX-PROJ Kickoff EC 21.1004.docx”
- c. How much time do you allow yourself for reviewing?  
[DAS] no set time, as much as required
- d. Where is all your documentation housed for your prepared quotes/proposals?  
[DAS] Project Folder (in teams)
- e. Do you prepare your quotes yourself, or is your team involved?  
[DAS] team is involved. The quote is prepared during the solutions phase. This task is just reviewing the quote and proposal for the “as sold” scope of work
- f. Do you hold meetings for this or send out requests via email?  
[DAS] sales and project manager sends meeting invites
- g. Is there anything we missed or that you would like to add?  
[DAS] this task is for the EE Lead after he is assigned
- h. Is there anything you would do to improve the efficiency or time used to prepare your quotes?  
[DAS] we are not preparing a quote here, just reviewing the one that was sold.

**2. Kickoff Meeting/activities**

- a. Who puts the kickoff meeting together?  
[DAS] sales and project manager
- b. Why is there a kickoff meeting?  
[DAS] to review the as-sold scope of work, project schedule and budget
- c. Is this one meeting or multiple?  
[DAS] typically one, multiple if needed
- d. Please provide a thorough list of topics that are discussed during the kickoff meeting?  
[DAS] scope of work, project schedule, budget, people involved
- e. What do you need to bring/prepare for the kickoff event?  
[DAS] notes from reviewing the proposal and quote

- f. How many hours do you need for the kickoff meeting if you must prepare documents/drawings/slides etc.?  
[DAS] as needed, no set amount of time
  - g. Is there anything you would like to add?  
[DAS] no
  - h. Is there anything you would do to improve the efficiency or time used for the kickoff activities?  
[DAS] no
3. Submit Long-Lead BOM to MHS-E for procurement & scheduling
- a. Who is MHS-E?  
[DAS] MHS Equipment, the division of MHS that builds equipment. All of our Electrical Control Panels are generally build by MHS-E
  - b. Is there a form or template for the BOM that you are submitting?  
[DAS] yes
  - c. What do you do if an item is not attainable in time for the build or unattainable?  
[DAS] #1) Ask the vendor and manufacturer to expediate (sometimes for a fee).  
  
#2) Ask the vendor for an alternative item that has a better lead time. [EE Lead must confirm equal by looking at specifications]  
  
#3) ask alternate vendors for equivalent item that is in stock/lower lead time. [EE Lead must confirm equal by looking at specifications]  
  
#4) Look for alternatives in stock at MHS-E or Norcross offices  
  
#5) Can the item be shipped and installed later? If so, will the expected date arrive on site for installation by the time it is required? #6) if all else fails, shipment must be delayed
  - d. Is creating the BOM a team effort?  
[DAS] it can be if the project is large
  - e. Do you get an automated or manual confirmation of long lead orders and delivery dates after ordered?  
[DAS] no, not at this time, we have asked for it to be automated. At this time, we have a weekly meeting and we ask for this information every week
  - f. Is there anything you would like to add to this task to improve efficiency?  
[DAS] no
  - g. Is there anything we are leaving out?  
[DAS] no

4. Obtain Layout and Conveyor data from Mechanical Dynmaic Engineering.
  - a. How do you get the layout; hardcopy, email, or stored in a known location?  
[DAS] this is an autocad drawing stored in a known location. (that is how it should be done, sometimes it is emailed, but it should be stored in known location (Vault)
  - b. What format is the data; drawing, spreadsheet, etc.?  
[DAS] autocad drawing(s) in .DWG format, Excel Worksheet referred to as the “Conveyor BOM”, “Motor Manifest” or combination of those words. This process/template needs better definition from MDE
  - c. What do you do with this data and what type of data is it?  
[DAS] The layout drawing contains size and location information for each conveyor, the excel worksheet contains, horsepower, speed and other info
  - d. Where do you keep this information?  
[DAS] excel worksheet is kept in Teams:  
  
@Project Folder@/08. Engineering/04. Electrical/1. Documents.  
  
Drawings are kept in Vault:  
  
ENG/\_D+F/%Customer%/\$City,State\$/@Project Folder@
  - e. Is there anything you would like to add to this task to improve efficiency?  
[DAS] no
  - f. Is there anything we are leaving out?  
[DAS] no

### 5.2.3 Design Project

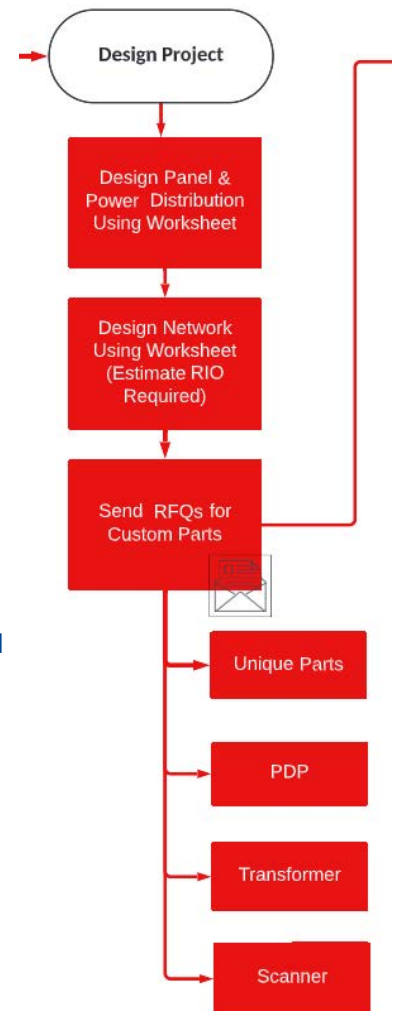
1. Design Panel & Power Distribution using worksheet.
  - a. Is this a template, if so, can you provide us with the template or worksheet?  
[DAS] yes actually three templates.  
  
