



Drawing Requirements

I. Background and Overview

- A. The City's Program Standards and Procedures (PSP) are intended to be used in conjunction with the data contained in related standards and procedures. They are not intended to be used as stand alone documents. It is the responsibility of the Designer to become familiar with all the PSP documents and comply with the criteria set forth as a whole.
- B. In order to provide for consistency in document preparation and presentation, the Uniform Drawing System (UDS) has been adopted, as refined below. Consultants and their Subconsultants responsible for preparing drawings, will be required to purchase the current version of the UDS and provide proof of same prior to rendering services.
- C. Consultants providing services to the City are expected to incorporate time in their proposals to review the UDS, become familiar with the following refinements, examine the contents of the Drawing Library, and train the members of the Design Team in order to efficiently develop the project drawings with minimal rework. This advance effort to appropriately apply the drawing standard and avoid rework is a beneficial quality assurance activity. This Drawing Requirement includes the following sections:

- II. Presentation of Refinements
- III. Drawing Requirements by Discipline

II. Presentation of Refinements

- A. The following are the various refinements to be applied to the UDS. They are presented in the same order as the modules in the UDS. Refer to the Drawing Library for clarification of application of the drawing standard.

Introduction.

Add the following on Page 10 of the "Introduction," following the Subsection entitled "Linking."

- 1. Drawing Set Ownership:
 - a. A primary objective of these design standards is to develop documented requirements so they can be part of a continuous improvement process. This approach also applies to the Drawing Library contents. The development of drawings for a specific project, or for the Drawing

Library, is an effort the rate payers are vested in through the payment of fees for the related professional and technical services. It is a vital component of this standard for the City to own, and have unrestricted re-use rights in order for this process to provide for the fullest benefit to the City.

- b. Based on the premise indicated above, drawings developed by City employees or Consultants as part of an effort performed pursuant to these design standards, the following shall apply:

The City shall own the electronic file of the drawing(s) developed upon payment of the Consultant’s invoice related to the preparation of the drawing(s). Efforts to represent drawings as possessing a copyright shall not be acceptable and payments related to the services to prepare these drawings may be withheld until this requirement is met.

- c. Drawings shall be submitted as:
 - 1) Hard copy.
 - 2) AutoCAD dwg format.
 - 3) Adobe pdf format for both Bid Documents and as-built documents.
- d. The City shall be allowed to reuse the electronic files of the drawing(s) without restriction. The liability for the reuse of these drawings shall lie with the professional responsible of their application in subsequent projects.

B. Module 1 - Drawing Set Organization.

- 1. Delete the Subsection entitled “Subsets” and replace it with the following:

Order of Disciplines—Following the cover sheet, sheets shall be organized into subsets in the order indicated in the following table:

DISCIPLINE DESIGNATOR			
Level 1 Designator	Level 2 Designator	Sheet Name	Content
G		General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for entire project. Also overall phasing, staging area, temporary fencing and surfacing, haul routes, informational photographs, and other special requirements.



DISCIPLINE DESIGNATOR			
C		Civil	
	CG	Civil General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for civil discipline. Also discipline-specific phasing, staging area, temporary fencing and surfacing, haul routes, informational photographs, and other special requirements.
	CH	Hazardous Materials	Hazardous materials abatement, identification or containment.
	CD	Site Demolition	Site clearing, removal, and protection of existing civil improvements.
	CS	Survey	Horizontal and vertical control.
	CE	Earthwork & Erosion and Sediment Control	Finish grades and erosion and sediment control shown here.
	CU	Utilities	Site utilities not included in the mechanical drawings. Utility tunnel alignment-related information shown here.
	CP	Paving	Drawings related to asphalt, PCC, and brick paving.
	CM	Miscellaneous Improvements	Retaining walls and walkways not adjacent to streets.
L		Landscaping	
	LG	Landscaping General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary fencing and surfacing, haul routes, informational photographs, and other special requirements.
	LD	Landscaping Demolition	Removal and protection of landscape features.
	LI	Landscape Irrigation	Drawings related to the irrigation system.



