هيئة كفاءة الإنفاق والمشروعات الحكومية
Expenditure Efficiency & Projects Authority

EXPRO National Manual for Projects Management

Volume 6, chapter 7

Electrical Design Aids

Document No. EPM-KEE-GL-000003 Rev 003

Document Submittal History:

Revision:	Date:	Reason For Issue
000	22/10/2017	For Use
001	11/02/2018	For Use
002	10/01/2019	For Use
003	15/08/2021	For Use

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1.0 PURPOSE

The purpose of this section is to provide the Entity-A/E the templates, checklists, design guidelines, etc. (collectively called Design Aids) to comprehensively define the Electrical design of a Project and ensure that the design is complete, uses appropriate templates and has undergone the necessary checks to achieve the quality design which can be used to purchase fit for purpose material/ equipment and safely install all facilities under Entity's project.

Refer to Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the definition of terms used and the instructions on the use of every element of Design Aids. The Section 1 also covers non-discipline specific Design Aid such as Calculation Templates, Calculation check list, Design software list, etc. which apply to all engineering disciplines including Electrical. Users are urged to carefully read the instructions provided in Volume 6, Chapter 7, Section 1 to fully understand the purpose and use of all documents listed in this section.

The Entity-A/E shall review the list of documents in both sections (Section 1 and 6) of Volume 6, Chapter 7 to determine the templates, check lists, etc. applicable to their project. The list of applicable templates/ checklists/ etc. may vary from project to project depending upon the Design Scope of Work of every Project.

2.0 REFERENCE

1. EPM-KE0-GL-000016 : General Design Guidelines
2. EPM-KEE-GL-000001 : Electrical Design Guideline
3. EPM-KE0-GL-000007 : ELV System Integration Guidelines
4. EPM-KE0-GL-000008 : Fire and Life Safety Integration Guideline
5. EPM-KE0-GL-000009 : Building Management System (BMS) and Mechanical System integration Guideline

3.0 ELECTRICAL DESIGN AIDS

The Electrical Design Aids developed for use on Entity's projects are listed below, each issued as a standalone document.

3.1 Electrical Design Guideline

Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the purpose and the instructions on the use of discipline Design Guidelines issued for use in the design of Entity's Projects.

Refer to the document **EPM-KEE-GL-000001** for the details of Electrical Design Guideline.

3.2 Electrical Design Deliverables

Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the purpose and the instructions on the use of List of Design Deliverables issued for use in the design of Entity's projects.

Refer to the document EPM-KEE-RG-000001 for a typical list of design deliverables applicable for the Electrical design discipline.

3.3 Design Check Lists

Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the purpose and the instructions on the use of Checklists issued for the use in the design of Entity's projects.

The Table below lists Electrical Checklists issued for use on Entity's Projects.

List of Electrical - Checklist

SN	Title of the Documents	Document Number
1	Checklist - Lighting & Small Power Layout	EPM-KEE-TP-000001
2	Checklist - Single Line Diagram	EPM-KEE-TP-000002
3	Checklist - Building Conduit (Raceway) layout	EPM-KEE-TP-000003
4	Checklist - Cable Rack and Tray layout	EPM-KEE-TP-000004
5	Checklist - Earthing/Grounding Layout	EPM-KEE-TP-000005
6	Checklist - UG (Underground) Raceway layout	EPM-KEE-TP-000006
7	Checklist - Interface with SEC	EPM-KEE-TP-000024
8	Checklist - Lightning Protection System Layout	EPM-KEE-TP-000007

3.4 Templates

Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the purpose and the instructions on the use of Templates issued for the use in the design of Entity's projects.

Table below lists Electrical templates issued for use on Entity's Projects

List of Electrical - Templates

SN	Title of the Documents	Document Number
1	Template - Data Sheet - UPS System	EPM-KEE-TP-000013
2	Template - Data Sheet - Liquid Immersed Distribution Transformer	EPM-KEE-TP-000014
3	Template - Data Sheet - Capacitor Bank	EPM-KEE-TP-000015
4	Template - Data Sheet - Electrical Requirements for Packaged Equipment	EPM-KEE-TP-000016
5	Template - Data Sheet - Prefabricated Substation Buildings	EPM-KEE-TP-000017
6	Template - Data Sheet - DC System	EPM-KEE-TP-000018
7	Template - Electrical Design Criteria	EPM-KEE-TP-000019
8	Template - Electrical Equipment List	EPM-KEE-TP-000020
9	Template - Data Sheet - Dry Type Distribution Transformer	EPM-KEE-TP-000021
10	Template - Data Sheet - Motor	EPM-KEE-TP-000023

3.5 Typical Construction Detail Drawings (TCDDs)

Volume 6, Chapter 7, Section 1 - General Design Guidelines (Document No EPM-KE0-GL-000016) for the purpose of issue of TCDD in the design of Entity's projects.

Table below lists examples of Electrical TCDD's issued as sample for use by Entity.

SN	Title of Drawing	Discipline	Document Number
1	Single Line Diagram for Street Lighting	**Electrica**l	EPM-KEE-05-000001
2	Cable Tray Mechanical Support Details	**Electrical**	EPM-KEE-05-000002
3	Street Light Pole Base Details	**Electrical**	EPM-KEE-05-000003
4	Cable Riser Section	**Electrical**	EPM-KEE-05-000004
5	Emergency Generator Grounding Details	**Electrical**	EPM-KEE-05-000005

4.0 ATTACHMENTS

1. EPM-KEE-TP-000001 - Checklist - Lighting and Small Power Layout
2. EPM-KEE-TP-000002 - Checklist - Single Line Diagram
3. EPM-KEE-TP-000003 - Checklist - Conduit (Raceway) Layout
4. EPM-KEE-TP-000004 - Checklist - Cable Rack/Tray Layout
5. EPM-KEE-TP-000005 - Checklist - Earthing/Grounding Layout
6. EPM-KEE-TP-000006 - Checklist - Underground (UG) Raceway Layout
7. EPM-KEE-TP-000007 - Checklist - Lightning Protection System Layout
8. EPM-KEE-TP-000013 - Template - Data Sheet - UPS System
9. EPM-KEE-TP-000014 - Template - Data Sheet- Liquid Immersed Distribution Transformer
10. EPM-KEE-TP-000015 - Template - Data Sheet - Capacitor Bank
11. EPM-KEE-TP-000016 - Template - Data Sheet - Electrical Requirements for Packaged Equipment
12. EPM-KEE-TP-000017 - Template - Data Sheet - Prefabricated Substation Buildings
13. EPM-KEE-TP-000018 - Template - Data Sheet - DC System
14. EPM-KEE-TP-000019 - Template - Electrical Design Criteria
15. EPM-KEE-TP-000020 - Template - Electrical Equipment List
16. EPM-KEE-TP-000021 - Template - Data Sheet - Dry Type Distribution Transformer
17. EPM-KEE-TP-000023 - Template - Data Sheet - Motor
18. EPM-KEE-TP-000024 - Checklist - Interface with Saudi Electricity Company (SEC)
19. EPM-KEE-RG-000001 - List of Electrical Design Deliverables
20. EPM-KEE-05-000001 - Single Line Diagram for Street Lighting
21. EPM-KEE-05-000002 - Cable Tray Mechanical Support Details
22. EPM-KEE-05-000003 - Street Light Pole Base Details
23. EPM-KEE-05-000004 - Cable Riser Section
24. EPM-KEE-05-000005 - Emergency Generator Grounding Details

Attachment 1 - EPM-KEE-TP-000001 - Checklist - Lighting and Small Power Layout

PROJECT NAME:	CALCULATION NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
	Does the drawing comply with the project CAD Standards (All lines, symbols, legends, abbreviations, text, etc. are legible)?	☐	☐	☐	☐	☐	☐
1	Does the Drawing reviewed for constructability?	☐	☐	☐	☐	☐	☐
2	Does the layout read and interpreted in conjunction with the applicable Architectural, Civil, Electrical (both LV System & ELV System) and Mechanical Layout?	☐	☐	☐	☐	☐	☐
3	Are the fields in the title block consistent with the project drawing log/ index?	☐	☐	☐	☐	☐	☐
4	Key plan and North arrow are provided & the key plan shall have the layout area hatched.	☐	☐	☐	☐	☐	☐
5	Match lines or X-Y Grid are clearly defined.	☐	☐	☐	☐	☐	☐
6	Drawing notes are complete & agree with information on the drawings & details.	☐	☐	☐	☐	☐	☐
7	Are the layout dimensions (fixture spacing, mounting height, operating height for panels etc.) clearly defined?	☐	☐	☐	☐	☐	☐
8	Are the layout legends specific or provide the details regarding the type, rating and mounting height of the switches and receptacles or power outlets?	☐	☐	☐	☐	☐	☐
9	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
10	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Delta & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
11	Are the layout clearly defined the limits of existing and new work including future expansions, interface points, Battery limits.	☐	☐	☐	☐	☐	☐
12	Have the conduit continuations between the drawings verified and properly identified?	☐	☐	☐	☐	☐	☐
Codes/Standards/Project Requirements							
13	Does the system design comply with the applicable Code, International and Saudi standard, local Government Regulation, and Project Specification	☐	☐	☐	☐	☐	☐
14	Have the mounting/installation of the light fixtures and power outlets as per the project specification?	☐	☐	☐	☐	☐	☐
15	Is the circuit Identification and tagging as per the load schedules and project requirements?	☐	☐	☐	☐	☐	☐
16	The designing of the Lighting / Small Power System shall comply with the project design criteria.	☐	☐	☐	☐	☐	☐
Reference Information							
17	Check to ensure general notes include reference to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
18	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
19	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
20	Does the layout confirm the availability of the standard installation and mounting details of Light Fixtures and Power outlets as required by the specialist?	☐	☐	☐	☐	☐	☐
21	Are the circuit number on the light Fixtures and Receptacles verified against the Panel Schedules?	☐	☐	☐	☐	☐	☐