In Teams: MHS D&F Eng Internal Projects | IR000086 DF Engineering Processes > Dept Resource Docs > EE  
  
"A.YY.XXXX-NAME\_Panels-Design\_2022-0309.xlsm"  
"A.YY.XXXX-NAME\_PDP-HV1\_2022-0217.xlsx"  
"A.YY.XXXX-NAME\_PDP-LV1\_2022-0311.xlsx"
  - b. Is there one location that you keep your templates?  
[DAS] yes in Teams: MHS\_D+F\_Engineering | ENG Electrical Engineering > DF EE Standards > Document Templates. At some point these files will need to be moved to the ISO9001 directory on Sharepoint
  - c. Was any of this completed during the quoting process?  
[DAS] no
  - d. What all do you need to complete this task?  
[DAS] layout drawing, Mechanical "BOM/Motor Manifest" and templates.

First, the EE Lead fills out "Panel-Design" worksheet:

1. add all conveyor names from Motor manifest
2. fill in horsepower data and control types (i.e VFD, FVNR, FV-Rev, Soft-Start, etc)
3. fill in MDR Power Supply data
4. Add MDR Motor Starters to design to supply power to MDR Power Supplies
5. Add any other loads
6. Assign all lines to a control panel, using the location of the motor, and location of the panel as references while balancing the panel loads.

Second, the EE Lead fills out the "PDP-LV1" worksheet if the project needs 120VAC power distribution:

1. Add all device names in description columns
2. For 120VAC loads, Fill out the "VA" columns using (amps \* 120)
3. For any 208VAC loads, Fill out using two phases (1/2 amps\*208) in each
4. Balance the load on phases A, B, C using cells E33, F33, G33
5. Adjust the breaker sizes as required (columns H & L)



6. Size Transformer using drop down in M39. Use M36 as minimum size required.
  7. Transformer Secondary current shown in R39 will determine Low Voltage Panel size.
  8. Transformer Primary current shown in R40 will be recorded in PDP-HV1 worksheet.
  9. If multiple low voltage distribution panels and transformers are required, save another worksheet for each PDP.
- Third, the EE Lead fills out the “PDP-HV1” worksheet:
1. Add all loads from low voltage distribution panels and control panels.
  2. Add any 3rd party loads required.
  3. High Voltage Panel Size provided in B33.
  4. If multiple high voltage distribution panels are required, save another worksheet for each PDP.
- a. Who do you submit your design to?  
[DAS] the EE Lead may discuss this with peers or EE Manager. Once complete, these worksheets are used to create drawings. They are “living documents” and updated as information changes
  - b. Do you hold a series of meetings with your team to complete this task and if so how often?  
[DAS] no
  - c. Why do you have to do this at this point?  
[DAS] This design worksheet is used to create several other drawings. The worksheet provides several pieces of information:
    - How many control panels in project
    - What conveyors are controlled by what panel
    - Load calculations
  - d. What tools do you use for designing?  
[DAS] excel
  - e. Where do you store your designs?  
[DAS] excel worksheet is kept in Teams:  
[@Project Folder@/08. Engineering/04. Electrical/1. Documents](#)
  - f. Can anyone access the design or do you have to give permissions.  
[DAS] any D+F engineer can access
  - g. Can you provide us with a sample?  
[DAS] template is provided with an example in document
  - h. How are you certain that all design criteria/requirements are satisfied.  
[DAS] EE Lead is responsible for updating all information. Others can compare to drawing and motor manifest to look for missing information
  - i. Is there anything you would like to add to this task to improve efficiency?

[DAS] no

- j. Is there anything we are leaving out?

[DAS] no

2. Design Network using worksheet.

- k. What type of network is this?

[DAS] data/Ethernet network

- l. Can you provide a sample for our document?

[DAS] this document must be created. This task is a placeholder

- m. Is this a template, if so, can you provide a copy and let us know where they are housed?

[DAS] template doesn't exist yet, will be located in same place as other templates

- n. Who do you submit the network design to?

[DAS] the EE Lead may discuss this with peers or EE Manager. Once complete, this worksheet is used to create drawings. It is a "living document" and updated as information changes

- o. Who all signs off on it?

[DAS] Customer, through approving the network drawings

- p. What all do you need to create the network design?

[DAS] need to understand architecture requirements from quote/proposal and customer specifications. EE Lead uses Layout drawing and identifies network devices. EE Lead fills out template indicating network cabling as "from/to" to all network devices. Network can be Ring, Star, or Bus configuration

- q. Does this involve your team or members of your team?

[DAS] EE Lead is responsible

- r. Is meeting(s) held to accomplish this?

[DAS] no

- s. Is there anything you would like to add to this task to improve efficiency?

[DAS] no

- t. Is there anything we are leaving out?

[DAS] no

3. Send RFQs for custom parts

Define the following:

- i. Unique parts

[DAS] D+F has a list of "standard parts" that we use all the time and maintain good pricing agreements on. Any part that is not included in the standard design parts is a unique part.



## ii. PDP

[DAS] Power Distribution Panel

This panel is very similar to the breaker panel that is in a residential house. Each one must be specified for overall size/voltage, number of circuit breakers, size of breakers, etc

## iii. Transformer

[DAS] we regularly need to use 3phase transformers to change 480V to 120V for different equipment. This is quoted based on project specifications

## iv. Scanner

[DAS] Conveyor systems use Cameras to read barcodes on boxes. These systems are provided by specific vendors (Cognex, Datalogic, Sick, Keyence) and can be very simple or very complex based on the project application.

Others:

P+A: Print and Apply, also called Panda (PandA). Equipment that combines a printer with an applicator to print a label and apply it to a moving box. Applicator can be a “tamp” moving in one linear direction or a “Swing arm”

Dimmer: Dimensioner, equipment to scan the case and determine the size in 3-dimensions. Some can also determine if a box is damaged or open as a quality check.

Weigh Scale: a “in-motion” Weigh Scale can provide the weight of the box without the box stopping. Highly accurate scales come with an optional feature to be “Legal-for-Trade”.