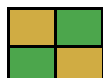
DISCIPLINE DESIGNATOR			
	LP	Landscape Planting	Drawings depicting the permanent plants for a project.
A		Architectural	
	AG	Architectural General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	AD	Architectural Demolition	Exterior and interior demolition and protection.
	AE	Architectural Elements	Drawings related to the architectural features of a facility, not included in finishes.
	AF	Architectural Finishes	Drawings related to the interior and exterior finishes of a facility.
S		Structural	
	SG	Structural General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	SD	Structural Demolition	Protection and removal of existing structural elements.
	SB	Structural Substructure	Foundations, piers, slabs, and retaining walls.
	SF	Structural Framing	Floors, walls, and roofs.
F		Fire Protection	
	FG	Fire Protection General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, and informational photographs, other special requirements.



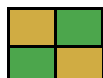
DISCIPLINE DESIGNATOR			
	FA	Fire Alarm	Equipment and circuitry related to monitoring and control of smoke and fire conditions.
	FS	Fire Suppression	Fire extinguishing systems and equipment.
P		Plumbing	Work by a licensed plumber.
	PG	Plumbing General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	PD	Plumbing Demolition	Protection and demolition of equipment, partial demolition of equipment for reuse, and salvage.
	PQ	Plumbing Equipment and Piping	Equipment and piping required to be done by a licensed plumber.
M		Mechanical	
	MG	Mechanical General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	MD	Mechanical Demolition	Protection and demolition of equipment, partial demolition of equipment for reuse, and salvage.
	MQ	Mechanical Equipment and Piping	Process-related piping and equipment not included in plumbing.



DISCIPLINE DESIGNATOR			
H		Heating, Ventilation and Air Conditioning	
	HG	HVAC General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	HD	HVAC Demolition	Protection and demolition of equipment, partial demolition of equipment for reuse, and salvage.
	HQ	HVAC Equipment	Duct work and equipment related to HVAC.
	HI	HVAC Controls	Monitoring and control system for HVAC equipment.
E		Electrical	
	EG	Electrical General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	ED	Electrical Demolition	Protection and demolition of equipment, partial demolition of equipment for reuse, and salvage.
	EP	Electrical Power	Power drawings except those associated with measurement and control circuits. Site plans, floor plans, one-line diagrams, power panel schedules, and conduit and conductor schedules for power circuits.
	EL	Electrical Lighting	Interior and exterior lighting drawings except those located within equipment enclosures. Site plans, floor plans, installation details, lighting control drawings, reflected ceiling plans, and conduit and conductor schedules for lighting circuits.



DISCIPLINE DESIGNATOR			
	EQ	Electrical Equipment	Elevation, sections, and detail drawings for electrical equipment or equipment requiring electrical power such as switchboards, medium voltage equipment, MCCs, VFDs, transformers, motors, motor starters, HVAC equipment, and irrigation equipment. Also includes motor schematic diagrams.
I		Process Instrumentation	
	IG	Process Instrumentation General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	ID	Process Instrumentation Demolition	Protection and demolition of equipment, partial demolition of equipment for reuse, and salvage.
	IS	Process Instrumentation System	Drawings associated with measurement and control circuits, including floor plans, site plans, conduit and conductor schedules for measurement and control circuits, P&IDs, control system block diagrams, details, and sections.
	IQ	Process Instrumentation Equipment	Control panel drawings, control panel schedules, discrete I/O drawings, instrument loop drawings, and details.
Z		Communications	
	ZG	Communications General	Drawing index (table and graphic), code summary, symbol legend, and orientation maps for discipline. Also discipline-specific phasing, staging area, temporary barriers, informational photographs, and other special requirements.
	ZA	Audio Visual	Cable, music, and CCTV systems.



DISCIPLINE DESIGNATOR			
	ZT	Telephone and Data Networks	Telephone systems, public address system, intercom, and local area networks not related to process instrumentation.
	ZY	Security	Access control and alarm systems related to ingress and egress.