Attachment 2 - EPM-KEE-TP-000002 - Checklist - Single Line Diagram

PROJECT NAME:	SINGLE LINE DIAGRAM NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
1	All lines, symbols, legends, abbreviations and text are legible and in compliance with Project CAD procedures.	☐	☐	☐	☐	☐	☐
2	Fields in the drawing title block are consistent with the project Procedure.	☐	☐	☐	☐	☐	☐
3	Drawing notes are complete & agree with information on the drawings & details.	☐	☐	☐	☐	☐	☐
4	Holds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
5	Match lines verified with matching drawings and found correct with respect to circuit continuity and drawing numbers.	☐	☐	☐	☐	☐	☐
Codes/Standards/Project Requirements							
6	The system design and the selection of the equipments shall comply with the applicable Code, International and Saudi standard, local Government Regulation and Project Specification	☐	☐	☐	☐	☐	☐
7	Verify the equipment tag/identification numbers, dimensions, locations, etc. with project standards/vendor documents.	☐	☐	☐	☐	☐	☐
8	Feeder rating and cable sizes for loads as per Project specifications, Design criteria, Manufacturer's catalogues and applicable codes and standards.	☐	☐	☐	☐	☐	☐
9	All protections and metering arrangement have been shown as per project specifications/design criteria.	☐	☐	☐	☐	☐	☐
10	Breaker rating, Contactor rating, starter rating & fuse rating in accordance with Project Specifications/design criteria.	☐	☐	☐	☐	☐	☐
Reference Information							
11	Check to ensure general notes include reference to applicable Codes, Standards and Project specifications/supplier submittals.	☐	☐	☐	☐	☐	☐
12	Do SLD specifies the type of enclosure and switchgear assemblies?	☐	☐	☐	☐	☐	☐
13	Do the SLD specify the requirement regarding ARC Ventilation System?	☐	☐	☐	☐	☐	☐
14	Are the layout provided with the detail of the components (Main Bus, Ground bus, Instrument transformers (CT's & PT's), Metering's, relays, surge protection devices, etc.)?	☐	☐	☐	☐	☐	☐
15	Check for correctness and completeness of applicable documents, reference drawings and legend list.	☐	☐	☐	☐	☐	☐
16	List and verify any special/specific requirements by others (Sub-Contractors, Vendors, etc.).	☐	☐	☐	☐	☐	☐
Design							
17	Have the feeders (incoming, outgoing, bus coupling or Tie Breaker, etc.) verified per load list/equipment list report? Verify all loads are shown on drawings.	☐	☐	☐	☐	☐	☐
18	Does Single Line Diagram (SLD) provide the details of the contract and or ownership boundaries.	☐	☐	☐	☐	☐	☐
19	Are the Feeder sizes and cable sizes verified for proper voltage drop/ continuous & short circuit current rating (kA) per Project Specifications/ design criteria/Manufacturer's catalogues? Check against project cable sizing calculations.	☐	☐	☐	☐	☐	☐
20	Are the feeder sizes verified for the loads indicated per Equipment list, Project Specifications and applicable codes and standards?	☐	☐	☐	☐	☐	☐
21	Have the electrical equipment numbers verified against component numbering system applicable for the project?	☐	☐	☐	☐	☐	☐
22	Are bus designations, bus voltage, ampere ratings, short circuit ratings and configuration (3ph. 3 wire or 4 wire, etc.) identified & verified for all buses / bus sections?	☐	☐	☐	☐	☐	☐

Attachment 3 - EPM-KEE-TP-000003 - Checklist - Conduit (Raceway) Layout

PROJECT NAME:		CALCULATION NO.			REV.		
No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
A.	**Drawing Presentation**						
1	Does the drawing comply with the project CAD Standards (All lines, symbols, legends, abbreviations, text, etc. are legible)?	☐	☐	☐	☐	☐	☐
2	Is the Drawing reviewed for constructability?	☐	☐	☐	☐	☐	☐
3	Does the layout read and interpreted in conjunction with the applicable Architectural, Civil, Electrical (both LV System & ELV System) and Mechanical Layout?	☐	☐	☐	☐	☐	☐
4	Fields in the title block are consistent with the project drawing log/index.	☐	☐	☐	☐	☐	☐
5	Key plan and North arrow are provided & the key plan shall have the layout area hatched.	☐	☐	☐	☐	☐	☐
6	Match lines or X-Y Grid are clearly defined.	☐	☐	☐	☐	☐	☐
7	Drawing notes are complete & agree with information on the drawings & details.	☐	☐	☐	☐	☐	☐
8	Are the layout dimensions (conduit Type, size, number, etc.) clearly defined?	☐	☐	☐	☐	☐	☐
9	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
10	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Clouds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
11	Limits of existing and new work including future expansions, interface points, Battery limits are clearly defined.	☐	☐	☐	☐	☐	☐
12	Check if conduit continuations between drawings have been verified and properly identified. (Not Applicable for power projects).	☐	☐	☐	☐	☐	☐
B.	**Code/Standard/ Project Specification**						
13	Does the system design comply with the applicable Code, International and Saudi standard, local Government Regulation and Project Specification	☐	☐	☐	☐	☐	☐
14	Are the conduit Installations in hazardous areas in accordance with the applicable codes and standards?	☐	☐	☐	☐	☐	☐
15	Is the circuit Identification and tagging as per the load schedules and project requirements?	☐	☐	☐	☐	☐	☐
C.	**Reference Information**						
16	Check to ensure general notes include reference to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
17	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
18	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
19	Check and verify any special requirements by other (vendors and sub-contractor).	☐	☐	☐	☐	☐	☐
D.	**Design**						
20	Does the conduit or raceway material suitable for the environment?	☐	☐	☐	☐	☐	☐
21	Are the radius of the bends for large conduits designed with consideration for the cable type / vendor data for minimum bending radius and side-wall pressure / Applicable codes and standards?	☐	☐	☐	☐	☐	☐
22	Are the filling ratio or space factors considered as per codes and standards?	☐	☐	☐	☐	☐	☐
23	Are the layout providing the detail regarding the pull boxes and Junction boxes requirement per the code and standard?	☐	☐	☐	☐	☐	☐

Attachment 4 - EPM-KEE-TP-000004 - Checklist - Cable Rack/Tray Layout

PROJECT NAME:	CALCULATION NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
1	Does the drawing comply with the project CAD Standards (All lines, symbols, legends, abbreviations, text, etc. are legible)?	☐	☐	☐	☐	☐	☐
2	Fields in the title block are consistent with the project drawing log/index.	☐	☐	☐	☐	☐	☐
3	Does the layout read and interpreted in conjunction with the applicable Architectural, Civil, Electrical (both LV System & ELV System) and Mechanical Layout?	☐	☐	☐	☐	☐	☐
4	Key plan and North arrow are provided & the key plan shall have the layout area hatched.	☐	☐	☐	☐	☐	☐
5	Match lines are clearly defined.	☐	☐	☐	☐	☐	☐
6	Drawing notes are complete & agree with information on the drawings & details.	☐	☐	☐	☐	☐	☐
7	Have the layout dimensions (Equipment spacing, tray elevations, raceway/conduit diameter, no. of raceways, etc.) at intermittent locations clearly defined.	☐	☐	☐	☐	☐	☐
8	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
9	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Holds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
10	Text to be written clear and without interference with tray positions.	☐	☐	☐	☐	☐	☐
11	Sectional details have been called out by alphabet designations.	☐	☐	☐	☐	☐	☐
12	Tray tag numbers have been provided on the layout.	☐	☐	☐	☐	☐	☐
13	Have the Cable Rack / cable Tray continuations between drawings verified and properly identified?	☐	☐	☐	☐	☐	☐
14	Limits of existing and new work including future expansions, interface points, Battery limits are clearly defined.	☐	☐	☐	☐	☐	☐
Codes/Standards/Project Requirements							
15	Does the system design comply with the applicable Code, International and Saudi standard, local Government Regulation and Project Specification	☐	☐	☐	☐	☐	☐
16	Check that Separation between raceways of different service levels has been maintained as per design criteria.	☐	☐	☐	☐	☐	☐
17	Cable trays are supported in accordance with manufacturer's technical data.	☐	☐	☐	☐	☐	☐
18	Tray/rack sizes and material of construction meet project design criteria.	☐	☐	☐	☐	☐	☐
19	The numbering/tagging of trays should as per project procedures and match with information on related documents like cable schedule.	☐	☐	☐	☐	☐	☐
20	Cable tray fill ratio is in compliance with applicable codes and standards.	☐	☐	☐	☐	☐	☐
Reference Information							
21	Check to ensure general notes include reference to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
22	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
23	List and verify any special requirements by others (Sub-Contractors, Vendors, etc.).	☐	☐	☐	☐	☐	☐
24	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
25	Refer standard installation details for cable trays, supports, etc.	☐	☐	☐	☐	☐	☐
Design							