Machines: equipment to perform a complicated function. Each of these must be built for the custom application. Common Machines include:

- Robots- many different applications
- Case Erectors – makes a box and places it on a conveyor
- Case Sealer – takes a full box, closes the lid and seals it with tape or glue
- Taper – tapes a closed box
- Loader/Unloader/Extendo – an extendable conveyor that is used to load or unload a 54 foot truck load. The conveyor extends into the truck bed and brings cases to people loading the truck without walking back to the building.
- Palletizer – takes multiple cases and builds a complete pallet
- De-palletizer – takes multiple cases off a pallet
- Stretch Wrapper – wraps a pallet with stretch wrap
- Crane – moves a pallet in to / out of an ASRS
- LTS – Load Transfer System, used to remove the wooden pallet from a full pallet and replace it with another (less expensive) pallet for shipping

- Pallet Inverter – used to Invert the load of a full pallet so that the cases on the bottom are the cases on the top
- u. Why do we do this now at this point?  
[DAS] For some projects, a quote may have provided a price based on previous projects, but not a formal quote from a vendor. Other times, we may have a formal quote for the project, but the application information often changes. At this stage, we have more information and can either get formal quotes for the first time or get them updated to be more accurate before ordering.
- v. Do you inform anyone that this has been done?  
[DAS] EE Lead will inform the PM after task is complete.
- w. Do you have a list of approved vendors, and how do we access?  
[DAS] yes, but it can change if a customer requests a specific vendor. I have copied the vendor list to the In Teams: MHS D&F Eng Internal Projects | IR000086 DF Engineering Processes > Dept Resource Docs > EE folder Called “ELEC VENDOR LSIT v3.xlsx”
- x. Is there an RFQ template or is this completed on the PC?  
[DAS] EE usually uses email. We should create a template for scanners however.
- y. Are there any hard copies of RFQ’s that must be submitted?  
[DAS] no
- z. What information do you require to submit an RFQ?  
[DAS] information differs with the item:

#### Unique part-

- Vendor
- Part number
- Voltage requirements
- Must be NRTL (UL) approved
- Other requirements based on environment, size, amp load, connection methods, features, conveyor speed, as identified by project application

#### PDP-

- Panel Voltage Rating
- Number of Phases
- Neutral included or not included
- Copper or Aluminum buss
- KAIC (kilo-amps interrupting current) rating
- Panel Size (Amps)
- Main Circuit Breaker size or MLO (Main-Lug-Only)
- Number of distribution breakers, size, and number of phases of each
- Must be NRTL (UL) approved
- Any other special requirements

**Transformer-**

- Voltage Ratio (i.e. 480V:120V)
- Number of Phases
- Neutral included or not included
- Transformer Size (Amps)
- Must be NRTL (UL) approved
- Any other special requirements

**Scanners-**

- Barcode Size (Label Size, Barcode Size, MIL Size)
- Barcode Type (Code 128, UPC, 2D, 3D etc)
- Label location on case
- fixed or random/anywhere
- top, right, left, front, back, bottom
- if fixed, is it always in the same location, i.e. left side, leading edge, bottom 2 inches
- MTBH (Materials to be handled) Table
- Minimum and Maximum length, width and height of all cases
- Width of Conveyor
- Speed of Conveyor
- Gap required between cases
- Must confirm system can achieve desired CPM rate (Cases per minute)
- Boxes justified on conveyor: Left, Right, Center, or not justified
- Any known constraints on physical size of stand (is there something in the same location that will interfere?)
- Ethernet/IP always preferred
- Must be NRTL (UL) approved
- Special Requirements

**P+A-**

- Often specified with another discipline, MDE, etc.
- Label Size (Label Size, Barcode Size, MIL Size)
- Barcode Type (Code 128, UPC, 2D, 3D etc)
- Label location on case
- top, right, left, front, back
- i.e. left side, leading edge, bottom 2 inches
- MTBH (Materials to be handled) Table
- Minimum and Maximum length, width and height of all cases
- Width of Conveyor
- Speed of Conveyor
- Gap required between cases
- Must confirm system can achieve desired CPM rate (Cases per minute)
- Boxes justified on conveyor: Left, Right, Center, or not justified

- Any known constraints on physical size of stand (is there something in the same location that will interfere?)
- Ethernet/IP always preferred
- Zebra or Sato printer desired?
- tamp or swing desired
- electric or pneumatic desired
- Must be NRTL (UL) approved
- Special Requirements

#### Dimmer-

- Often specified with another discipline, MDE, etc.
- MTBH (Materials to be handled) Table
- Minimum and Maximum length, width and height of all cases
- Width of Conveyor
- Speed of Conveyor
- Gap required between cases
- Must confirm system can achieve desired CPM rate (Cases per minute)
- Boxes justified on conveyor: Left, Right, Center, or not justified
- Any known constraints on physical size of stand (is there something in the same location that will interfere?)
- Ethernet/IP always preferred
- Must be NRTL (UL) approved
- Special Requirements

#### Weigh Scale-

- Often specified with another discipline, MDE, etc.
- MTBH (Materials to be handled) Table
- Minimum and Maximum length, width and height of all cases
- Width of Conveyor
- Speed of Conveyor
- Gap required between cases
- Must confirm system can achieve desired CPM rate (Cases per minute)
- Boxes justified on conveyor: Left, Right, Center, or not justified
- We usually ask that vendor does not supply a VFD but provides requirements. MHS will supply the VFD so that it same make and model as conveyor system (better for spare parts)
- Any known constraints on physical size of stand (is there something in the same location that will interfere?)
- Ethernet/IP always preferred
- Must be NRTL (UL) approved
- Special Requirements