2. Delete the section entitled “Sheet Identification” and replace it with the following:

Sheet Identification—The sheet identification system has the following four components:

- a. Discipline Designator - One alphabetical character for Level 1 projects (smaller and/or less complex) and two alphabetical characters for Level 2 projects (larger and/or more complex). Level 1 and Level 2 designators may be used in combination on the same project as appropriate. A discipline with Level 2 designators shall be segregated using all the level two designators within the discipline. The discipline designator is shown below as two bold As:

AA-NNN.SSS

- b. Sheet Type Designator - One numerical character as indicated in the following table. Information and graphic types (legends, plans, details, sections, etc.) shall be placed only on the sheet type of the appropriate designation. The sheet type designator is shown below as one bold N:

AA-**N**NN.SSS

SHEET TYPE DESIGNATORS	
Sheet Type Designator	Sheet Type Description
0	General (symbols legend, notes, etc., one-line diagrams and P&IDs will follow the other general sheets)
1	Plans (horizontal views and plan/profile sheets)
2	Elevations (vertical views)
3	Sections (sectional views)
4	Large Scale Views (plans, elevations, or sections that are not details)
5	Details



SHEET TYPE DESIGNATORS	
6	Schedules and Diagrams
7	User Defined (for types which do not fall in other categories)
8	User Defined (for types which do not fall in other categories)
9	3D Representations (isometrics, perspectives, photographs)

3. Sheet Sequence Number - Two numerical characters. The sheet sequence number is shown below as two bold Ns. Sheets shall be numbered in a non-consecutive (by three) sequential manner.

AA-**NN**.FFF

4. Facility Number - The three digit facility number shall be placed on each sheet utilizing the three numbers indicated below as three bold Fs. A decimal point separates the sheet sequence number and the facility number. The facility number will be provided by the City PM.

AA-NNN.**FFF**

5. Delete the section entitled “File Naming” and replace it with the following:
- a. File Naming Convention.
 - b. Drawings are to be created using AutoCAD. The line work is to be in model space and the sheets are to be created in paper space. A separate drawing will be developed for each sheet. The files are to be named using the facility number (if applicable), followed by an underscore, the sheet identification as described herein, followed by an underscore, the City project number, and the “.dwg” file extension. An example of this is 022_C-501_702178.dwg. Drawings shall have the same insertion point in model space (0,0), and shall fit with the other related drawings without further rotation or translation.
 - c. The base map drawing and the project border files (title block) will be maintained as separate drawings and used as xrefs (overlay mode) to the project drawings (see Figure 1). These files will be named using the City project number, followed by a dash, the appropriate designator “BASE” or “TITLE,” and the “.dwg” file extension. Examples of these are 702178-BASE.dwg and 702178-TITLE.dwg.
 - d. The details in the Drawing Library are to be named and referenced in the following format:

DD.NNN



DD refers to the Master Format division number most appropriate for the detail, and NNN is three numerical characters representing a sequence. Details shall be numbered in a nonconsecutive (by five) sequential manner (005, 010, 015, ...). An example of this is 13.005.dwg.