Attachment 5 - EPM-KEE-TP-000005 - Checklist - Earthing/Grounding Layout

PROJECT NAME:		DRAWING NO.			REV.		
No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
1	All lines, symbols, legends, abbreviations and text are legible and in compliance with Project CAD procedures.	☐	☐	☐	☐	☐	☐
2	Fields in the title block are consistent with the project drawing log/index.	☐	☐	☐	☐	☐	☐
3	Key plan and North arrow are provided. The key plan shall have the earthing/grounding layout area hatched.	☐	☐	☐	☐	☐	☐
4	All match lines or X-Y Grids are clearly defined.	☐	☐	☐	☐	☐	☐
5	Drawing notes are complete & agree with information on the drawings & details.	☐	☐	☐	☐	☐	☐
6	Grounding/Earthing Coordinates and Layout dimensions (Electrode spacing, grid spacing, earthing/grounding bar details, etc.) are clearly defined.	☐	☐	☐	☐	☐	☐
7	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
8	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Holds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
9	Are the layout provide the installation details (Earth Pit, Test Link, Air terminals, Busbar Connections, etc.)?	☐	☐	☐	☐	☐	☐
10	Limits of existing and new work including future expansions, interface points, Battery limits are clearly defined.	☐	☐	☐	☐	☐	☐
11	Review to see if opportunities exist to tie into switchyard ground grids or ground grids of adjacent Owner facilities to optimize site ground grid.	☐	☐	☐	☐	☐	☐
12	Bill of Materials is correctly presented on the drawing.	☐	☐	☐	☐	☐	☐
Codes and Standards							
13	All grounding installations shown are in compliance with the design criteria.	☐	☐	☐	☐	☐	☐
14	Verify equipment tag/identification numbers, dimensions, locations, etc. with project standards/vendor documents, as applicable.	☐	☐	☐	☐	☐	☐
15	Where equipment-earthing conductor is located inside power cable (along with power conductors), the cable shall meet the requirement of applicable codes/standards and project specifications.	☐	☐	☐	☐	☐	☐
16	Make sure that each type of connection/installation is represented either by standard details applicable for the project or details are drawn on the layout drawing.	☐	☐	☐	☐	☐	☐
Reference Information							
17	Check to ensure general notes include reference to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
18	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
19	List and verify any special requirements by others (Sub-Contractors, Vendors, etc.)	☐	☐	☐	☐	☐	☐
20	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
21	Verify cross-references with other layout drawings like Power layouts, communication drawings, lighting drawings, etc.	☐	☐	☐	☐	☐	☐
22	Where lightning protection system connections are to be made to the grounding system, proper and correct reference has been made between drawings?	☐	☐	☐	☐	☐	☐
Design							

Attachment 6 - EPM-KEE-TP-000006 - Checklist - Underground (UG) Raceway Layout

PROJECT NAME:		CALCULATION NO.			REV.		
No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
	Does the drawing comply with the project CAD Standards (All lines, symbols, legends, abbreviations, text, etc. are legible)?	☐	☐	☐	☐	☐	☐
2	Does the legend provide the installation detail regarding the cable rout marker, warning tape, etc.?	☐	☐	☐	☐	☐	☐
3	Fields in the title block are consistent with the project drawing log/index.	☐	☐	☐	☐	☐	☐
4	Key plan and North arrow are provided & the key plan shall have the layout area hatched.	☐	☐	☐	☐	☐	☐
5	Match lines are clearly defined.	☐	☐	☐	☐	☐	☐
6	Drawing notes are complete & agree with information on the drawings and details.	☐	☐	☐	☐	☐	☐
7	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
8	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Holds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
9	Limits of existing and new work including future expansions, interface points, Battery limits are clearly defined.	☐	☐	☐	☐	☐	☐
Codes/ Standards/Project Requirements							
10	Does the system design comply with the applicable Code, International and Saudi standard, local Government Regulation and Project Specification	☐	☐	☐	☐	☐	☐
11	Depth of the duct banks are in accordance with the applicable codes and standards/design criteria/project requirements.	☐	☐	☐	☐	☐	☐
12	Manholes are designed and sized in accordance with the applicable codes and standards.	☐	☐	☐	☐	☐	☐
13	Direct burial installation is in accordance with the applicable codes and standards.	☐	☐	☐	☐	☐	☐
Reference Information							
14	Check to ensure general notes include reference to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
15	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
16	List and verify any special requirements by others (Sub-Contractors, Vendors, etc.)	☐	☐	☐	☐	☐	☐
17	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
18	Conduit stub-up locations are shown with the proper installation detail referenced.	☐	☐	☐	☐	☐	☐
Design							
19	Does the layout provide the details of the conduit/raceway type, size and the route	☐	☐	☐	☐	☐	☐
20	Does the layout illustrate the underground heat loss and pulling calculation?	☐	☐	☐	☐	☐	☐
21	Have the manhole locations coordinated with plant coordinate showing the center line of the manhole?	☐	☐	☐	☐	☐	☐
22	Are the manholes located outside hazardous areas and a note has been added to the drawing indicating that the manhole shall be back-filled with clean sand prior to commissioning?	☐	☐	☐	☐	☐	☐
23	Does the manhole designed for pulling the cables by ensuring the pulling irons and sufficient hardware to support the cable?	☐	☐	☐	☐	☐	☐
24	Are the manholes sized to accommodate the cable racking around sides of the manhole, splicing and cable bend radii?	☐	☐	☐	☐	☐	☐
25	Does the layout indicate the ladders inside the manhole, where required?	☐	☐	☐	☐	☐	☐

Attachment 7 - EPM-KEE-TP-000007 - Checklist - Lightning Protection System Layout

PROJECT NAME:		CALCULATION NO.			REV.		
No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
Drawing Presentation							
1	All lines, symbols, legends, abbreviations and text are legible and in compliance with Project CAD procedures.	☐	☐	☐	☐	☐	☐
2	Fields in the title block are consistent with the project drawing log/index	☐	☐	☐	☐	☐	☐
3	Key plan and North arrow are provided.	☐	☐	☐	☐	☐	☐
4	All match lines are clearly defined.	☐	☐	☐	☐	☐	☐
5	Drawing notes are complete & agree with information on the drawings and details.	☐	☐	☐	☐	☐	☐
6	Coordinates and Layout dimensions (Electrode spacing, grid spacing, Earthing/Grounding bar details, etc.) are clearly defined.	☐	☐	☐	☐	☐	☐
7	Bar scale is shown on the drawing & correct scale is used for all details, plan/elevation & sections. Details Not to Scale are also clearly marked.	☐	☐	☐	☐	☐	☐
8	All interdisciplinary comments & comments from previous revisions have been resolved and incorporated. Holds & revisions are correctly marked.	☐	☐	☐	☐	☐	☐
9	Bill of Materials is correctly presented on the drawing.	☐	☐	☐	☐	☐	☐
Codes & Standards							
10	The system design shall comply with the applicable Code, International and Saudi standard, local Government Regulation and Project Specification.	☐	☐	☐	☐	☐	☐
11	Are the layouts prepared and compliance with the appropriate codes or standard? (BS 6651, NFPA 780, LP 175, 176 & 177).	☐	☐	☐	☐	☐	☐
12	Lightning Protection installations are in compliance with the design criteria.	☐	☐	☐	☐	☐	☐
13	Verify the equipment and components tag/identification numbers, dimensions, locations, etc. with project standards/vendor documents, as applicable	☐	☐	☐	☐	☐	☐
14	Make sure that each type of connection/installation is represented either by standard details applicable for the project or details are drawn on the layout drawing.	☐	☐	☐	☐	☐	☐
Reference Information							
15	Have the technical feasibility of Lightning Protection System verified?	☐	☐	☐	☐	☐	☐
16	Check to ensure general notes include references to applicable Codes, Standards and Project Specifications/Supplier submittals.	☐	☐	☐	☐	☐	☐
17	Check for correctness of reference drawings.	☐	☐	☐	☐	☐	☐
18	List and verify any special requirements by others (Sub-Contractors, Vendors, etc.).	☐	☐	☐	☐	☐	☐
19	Does the layout provide the detail of the route (both the horizontal and vertical)?	☐	☐	☐	☐	☐	☐
20	Sections and details are correctly cross-referenced.	☐	☐	☐	☐	☐	☐
Design							
21	Has the technical feasibility of the components verified? (Note: The systems shall be coordinated with the specialist and the design complied to the latest technology).	☐	☐	☐	☐	☐	☐
22	Are the layouts coordinated with the structural (Zone of protection using Geometric model) and Architectural Layout?	☐	☐	☐	☐	☐	☐