Machines-

- Often specified with another discipline, MDE, SDT, etc.
- Voltage Requirements (in order of preference)
  - » 480VAC
  - » 24VDC
  - » 120VAC
  - » 208VAC
  - » Any others require special transformers/power distribution and should be rejected
    - Must have Amp Load and any special power requirements
    - MTBH (Materials to be handled) Table
  - » Minimum and Maximum length, width and height of all cases
    - Width of Conveyor
    - Speed of Conveyor
    - Gap required between cases
    - Must confirm system can achieve desired CPM rate (Cases per minute)
    - Boxes justified on conveyor: Left, Right, Center, or not justified
    - Any known constraints on physical size of stand (is there something in the same location that will interfere?)
    - How will the Machine Integrate to the MHS system
  - » Hardwired Interlocks?
    - ◇ *Machine Ready-to-Receive for incoming cases*
    - ◇ *Conveyor System Ready-to-Receive & Machine OK-Status for outgoing cases*
    - ◇ *What others are required?*
  - » Networked Interlocks?
    - ◇ *Ethernet/IP required*
    - ◇ *What are the data points that must be monitored?*
  - » Emergency Stop?
    - ◇ *Must Conveyor E-Stop cause Machine E-Stop or normal stop?*
    - ◇ *Must Machine E-Stop cause Conveyor E-Stop or normal stop?*
    - ◇ *What SIL/PL rating is required?*
    - ◇ *Is a Risk Assessment needed?*
  - » Does Conveyor HMI need to control or report alarms for Machine?
    - ◇ *Ethernet/IP required*
    - ◇ *How many alarms or controls must be programmed?*
      - Must be NRTL (UL) approved
      - Special Requirements

aa. How do you receive the quotes and what do you do with them once received?

[DAS] usually email. They are stored in the project folder

ab. How do you organize them and get them back in a timely manner?

[DAS] EE Lead is responsible for following up

ac. Is there anything you would like to add to this task to improve efficiency?

[DAS] no

ad. Is there anything we are leaving out?

[DAS] no

### 5.2.4 Complete Approval Drawing

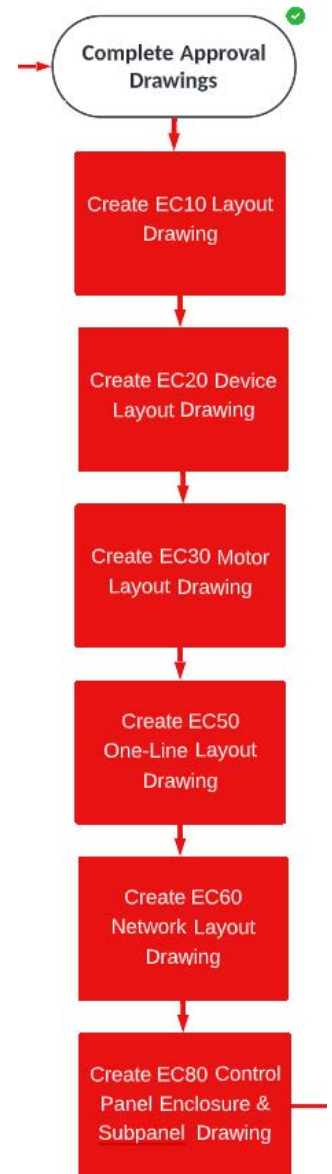
[DAS] the next Activity is “Complete Approval Drawings” These tasks have templates and I’ve started a first draft WI for some already. They are below:

#### Complete Approval Drawings

Task 1: Prepare Layout Model (this task is not in the list, but needs to be added)
Setup and Scrub Layout
Open Mech Drawing of building and conveyor Xrefs
Make sure all objects have color set to “by layer”
Make sure objects are on Layers with names that are useful and descriptive
Transfer Xrefs to EC10 Template

#### EC10-Overview

Task 2: Create EC10 Layout Drawings
Plan Layouts so that entire conveyor system can be easily viewed. Multiple Levels shown on different pages, areas with many devices use larger scale.
Change colors of conveyors to show different “SETS” of conveyors
Make sure that the Building and Column Grid is greyed out (Color 251)
Make sure that Existing Conveyor, Equipment not provided, Rack or other objects around SOW are greyed out (Color 253)
Add PDP, Transformer, & Control Panel Locations and Leaders
Add Power & Network Drops
Title Page (Update Project & Customer details)
Drawing Index (Add rows for every drawing in the EC10 to EC90 drawing sets)
Layout 1 shows entire building, Building & Grid in Black, Existing Conveyor Greyed out, Project SOW in Black. No do Not Show Power, network drops or panels.
Layout 2 shows close up of Project SOW in Set Color. No Devices, Estops, or Motors. Conveyor Tags are Readable on Smaller Projects (Larger Projects Tags are shown on Area pages or Individual conveyor pages) Show Power and Network Drops. If control panel leaders can easily be seen (very few panels or small layout) show the panels
Remaining Layouts are identical to the breakout of Device and Motor Layouts
Larger Projects should show an “Area” with Page Numbers to show the progression of the pages (for quick reference to the desired page)
Check all Title Blocks
Update Drawing Index Page 2



**EC20-Device**

**Task 3: Create EC20 Layout Drawings**

Change colors of conveyors to show different "SETS" of conveyors
Make sure that the Building and Column Grid is greyed out (Color 251)
Make sure that Existing Conveyor, Equipment not provided, Rack or other objects around SOW are greyed out (Color 253)
Add Devices & Leaders, Change Device Names
Add Estops & PullCords, Change Device Names
Add Equipment (Scanners, PrintApplies, etc)
Add RIOs as required (16 I/O points or devices more that 100 feet from a RIO)
Title Page (Delete Notes that are N/A, add new acronyms/abbr)
Interfaces & Bill of Material (change all Qty in column 2 to zero until finished, note any Interfaces that are used for the project but not in the table)
Remaining Layouts should match the EC10 pages starting with Page 5
On Each Drawing, check all Leaders for readability
Update all Bill of Materials & Interface drawings
Check all Title Blocks

**EC30-Motor**

**Task 4: Create EC30 Layout Drawings**

Change colors of conveyors to show different "SETS" of conveyors
Make sure that the Building and Column Grid is greyed out (Color 251)
make sure that Existing Conveyor, Equipment not provided, Rack or other objects around SOW are greyed out (Color 253)
Add Motor/VFD Symbols and Leaders, Change Motor Names
Add MDR, Rectacle and other power blocks & Leaders, change Names
Add Disconnects (If Monitored, must be copied to EC20 and added to IO-Points)
Title Page (Delete Notes that are N/A, add new acronyms/abbr)
Motor and Panel Summary Tables
Remaining Layouts should match the EC10 pages starting with Page 5
On Each Drawing, check all Leaders for readability
Update Motor & Panel Tables on Page 2
Check all Title Blocks



**EC50 -One Line**

**Task 5: Create EC50 Layout Drawings**

for systems with more than one PDP, the first page should be a “feeder” page showing each feed to each PDP. Do not show motors or loads. Add a Summary Power Distribution Calculation table (Image from Excel is fine) showing FLA and panel size for each PDP and total FLA, overall kW and kVA for the entire system.