Attachment 8 - EPM-KEE-TP-000013 - Template - Data Sheet - UPS System

Line No.	DESCRIPTION	UNITS	SPECIFIED	Bidder's Proposal	REMARKS
1.0	**GENERAL**				
1.1	**SITE CONDITIONS**				
	Altitude	m			
	Seismic zone	Zone			
	Minimum ambient temperature	°C			
	Maximum ambient temperature	°C			
	Design ambient temperature	°C			
	Maximum/minimum relative humidity at normal ambient temperature	%			
	Location				
	Battery and Disconnection Switch	-			
	Rectifier, inverter, static transfer switch, transformer, manual maintenance bypass switch and panel board	-			
	Battery Room area classification-				
	Zone	-			
	Gas Group	-			
	Temperature Class	-			
1.2	**SYSTEM PARAMETER**				
	Supply system - volts, phase, wire, Hz, earthing	w/3p/Hz			
	System Symmetrical fault level	kA			
	Steady state voltage variation	%			
	Transient voltage variation magnitude/ time	%			
	Transient frequency Variation magnitude/Time	+/-% / s			
	Continuous/Maximum supply voltage total harmonic distortion	+/-% / s			
	External supply for anti-condensation heaters, cabinet lighting, etc.	% VTHD / s			
	Voltage	V ac			
	Tolerance	%			
	Number of phases	-	Single Phase		
	Label				As per NFPA 70 Art.100
1.3	**PERFORMANCE**				
	Output:				
	- Rating	kVA			
	- Voltage	V			
	- Frequency	Hz			
	Battery load profile				
	Load power factor	PF			
	Max. sound power level at 1 meter	dB			
	Overall efficiency	%			
1.4	**ENCLOSURE**				
	Type/ Access				
	Mounting				
	IP Rating				
	Air Condensation Heater				
1.5	**MISCELLANEOUS**				
	Cable Entry	-			
	Control Wiring Voltage Rating	Vdc			
	Paint Specification	-			
	Paint Shade (Enclosure)	-			
	Paint Shade (Battery Rack)	-			
	Label language + letter color/ background color	-			
	Mean Time Between Failures (MTBF) - Input section	Years			
	Mean Time Between Failures (MTBF) - Rectifier	Years			

Attachment 9 - EPM-KEE-TP-000014 - Template - Data Sheet- Liquid Immersed Distribution Transformer

Line No.	DESCRIPTION	UNITS	SPECIFIED	BIDDER'S PROPOSAL	SUPPLIER DATA
1.0	**SITE CONDITIONS**				
	Altitude	m			
	Seismic Design Criteria	-			
	S_{DS}	g			
	S_{D1}	g			
	Maximum Ambient Temperature	°C			
	Minimum Ambient Temperature	°C			
	Design Ambient Temperature	°C			
	Design Average Monthly Temperature	°C			
	Design Solar Radiation Temperature (black body)	°C			
	Average Annual Temperature	°C			
	Atmospheric conditions	-			
	Maximum/Average Design Relative Humidity	%			
	Area Classification:	-			
	Gas Group and Temperature Class	-			
	Type of Protection Required	-			
	Mounting Arrangement	-			
	Indoors or outdoors	-			
	Duty Type	-			
	Service Life	Years			
2.0	**DESIGN AND RATING**				
	No load Voltage ratio (principal tap)	kV			
	Phase(s)/ Frequency	/Hz			
	Rating	kVA			
	Vector Group	-			
	Cooling Type	-			
	Number of Windings per phase	-			
	Impedance Principal Tap / Rating / Tolerance	% / kVA / %			
	Winding Material				
	Primary Winding	-			
	Secondary Winding	-			
	Insulation class / Type				
	Winding Insulation Materials				
	Insulation Between HV and LV Windings				
	Continuous Parallel Operation with identical Unit				
	Steady State Voltage Tolerance	%			
	Steady State Frequency Tolerance	%			
	Transient Voltage Tolerance	%			
	Transient Frequency Tolerance	%			
	Maximum Supply Harmonic Distortion	%THD			
	Primary System Fault Level	kA			
	Primary System Neutral Earthing	-			
	Secondary System Fault Level	kA			
	Secondary System Neutral Earthing	-			
	Primary Full Wave Lightning Impulse	kVp			
	Primary Applied Voltage Withstand	kV rms			
	Secondary Full Wave Lightning Impulse	kVp			
	Secondary Applied Voltage Withstand	kV rms			
	Tap Changer Type	-			
	Tapping Type (for OLTC)	-			
	Tapping Range	-			
	Tap Changing Switch Type	-			
	Number of Taps	-			
	Location of Taps	-			
	Maximum Sound Pressure Level (SPL)	dB			

Attachment 10 - EPM-KEE-TP-000015 - Template - Data Sheet - Capacitor Bank

ENTITY		EQUIPMENT NO.:	
PROJECT TITLE:		P.O. NO.:	
PROJECT LOCATION:		UNIT:	

Line No.	DESCRIPTION	UNITS	SPECIFIED	BIDDER'S PROPOSAL
1.0	**SITE CONDITIONS**			
1.1	Altitude	m	PROVIDE REFERENCE IF AVAILABLE (do not produce data provided elsewhere)	
1.2	Maximum Ambient Temperature	°C		
1.3	Minimum Ambient Temperature	°C		
1.4	Design Ambient Temperature	°C		
1.5	Relative Humidity	%		
1.6	Wind	mph		
1.7	Seismic Zone	-		
1.8	Unclassified Area	-		
1.9	Hazardous Area Classification	-		
1.10	Zone			
1.12	Group(s)			
1.13	Gas Ignition Temperature	°C		
2.0	**SYSTEM PARAMETERS**			
2.1	Voltage	kV		
2.2	Phases	3		
2.3	Frequency	Hz		
2.4	Short Circuit Current	kA		
2.5	Short Circuit X/R			
2.6	Owners Supplied LV Auxiliary Power AC	V		
2.7	Owner Supplied LV Auxiliary Power DC	V		
2.8	Type of System Neutral Ground			
3.0	**CAPACITOR BANK**			
3.1	Total Reactive Power Rating Capacitance	kVAr		
3.2	Total Expansion Capability			
3.3	Type (Fixed, Automatic)			
3.4	Number of Stages			
3.5	kVAR per Stage	kVAr		
3.6	kVAR Fixed Stage	kVAr		
3.7	Number of Units per Phase per Stage			
3.8	No of Elements in Series/Parallel/per unit Capacitor	Hz		
3.9	Rated Power Frequency	Hz		
3.10	Rated Insulation Level	kV		
3.11	Power Frequency Withstand Voltage	kV rms		
3.12	Lightning Impulse Withstand Voltage (BIL)	kV peak		
3.13	Rated Continuous Current (Future/Rated)	Amps/Amps		
3.15	Rated Momentary Withstand Current	kA		
3.16	Three Phase Connection Type:	kVAr		
3.17	Ungrounded Wye or Grounded			
3.18	Ungrounded Double Wye or Delta			
3.19	Type (1 bush-1 ph, 2 bush-1 ph,3-bush-3-ph)			
3.20	Discharge volts/time after de-energized			
4.0	**MV POWER CABLE ACCOMMODATION**			
4.1	Power Cable Size	mm^2		
4.2	Power Cable Type (i.e. Armored/Shielded)			

Attachment 11 - EPM-KEE-TP-000016 - Template - Data Sheet - Electrical Requirements for Packaged Equipment

ENTITY		EQUIPMENT NO.:	
PROJECT TITLE:		P.O. NO.:	
PROJECT LOCATION:		UNIT:	

SERVICE / SITE CONDITIONS	UNITS	SPECIFIED	BIDDER'S PROPOSAL
Altitude	m		
Seismic Zone	-		
Design Maximum ambient temperature	°C		
Design Minimum ambient temperature	°C		
Area Classification:	-		
Zone	-		
Group	-		
Temperature rating			
Indoors or outdoors			
Enclosure Type			
Enclosure Material			
Grounding / Earthing Type			
DESIGN AND RATING			
Power Supply:			
Motors smaller than 0.5 kW	V/P/W		
Controller provided by (Buyer/Seller)			
Buyer cable directly to Controller/or Sellers Junction Box (JB)			
Motors 0.5 kW and larger	V/P/W		
Contactor provided by (Buyer/Seller)	-		
Buyer cable directly to Controller/or Sellers JB			
Individual Heater 1 kW and smaller	V/P/W		
Controllers provided by Buyer/Seller	-		
Buyer cable directly to Controller/or Sellers JB			
Individual Heaters greater than 1kW	V/P/W		
Controllers provided by Buyer/Seller	-		
Buyer cable directly to Controller/or Sellers JB			
Combined loads (not heaters/motors) 5 kW & less	V/P/W		
Controllers provided by Buyer/Seller	-		
Buyer cable directly to Controller/or Sellers JB			
Combined loads (not heaters/motors) that exceed 5 kW	V/P/W		
Controllers provided by Buyer/Seller	-		
Buyer cable directly to Controller/or Sellers JB			
Instrument loads	V		
System frequency	Hz		
Raceway type			
Oversized Motor Terminal Box required (Yes/No)			
Relay & Indicating Lights rating (Volts/Frequency)	V/Hz		
Motor Disconnect Required (Yes/No)			
Space Heaters:			
Rated operating voltage	V		
Actual operating voltage	V		

Attachment 12 - EPM-KEE-TP-000017 - Template - Data Sheet - Prefabricated Substation Buildings

ENTITY		EQUIPMENT NO.:	
PROJECT TITLE:		P.O. NO.:	
PROJECT LOCATION:		UNIT:	

Line No.	DESCRIPTION	UNITS	SPECIFIED	BIDDER'S PROPOSAL
1.0	**SITE CONDITIONS**			
1.1	Altitude	m		
1.2	Average Ambient Temperature	°C		
1.3	Minimum Ambient Temperature	°C		
1.4	Maximum Ambient Temperature	°C		
1.5	Extreme Maximum Ambient Temperature	°C		
1.6	Extreme Minimum Ambient Temperature	°C		
1.7	Gas Ignition Temperature	°C		
1.8	Hazardous / Non - Hazardous			
1.9	Seismic Zone			
1.10	Seismic Load			
1.11	Over Pressure Design per			
1.12	Sun-Metal Design Temperature	°C		
1.13	Electrical Equipment Design Ambient Temperature	°C		
1.14	Relative Humidity	%		
1.15	Wind Speed Design			
1.16	Importance Levels			
2.0	**CODES AND STANDARDS**			
2.1	Compliance to Codes and Standards			
2.2	Compliance to Project Specifications			
2.3	Compliance to Prefabricated Substation Specification			
3.0	**SERVICE CONDITIONS**			
3.1	Design Temperature for Electrical Equipment Outdoors	°C		
3.2	Design Lifecycle - Minimum	Years		
3.3	Vendor Supplied Equipment Installed Indoors			
3.4	Hazardous Area Zone, Gas Group and Temperature Class			
3.5	Hazardous Equipment Certification			
3.6	Design Operating Ambient Temperature	°C		
4.0	**GENERAL**			
4.1	Expandable Substation			
4.2	Building IP Rating			
4.3	All Openings Required to be Vermin Proof			
4.4	Working Clearances per			
4.5	Install Arc Flash Plenums (Exhaust Ducts)			
4.6	Lightning Protection			
5.0	**DESIGN LOADING - STRUCTURAL DESIGN CRITERIA**			
5.1	Compliance with Structural Design Criteria			
5.2	Maximum Building Shipping Height and Weight			
5.3	Wind Load			
5.4	Professional Engineers Stamp			
5.5	Roof Designed for Live Load Support	kPa		
5.6	Concentrated Load Anywhere on the Roof	kg		

Attachment 13 - EPM-KEE-TP-000018 - Template - Data Sheet - DC System

Line No.	DESCRIPTION	Units	Specified	Bidder's Proposal	REMARKS
1.0	**SITE CONDITIONS**				
	Altitude	m			
	Seismic Zone	Zone			
	Minimum Ambient Temperature	°C			
	Maximum Ambient Temperature	°C			
	Design Ambient Temperature	°C			
	Maximum/minimum Relative Humidity at Normal Ambient Temperature	%			
	Location				
	Battery and Disconnection Switch	-			
	Battery Charger, Transformer and Distribution Board	-			
	Battery Room Area Classification				
	Zone	-			
	Gas Group	-			
	Temperature Class	-			
2.0	**SYSTEM PARAMETERS**				
	Supply System - Volts, Phase, Wire, Hz, Earthing	VAC/3p/ Hz			
	System Symmetrical Fault Level/Duration	kA			
	Steady State Voltage Variation	%			
	Steady State Frequency Variation	%			
	Transient Voltage Variation Magnitude/ Time	+/- % / s			
	Transient frequency Variation Magnitude/ Time	+/- % / s			
	Continuous/Maximum Supply Voltage Total Harmonic Distortion	% VTHD/ s			
	External Supply for Anti-Condensation Heaters, Cabinet Lighting, etc.				
	Voltage	V ac			
	Tolerance	%			
	Number of Phases	-	1 Phase		
	Label				asper NFPA 70 Art.100
3.0	**PERFORMANCE**				
	Output:				
	- Rating	kVA			
	- Voltage	VDC			
	- Frequency	Hz			
	Permissible Voltage Variation at Distribution Board				
	Max. Sound Power Level at 1 meter	dB			
	Overall Efficiency	%			
4.0	**ENCLOSURE**				
	Type/ Access				
	Mounting				
	IP Rating				
	Air Condensation Heater				
	Access				
5.0	**MISCELLANEOUS**				
	Cable Entry	-			
	Control Wiring Voltage Rating	Vdc			
	Paint Specification	-			
	Paint Shade (Enclosure)	-			
	Paint Shade (Battery Rack)	-			
	Label Language + Letter Color/ Background Color	-			
	Mean Time Between Failures (MTBF) - Input Section	Years			
	Mean Time Between Failures (MTBF) - Rectifier	Years			
	Mean Time Between Failures (MTBF) - Fans	Years			

Attachment 14 - EPM-KEE-TP-000019 - Template - Electrical Design Criteria

EXPRO

Template - Electrical Design Criteria

1.0 SCOPE

Describe in brief the overall project scope and the scope for which this criterion is applicable.

Provide reference of supporting documents wherever required to validate specific information provided in the design criteria such as voltage levels, Load Details SC ratings, etc.

2.0 CODES, STANDARDS AND REGULATIONS

List all applicable local, National and International codes and standards, regulations and measurement units applicable and considered in the design of project. Provide precedence of codes/ standard, specifications, etc. and advise how discrepancies between codes/ standard/ specifications shall be addressed.

Describe if the design, equipment or materials are to be approved by the recognized international and national certifying authorities.

3.0 BASIC CONDITIONS

Describe in detail basis of the selection of electrical equipment and material (e.g. safety and reliability, maintainability, availability of spares and service, local source, compatibility with specified future expansion, design margins, suitability for environment economic considerations, and past service history).

4.0 EQUIPMENT AND MATERIAL SPECIFICATIONS

List specifications applicable to the project including package equipment, switchgears and installation and testing. Any aspect of the project technical requirement not covered by specification is to be included here. Define redundancy levels (equipped and unequipped outlets of switchboards) if not defined in specifications.

5.0 SERVICE CONDITIONS

1. State the ambient conditions here or provide reference to an applicable document; reference shall be made to conditions specific to the electrical design such as design temperature of equipment indoor and outdoor, altitude, humidity, soil temperature, thermal and electrical resistivity, environmental conditions such as salt laden atmosphere for coastal installation, and atmospheric pollution, etc.
2. State if Equipment and materials shall be suitable for operation at their nameplate ratings in the conditions stated above.
3. State the design life of equipment.
4. State if any particular equipment has to work in controlled conditions.
5. State any particular requirement for standardization of equipment/ materials (make, type, country of origin, etc.)
6. State minimum degree of enclosure protection for indoor and outdoor electrical equipment.

6.0 DOCUMENTS AND DATA

List the design documents to be produced for the project and briefly describe the content in general terms.

7.0 AREA CLASSIFICATION (IF APPLICABLE)

Define how hazardous area classification shall be done (define code and certifying authorities acceptable) and which parts of the sites are likely to be hazardous areas and types of equipment to be selected.

Also, describe if dust hazard is considered in the design and what consideration shall be given in the selection of electrical equipment to protect against dust hazard.