Draw one-line using Electrical Design worksheet. Extend PDPs to second row or additional pages as needed.

Title Page (Delete Notes that are N/A, add new acronyms/abbr). Add any cable/conduit sizes that are needed to sizes table.

Feeder page, showing the feed from the bld swgr to multiple PDPs (with no motors or loads). Add a Summary Power Distribution Calculation table (Image from Excel is fine) showing FLA and panel size for each PDP and total FLA, overall kW and kVA for the entire system. for smaller systems with one PDP, this page can be skipped and the information can be shown on the next page.

Add ‘Distribution’ pages as needed. Show PDPs, Control Panels, motors, loads and transformers. When all loads on a PDP are shown, copy the PDP Calculation table (image from excel is fine) showing FLA and panel size for the PDP, and total FLA, overall kW and kVA for the PDP below or on the next page.

On Each Drawing, check all text and objects for readability

Check all Title Blocks

**EC60- Network Drawing**

**Task 6: Create EC60 Layout Drawings**

for larger systems, showing a typical or “Tier’d” network drawing maybe uesful. Tier 1 would include cable drops from the Building network to the PLC, network switches, cameras, HMIs or other equipment. Other devices would not be shown until the next page

Show Ring Networks clearly, keeping them on one page

all devices that home run to a network switch should be shown on the same page as the network switch (as much as possible)

Copy Cable schedules from the Design Worksheet to the drawing Cable Schedule Tables. Keep the Cable Schedules limited to a single switch or ring and show them after the switch or ring they are associated with (i.e. Graphic of Network Switch#1, then cable schedule for network Switch#1, then Graphic of network Switch #2, then cable schedule for network switch #2.

Update IP Address Tables for each page to include a row for every device that needs an IP address

Title Page (Delete Notes that are N/A, add new acronyms/abbr)

Add pages as needed to show the entire network

On Each Drawing, check all text and objects for readability

Check all Title Blocks

There are three different control panel designs, referred to as “Controlblox”, “Quick-Design”, and “Custom Design”

### Control Panels

Task 7: Create EC80 Layout Drawings
<b>EC8X- Standard Control Panels</b>
For every standard panel required, copy the template to the drawing set
Make changes to the panel design as required
Make changes to panel labels (FLA, Project #, etc) if required
Check Project & Customer details on Title Page
Delete Notes that are N/A, add new acronyms/abbr
On Each Drawing, check all text and objects for readability
Check all Title Blocks
<b>EC8X- Quick Design/Quarter-Back Panels</b>
For each panel required, copy the template to the drawing set
Standard Design Blocks and Schematics are located in Model space around the page layout areas. Copy objects as needed to create the panel required.
The templates have been setup to be flexible and useful for most situations. Keep Din-Rails and Panduit Wire Trays as drawn, or make as few modifications as possib
Layout devices onto the subpan template
Check Calculations for Power Distribution and ensure that incoming Feed Disconnect and Ckt Breaker are sized correctly
On Each Drawing, check all text and objects for readability
Check all Title Blocks
<b>EC8X- Custom Design Control Panel</b>
Copy TITLE Template to Drawing Set, name it EC8X-##01.
Title Page (Update Project & Customer details)
Drawing Index (Add rows for every drawing in the control panel drawing set)
On the Layout, check all text and objects for readability
Update Title Block
Copy the BOM Template, name it EC8X-##M0
Copy the BOM Table to the drawing. (Link Table to Excel for easy updating. Excel must be kept in same folder as drawing)
On the Layout, check all text and objects for readability
Update Title Block
Copy the ENCLOSURE Template, name it EC8X-##M1.
Create Front Elevation of Control Panel with Devices. Create views with cutouts and dimensions. Add Reference callouts that match the BOM. Add pages as needed.
On the Layout, check all text and objects for readability
Update Title Block
Copy the ENGRAVING Template, name it EC8X-##M2
Add, Remove, and Update Engravings as required. Include Dimensions. Add pages as needed
On the Layout, check all text and objects for readability

**Task 7: Create EC80 Layout Drawings**

Update Title Block
Copy the SUBPANEL Template, name it EC8X-##M3.
Create Sub-Panel views showing Devices, Din-Rail and Panduit Wire Ways. Show Back and Side Pans as needed. Add continuous-dimension lines to show dimensions. Add Reference callouts that match the BOM. Add pages as needed.
Check Calculations for Power Distribution and ensure that incoming Feed Disconnect and Ckt Breaker are sized correctly. Update SubPan and BOM (M0) as needed.
On the Layout, check all text and objects for readability
Update Title Block