Attachment 15 - EPM-KEE-TP-000020 - Template - Electrical Equipment List

(Below list is Only an indicative, A/E to generate the specific Electrical Equipment List)

S. No.	Equipment Tag Number	Equipment Rating	Specification Reference No.	Description	Actual Quantity	Procurement Quantity	Remarks
1				Power Transformers			See below note - Typical
2				Package Substation			See below note - Typical
3				Emergency/Standby Generators			See below note - Typical
4				Neutral Grounding Resistor (NGR)			See below note - Typical
5				MV Switchgear			See below note - Typical
6				LV Switchgear/Switchboard			See below note - Typical
7				MV Protection Unit			See below note - Typical
8				ATS (Automatic Transfer Switch)			See below note - Typical
9				RMU (Ring Main Unit)			See below note - Typical
10				Synchronization Panels			See below note - Typical
11				Capacitor Bank or Power Factor Correction Panels			See below note - Typical
12				Uninterruptible Power Supply (UPS)			See below note - Typical
13				Battery and Battery Charger			See below note - Typical
14				Motor Control Centre (MCC's) Panel			See below note - Typical
15				Distribution Boards			See below note - Typical
16				Sub Distribution Board (SDB's)			See below note - Typical
17				Electrical Panels (Lighting and Power)			See below note - Typical
18				Central Battery System			See below note - Typical
19				Disconnection Switch			See below note - Typical
20				Lighting Control Panels			See below note - Typical
21				Harmonic Filter			See below note - Typical
22				EPMS System (Electrical Power Management System			See below note - Typical
23				Dimmer System			See below note - Typical

Notes:

1. Each Equipment's shall be identified with the unique Tag Numbers of the quantity, if more than one.
2. Ensure the equipment and panels are comply with the relevant Saudi Standard.
3. Electrical specification: Please refer Deviation-16.
4. Responsible A/E shall prepare the calculation as required to support to the selection and sizing of the electrical equipment and component for each facilities.

Attachment 16 - EPM-KEE-TP-000021 - Template - Data Sheet - Dry Type Distribution Transformers

ENTITY		EQUIPMENT NO.:	
PROJECT TITLE:		P.O. NO.:	
PROJECT LOCATION:		UNIT:	

Line No.	DESCRIPTION	UNITS	SPECIFIED	BIDDER'S PROPOSAL
1.0	**SERVICE CONDITIONS**			
1.1	Location			
1.2	Minimum Ambient Temperature	°C (°F)		
1.3	Maximum Ambient Temperature	°C (°F)		
1.4	Relative Humidity Range	%		
1.5	Design Ambient Temperature	°C (°F)		
1.6	Seismic Zone			
1.7	Altitude	M		
1.8	Climatic, Environmental & Fire Behavior Classes per IEC			
1.9	Mounting Arrangement			
1.10	CE Marking Requirement			
2.0	**ELECTRICAL SYSTEM**			
2.1	Rating	kVA		
2.2	No load Voltage Ratio (Principal Tap)	kV/kV		
2.3	Impedance Principal Tap	%		
2.4	Supply System (Phase, Wire, Hz)			
2.5	Supply Variations (Volts, Hz)	%		
2.6	Primary System Neutral Earthing	Yes/No		
2.7	Secondary System Neutral Earthing	Yes/No		
2.8	Through withstand Fault Capability	kA		
2.9	Rated Primary Current	A		
2.10	Rated Secondary Current	A		
2.11	Cooling Method (AN/AF)	-		
2.12	Vector Group	-		
2.13	Primary Lightning Impulse Voltage	kV		
2.14	Secondary Lightning Impulse Voltage	kV		
2.15	Winding Temperature Rise			
2.16	Rated Insulation Class			
2.17	Tapping Range			
2.18	Regulation at 0.8 Power Factor			
2.19	Efficiency at 50/75/100% of Load at 0.8 Power Factor			
3.0	**CONSTRUCTION**			
3.1	Tap Changing Switch Type	-		
3.2	Tapping Type	-		
3.3	Maximum Sound Pressure Level	dB		
3.4	Winding Material	Cu/Al		
3.5	Core Assembly Material			
3.6	Painting & Finish			
3.7	Transformer Configuration			
4.0	**ACCESSORIES & FITTINGS**			
4.1	Winding Temperature Indicator			
4.2	-Alarm/Trip Contact			
4.3	-4-20 mA Output			
4.4	Protection Current Transformers			
4.5	Metering Current Transformers			

Attachment 17 - EPM-KEE-TP-000023 - Template - Data Sheet - Motor

ENTITY		EQUIPMENT NO.:	
PROJECT TITLE:		P.O. NO.:	
PROJECT LOCATION:		UNIT:	

Line No.	Description	Units	Specified	Bidder's Proposal
1.0	**SERVICE CONDITIONS**			
1.1	Altitude	m		
1.2	Seismic zone	-		
1.3	Maximum ambient temperature	°C		
1.4	Minimum ambient temperature	°C		
1.5	Design temperature	°C		
1.6	Maximum humidity	%		
1.7	Area classification	-		
1.8	Gas Group/Dust	-		
1.9	Temperature classification	-		
1.10	Type of protection required	-		
1.11	Indoors or outdoors	-		
1.12	Cable size/type - Motor	-		
1.13	Cable size/type - Heater			
1.14	Cable size/type - Auxiliaries	-		
1.15	Cable gland entry thread size - Motor	Metric		
1.16	Cable gland entry thread size - Heater	Metric		
1.17	Cable gland entry thread size - Auxiliaries	Metric		
1.18	Earth connection size - Frame	mm^2		
1.19	Earth connection size - Terminal box	mm^2		
2.0	**DESIGN AND RATING**			
2.1	System voltage(s)/fault level	V/kA		
2.2	Voltage variation	%		
2.3	Frequency/Phase(s)	Hz/ 3p		
2.4	Frequency variation	%		
2.5	Neutral earthing	-		
2.6	Duty type (IEC 60034-1)	-		
2.7	Rated output	kW		
2.8	Number of poles	-		
2.9	Direction of rotation viewed from drive end	-		
2.10	Insulation Class/Temperature rise limit	-		
2.11	Minimum terminal voltage during starting	per unit		
2.12	Maximum no load sound pressure level at one meter	dBA		
2.13	Inertia of driven equipment	kg m2		
2.14	Type of starter/Short circuit protection	-		
2.15	Min successive starts per hour (hot condition)	-		
2.16	Min Successive Starts per Hour (Cold Condition)	-		
2.17	Min equally spaced starts per hour	-		
2.18	Max locked rotor current	% FLC		
2.19	Start at settle out pressure (compressors)			
3.0	**MECHANICAL AND ENCLOSURE**			
3.1	Enclosure material	-		
3.2	Degree of protection - IP Code - Motor	-		
3.3	Degree of protection - IP Code - Terminal Box			
3.4	Mounting (IEC 60034-7 IM Code 1)	-		
3.5	Cooling (IEC 60034-6 IC code)	-		

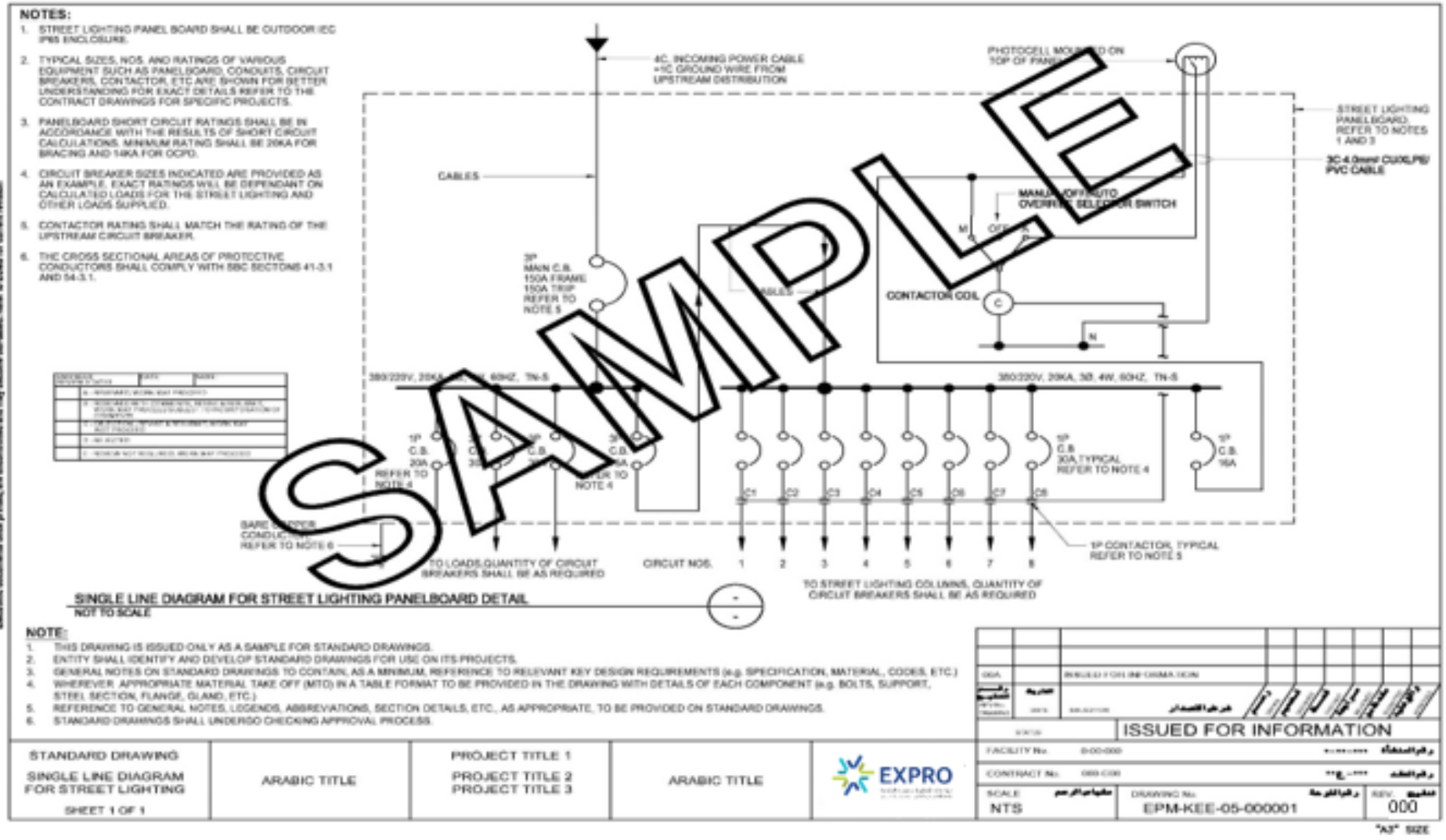
Attachment 18 - EPM-KEE-TP-000024 - Checklist - Interface with Saudi Electricity Company (SEC)

S. No.	QUESTIONS	Information Available			REMARKS
		N/A	Yes	No	
1	Availability of the updated or current Codes, Standards, local authority – Saudi Electricity Company (SEC) basic requirements and guidelines.				
2	Have No Objection Certificate (NOC's) obtained on project 'Demarcation Plan'?				to ensure SEC to reroute or rearrange the existing utility services (if applicable)
3	Are SEC approval obtained for Estimated Total Connected Load in kW?				
4	Are approval obtained to Tie-in to SEC substation?				
5	Have the schedule for SEC upgrade meet with the project schedule (if applicable)?				
6	Determine details of design documentations to be submitted to utility.				
7	Is Single Line Diagram (SLD) submitted and obtained approval from SEC?				
8	Is Load Schedules submitted and obtained approval from SEC?				
9	Are the substation layout and Feeder cable entry details submitted and obtained approval?				
10	Are Metering Requirement and specific metering equipment considered during design and approved by SEC?				
11	Have the detail required for the Fault distribution monitoring requirement (if applicable)?				
12	Are the details and scope determined for the requirement of Fiber Optic Cable installation and termination (if applicable)?				
13	Available utility short-circuit current, including values for normal and alternate supply facilities, as well as any anticipated future values (i.e., range of single and three phase-to-ground fault currents, and associated X/R ratios, at the consumer's point of service).				
14	Are the details determined regarding the confirmation on fault level settings or Protection Relay Settings?				
15	SCADA RTU Requirement - List of Analog Data and Status (Digital) points required to be sent to utility. Supervisory control requirement, if any. Specific equipment requirement.				
16	Do the information available regarding 'Utility grounding and lightning protection practices?				
17	Arrangement for Temporary Power for Construction, (if applicable).				
18	Telephone Line Interface, if any.				
19	Utility Phase designation and phasor rotation.				
20	Minimum Power Factor requirement. Power Factor penalties.				
21	Expected minimum, maximum, and nominal voltage/frequency at the consumer's point of service and obtain details regarding time duration on both steady state & transient condition				
22	Specific reclosing practices on both normal and alternate supply facilities.				
23	Power quality requirement - Harmonic content, voltage fluctuation, and current unbalance limits imposed by the utility.				
24	Load shedding requirements.				

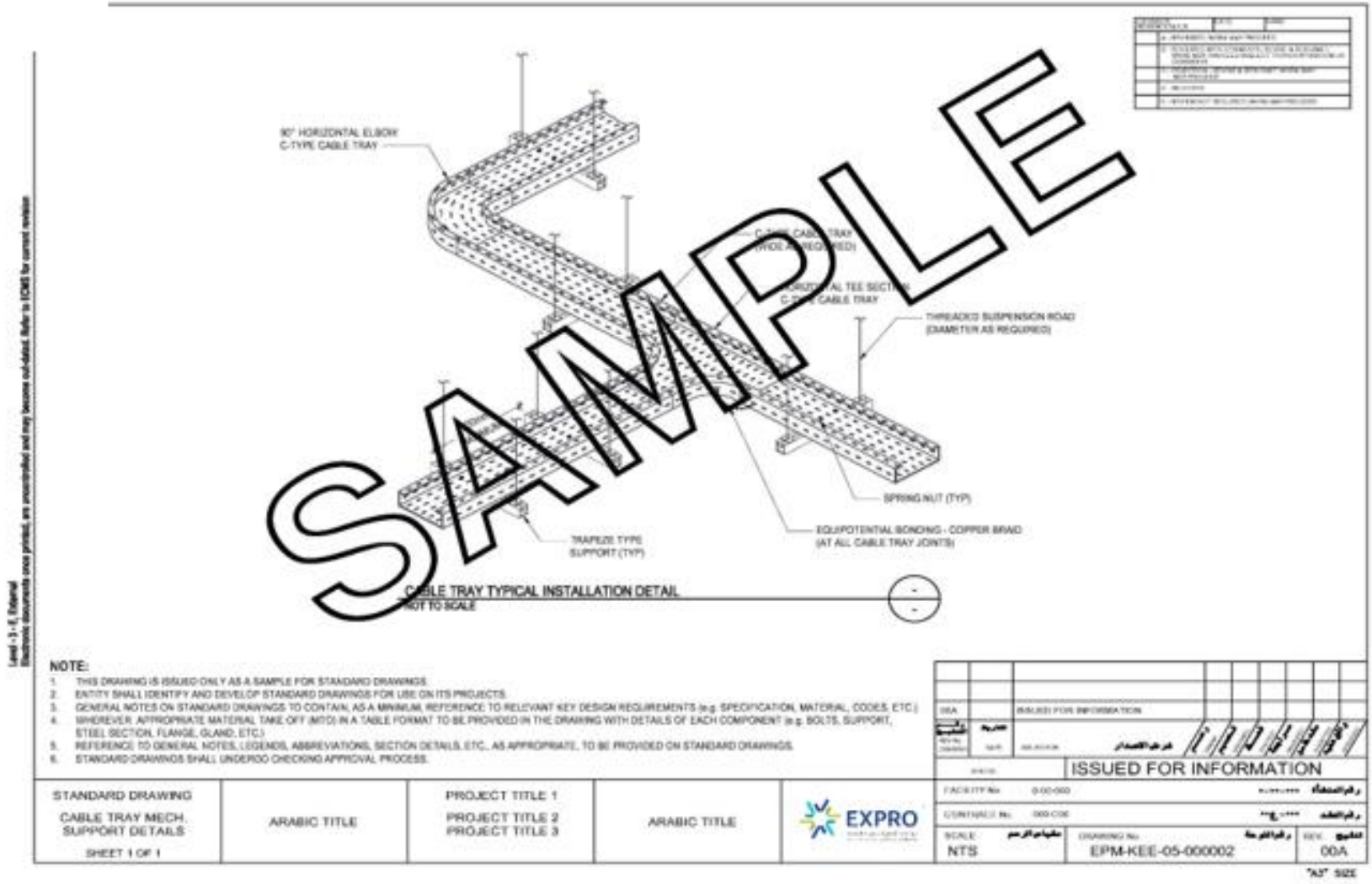
Attachment 19 - EPM-KEE-RG-000001 - List of Electrical Design Deliverables

SN	Deliverable	Tool	Deliverable Contents	Developed During	Deliverable Data Required for				Comments
					Procurement	Construction	Start-Up & Commissioning	Project Controls	
1	3D Model	3D modelling and Software	The 3D model shall show realistic depictions and contain relevant design data for all physical disciplines in sufficient detail as per the project 3D CAD procedures	B&D		Y	Y		Refer to Project Design Criteria for the requirement of 3D modelling and software to be used
2	Material Assignment Schedule (MAS) and Contract Assignment Schedule (CAS)	MS Excel	Developed by Contracts group with Engineering input	B&D	Y			Y	
3	Construction Facilities / Site Coordinating Plan	2D	Shows the location and type of required facilities, including lay down areas, trailer locations, fabrication areas and temporary warehouses	B&D		Y			Project to determine if this is done by Engineering or Construction,
4	Construction Electrical Power / Camp Electrical Power	2D	Layout for Temporary or Construction power supply which includes the arrangement of the temporary substation and electrical panel location			Y			
5	Permitting submittals	PDF	Includes documents and drawings required for applicable construction and environmental permitting activities for the project	B		Y			Refer to project permitting requirements,
6	Design Basis / Design Criteria Document	MS Word	Refer document **EPM-KEE-TP-000013** for the contents of Design Criteria	B					
7	Scope of Work/ Specifications	MS Word	Refer to templates for the contents of SOW and Specification	B&D	Y	Y	Y		
8	Data Sheet(s)	MS Word/ MS Excel	Engineered component data sheets which are generated to include all functional requirements for the inclusion within subcontract packages.	D		Y	Y		
9	Bulk Quantity Takeoff / BOQ	MS Excel/ MS Access	Bulk Quantity Takeoffs (QTOs) for tracking engineering-released quantities at 30%, 60%, & 90% Milestones to support construction installation.	B&D		Y		Y	