**5.2.5 Design Review I**

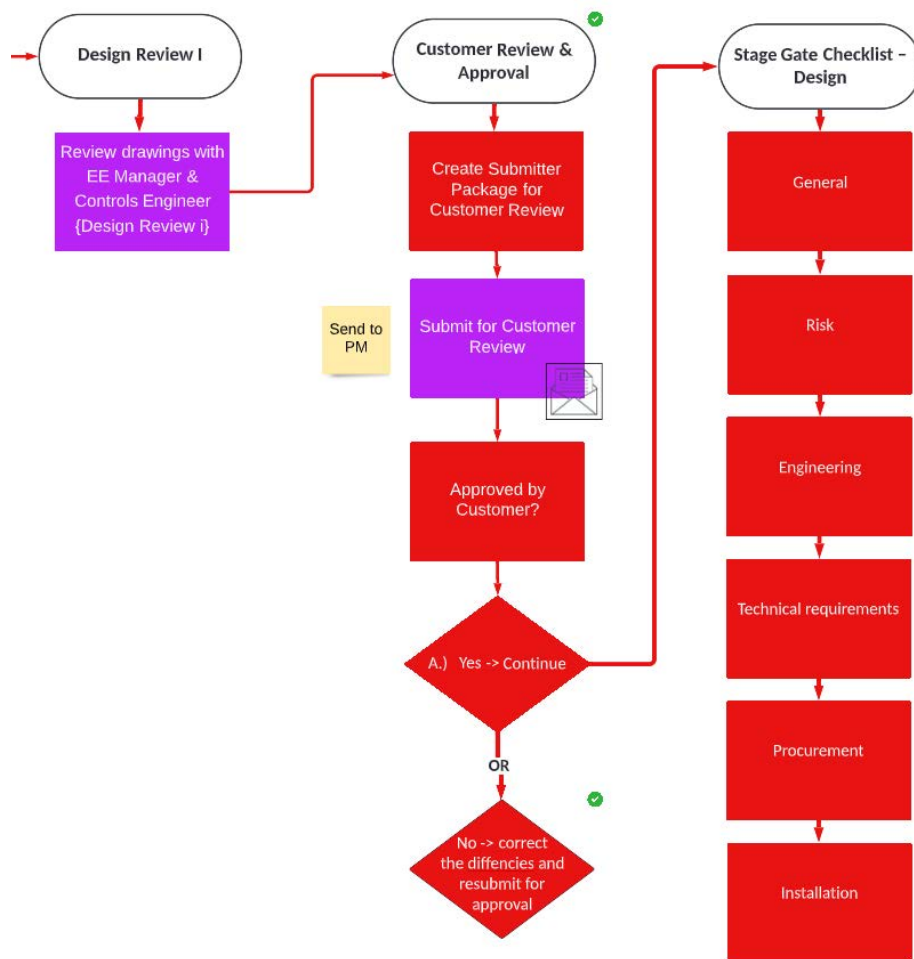
1. Review drawings with EE Manager & Controls Engineer [Design Review I]

**5.2.6 Customer Review & Approval**

1. Create Submittal Package for Customer Review
2. Submit for customer review
3. Approved by Customer?
  - a. Yes -> Continue
  - b. No -> Correct issues ->Resubmit

**5.2.7 Stage Gate Checklist for Design**

1. Genral
2. Risk
3. Engineering
4. Technical Requirements
5. Procurement
6. Installation





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### 5.3 DEVELOPMENT STAGE

Post Customer Approval

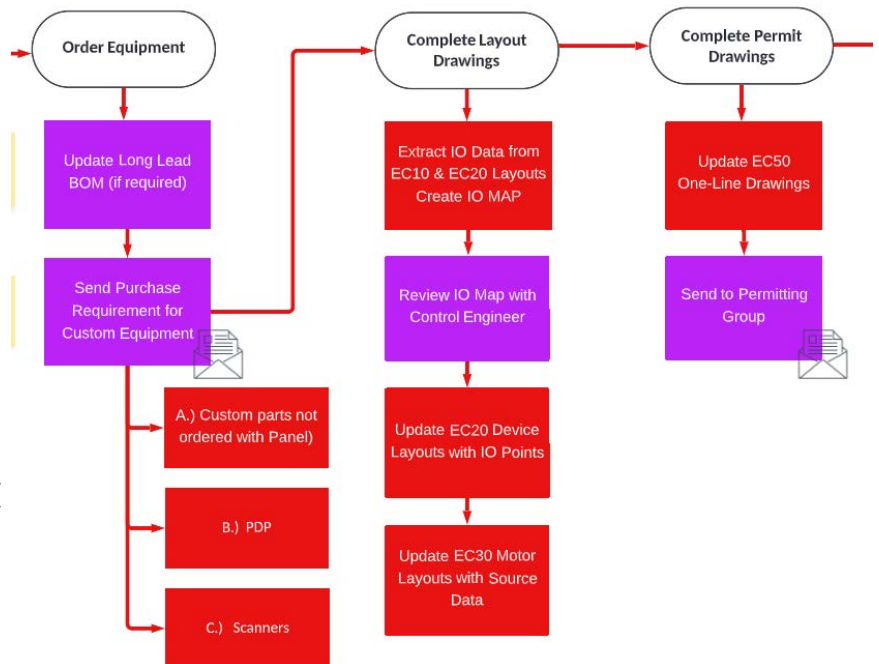


#### 5.3.1 Order Equipment

1. Update Long Lead BOM (if required)
2. Send Purchase Req for Custom Equipment
  - a. Custom parts (not ordered with Panel)
  - b. PDP
  - c. Scanners

#### 5.3.2 Complete Layout Drawings

1. Extract IO Data from EC10 & EC20 Layouts & Creates IO Map
2. Review IO Map with Controls Engineer [ Design Review II]
3. Update EC20 Device Layouts with IO Points
4. Update EC30 Motor Layouts with Source Data



#### 5.3.3 Complete Permit Drawings

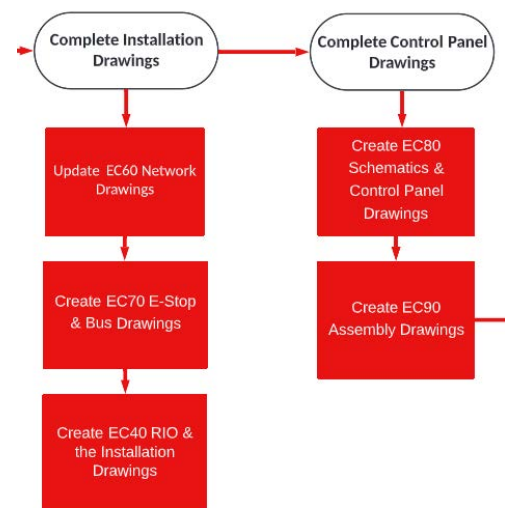
1. Update EC50 One-Line Drawings
2. Send to Permitting Group