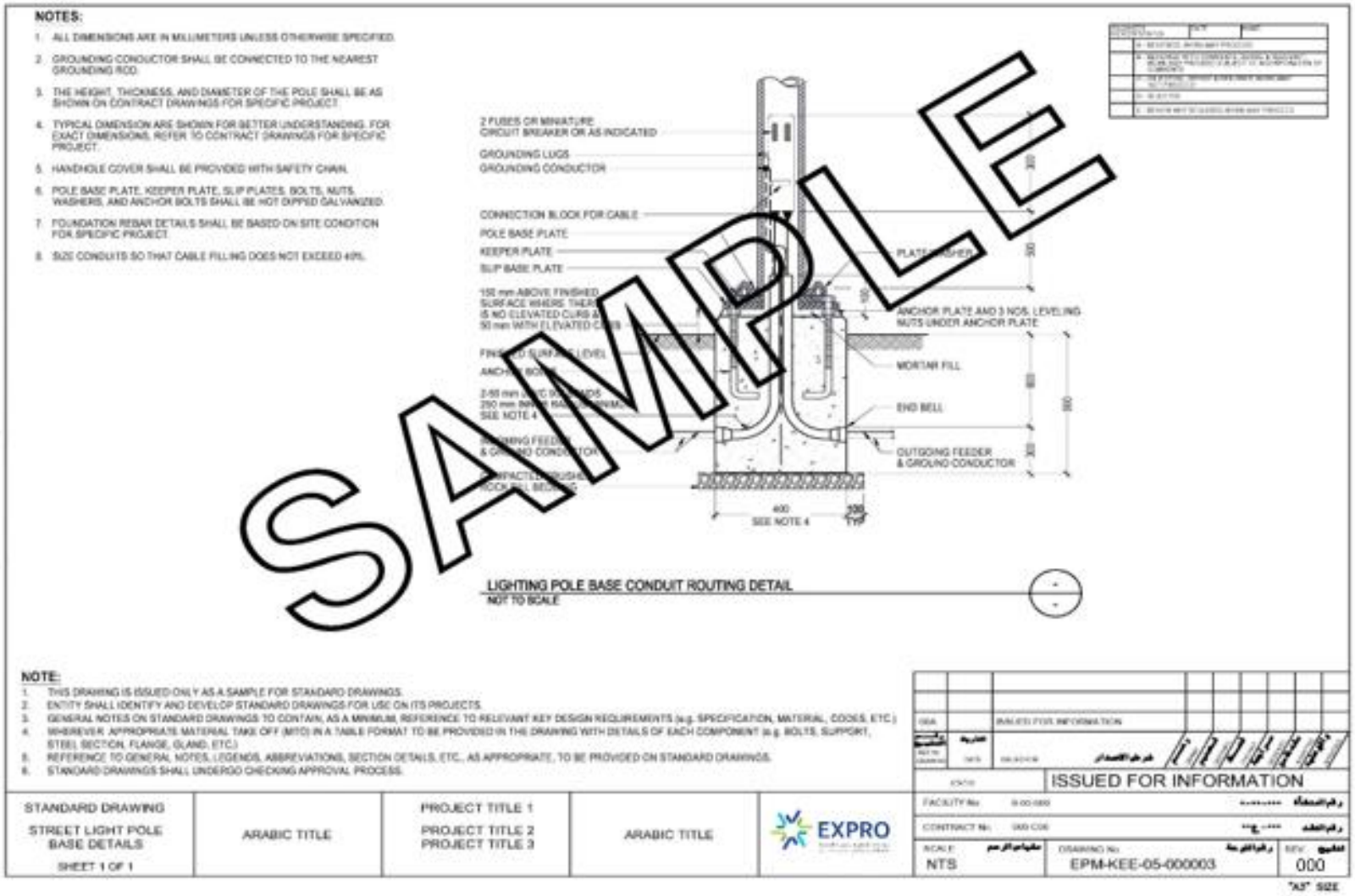
Attachment 20 - EPM-KEE-05-000001 - Single Line Diagram for Street Lighting



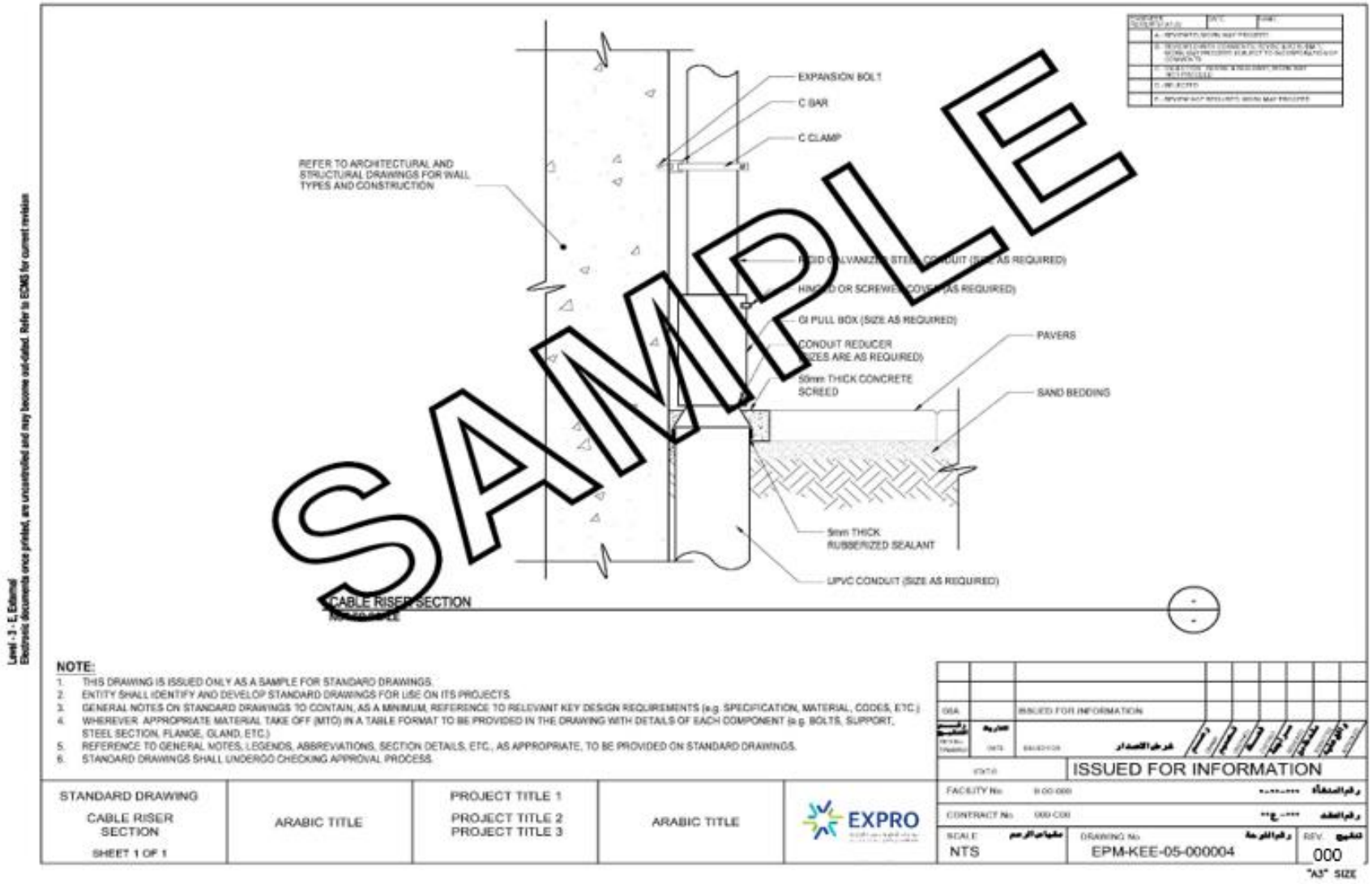
Attachment 21 - EPM-KEE-05-000002 - Cable Tray Mechanical Support Details



Attachment 22 - EPM-KEE-05-000003 - Street Light Pole Base Details



Attachment 23 - EPM-KEE-05-000004 - Cable Riser Section



Attachment 24 - EPM-KEE-05-000005 - Emergency Generator Grounding Details