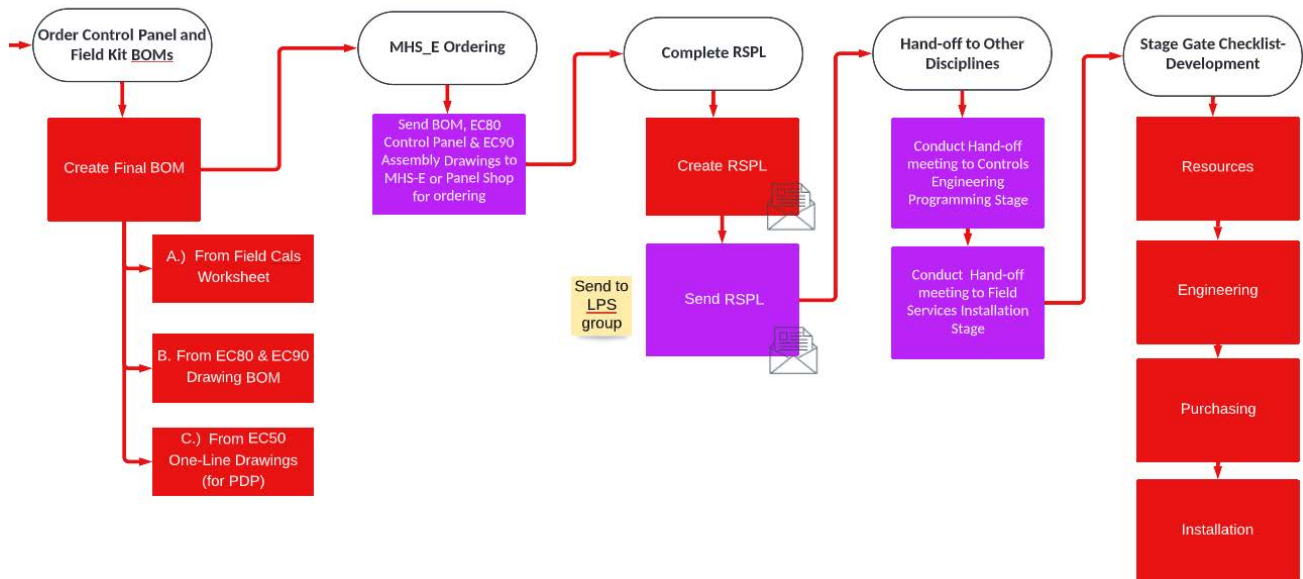
#### 5.3.4 Complete Installation Drawings

1. Update EC60 Network Drawings
2. Create EC70 E-Stop & Bus Drawings
3. Create EC40 RIO Drawings & Installation Drawings

#### 5.3.5 Complete Control Panel Drawings

1. Create EC80 Schematics & Control Panel Drawings
2. Create EC90 Assembly Drawings





### 5.3.6 Order Control Panel and Field Kit BOMs

1. Create Final BOM
  - a. From Field Calcs Worksheet
  - b. From EC80 & EC90 Drawing BOMs
  - c. From EC50

### 5.3.7 MHS\_E Ordering

1. Send BOM, EC80 Control Panel & EC90 Assembly Drawings to MHS-E or Panel Shop for ordering

### 5.3.8 Complete RSPL

1. Create & Send RSPL

### 5.3.9 Handoff to Other Disciplines

1. Conduct Handoff meeting to Controls Engineering Programming Stage
2. Conduct Handoff meeting to Field Services Installation Stage

### 5.3.10 Stage Gate Checklist for Development

1. Resources
2. Engineering
3. Purchasing
4. Installation

## 5.4 TEST AND INSTALLATION STAGE



### 5.4.1 Support Procurement

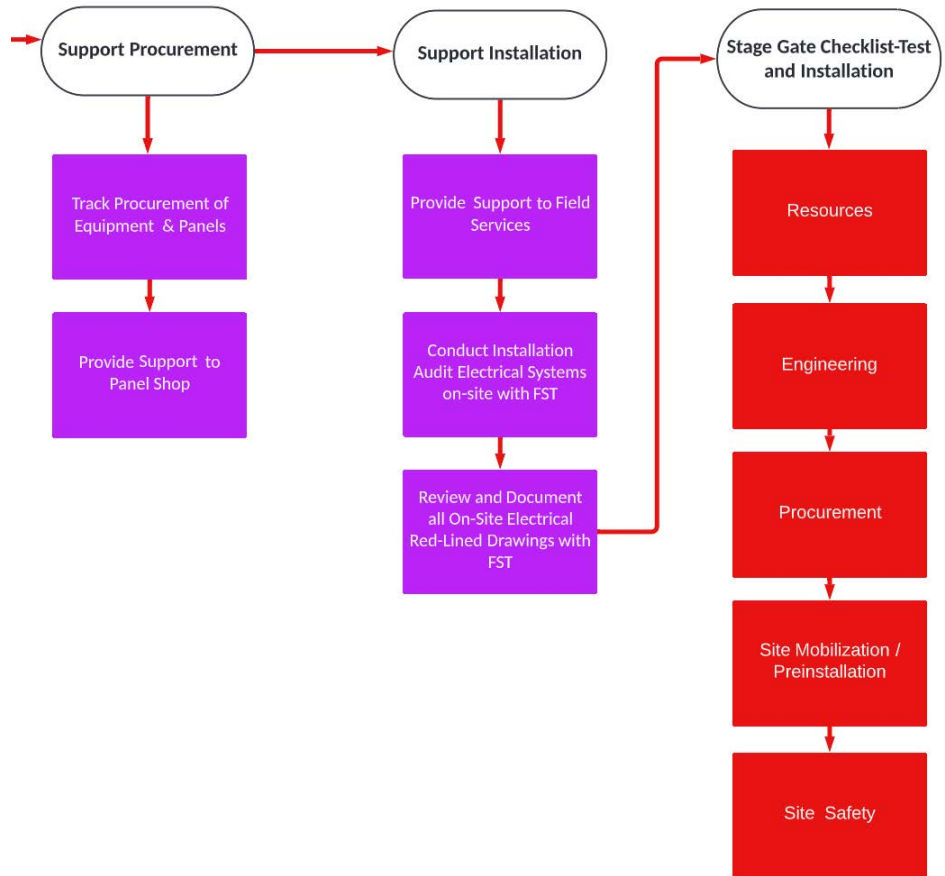
1. Track Procurement of Equipment & Panels
2. Provide Support to Panel Shop

### 5.4.2 Support Installation

1. Provide Support to Field Services
2. Conduct Installation Audit Electrical Systems on with FST
3. Review and Document all On-Site Electrical Red-Lined Drawings with FST

### 5.4.3 Stage Gate Checklist-Test and Installation

1. Resources
2. Engineering
3. Procurement
4. Site Mobilization / Preinstallation
5. Site Safety





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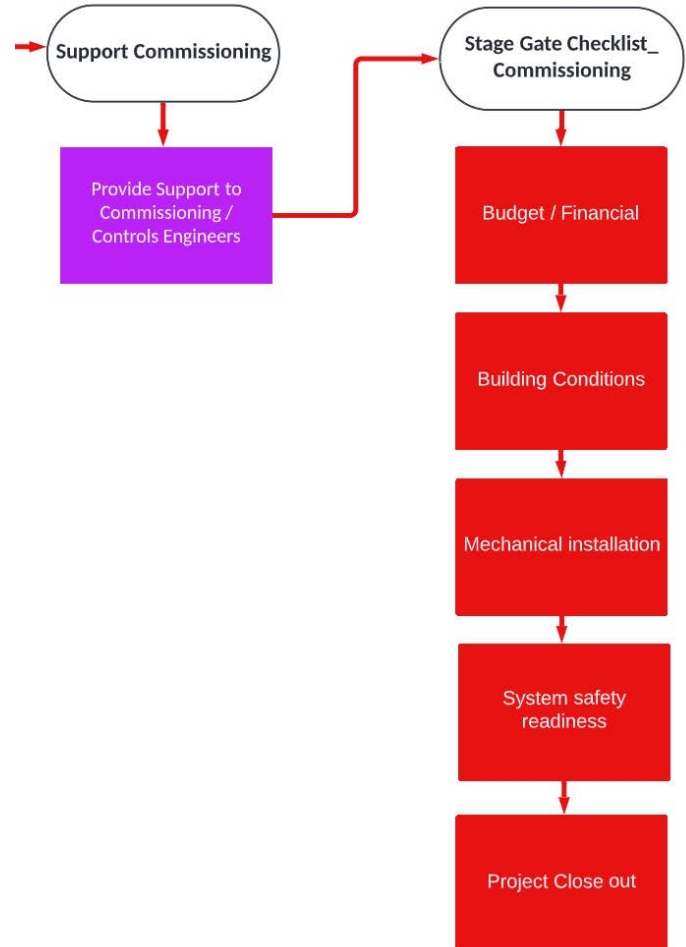
## 5.5 COMMISSIONING STAGE

### 5.5.1 Support Commissioning

1. Provide Support to Commissioning /Controls Engineers

### 5.5.2 Stage Gate Checklist \_Commissioning

1. Budget and Financial
2. Building Conditions
3. Mechanical Installation
4. System Safety Readiness
5. Project Close Out





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## 5.6 CLOSE OUT STAGE

### 5.6.1 AS-Built Documentation

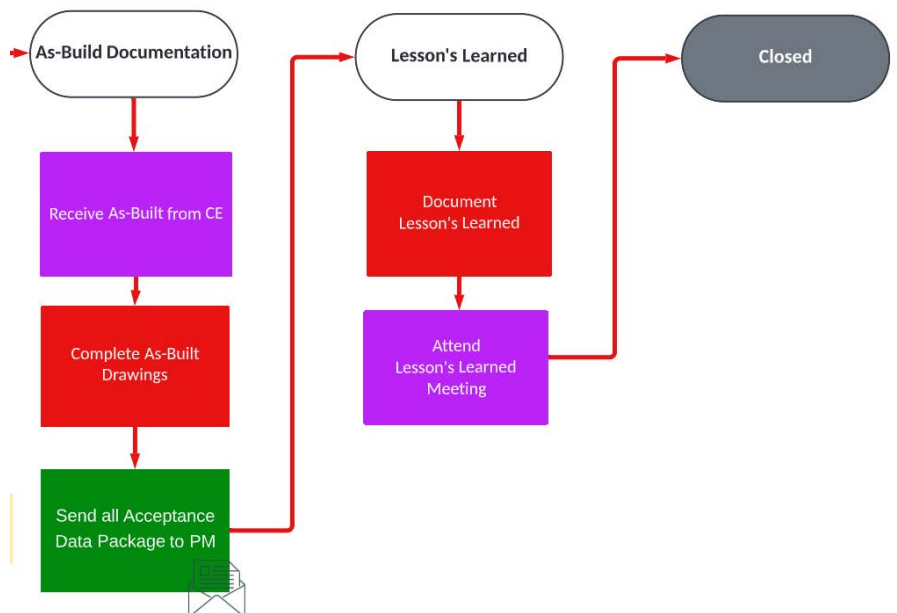
1. Recieve As-Builts from CE
2. Complete As-Built Drawings
3. Send all Acceptance Data Package to Project Mangement.



### 5.6.2 Lesson's Learned

1. Document Lesson's Learned
2. Attend Lesson's Learned Meeting

### 5.6.1 Closed





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## 6 Resource Documents

[List below the reference document to be consider with this Process Document]

[A.21.2778\\_IOMAP\\_2021-1001v3](#)

[A.YY.XXXX\\_LVL1\\_IOMAP](#)

[A.YY.XXXX-NAME\\_Panels-Design\\_2022-0309](#)

[A.YY.XXXX-NAME\\_PDP-HV1\\_2022-0217](#)

[A.YY.XXXX-NAME\\_PDP-LV1\\_2021-0311](#)

[A.YY.XXXX-NAME\\_RSPL\\_2021-0311](#)

[A.YY.XXXX-PROJ Kickoff EC 21.1004](#)

[ELEC VENDOR LIST v3](#)



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