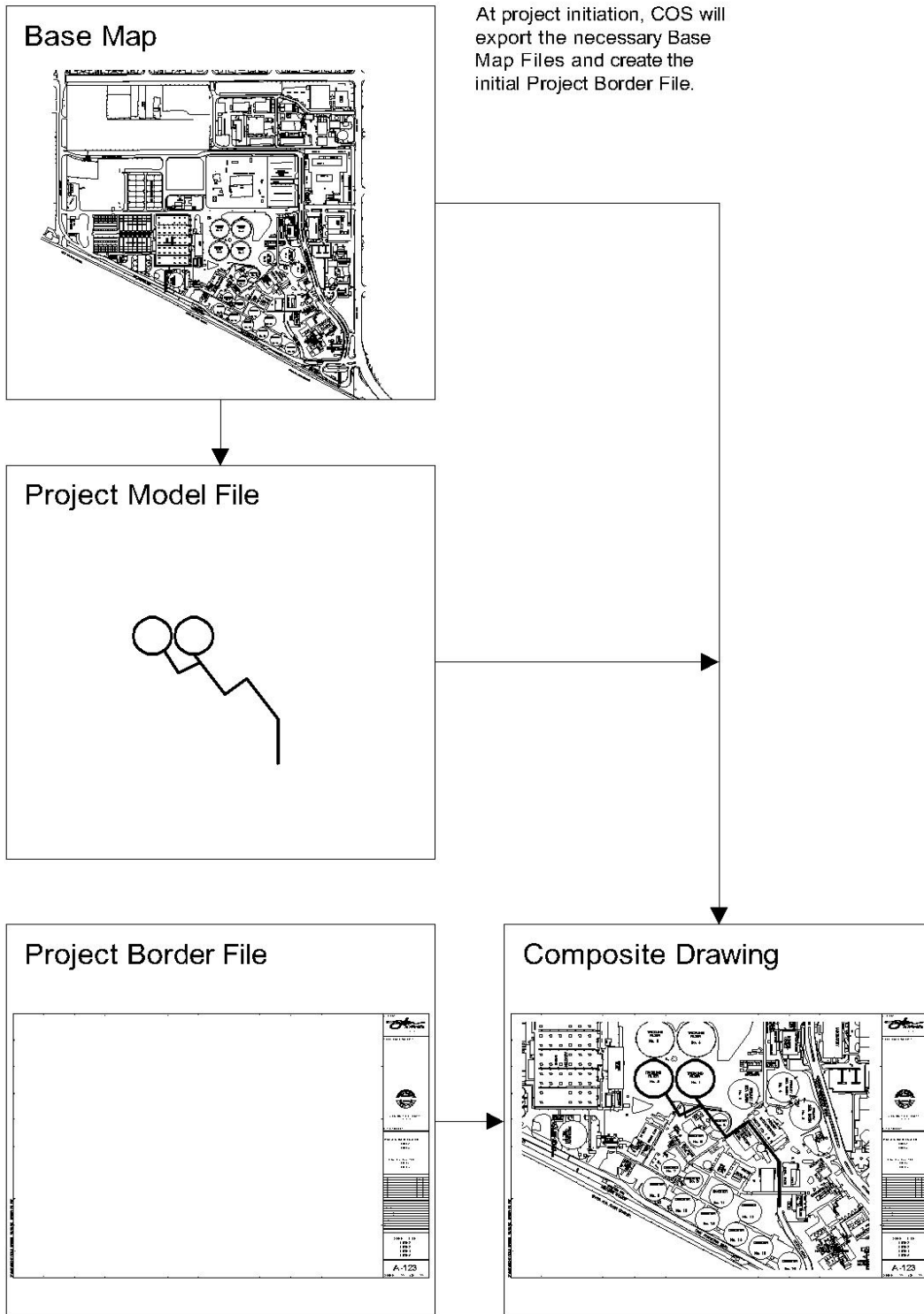


Figure 1 - Drawing Organization



6. The standard sheets and example sheets in the Drawing Library are to be named using the discipline designator, followed by a space and the sheet name. An example of this is G Cover Sheet.dwg.
 7. Delete appendices A–C.
- C. Module 2 - Sheet Organization.
1. Delete the section entitled “Sheet Sizes” and replace it with the following:
 - a. The contract drawings shall be either 22" x 34" (ANSI D size media) or 34" x 44" (ANSI E size media), subject to approval by the City. Scales and related matters shall be developed to accommodate this requirement. Review sets and additional sets for the Contractor may be printed at half size for convenience. Text heights shall apply to contract drawings.
 - b. All sheets within the contract drawings shall be of the same size. (ANSI D or ANSI E).
 2. Delete the Subsections entitled “Title Block Area,” “Sheet Identification Block,” “Sheet Title Block,” “Management Block,” “Issue Block,” “Project Identification Block,” “Designer Identification Block,” and “Formats for Title Block Area,” and replace it with the following:
 - a. The project border files (title block) will be provided by the City. The preparing firms logo and professional’s seal shall be added to the project border file as shown on the sample sheet.
 - b. The sample sheet includes a grid system with numbers across the top and bottom (increasing to the right) and capital letters up the left side (increasing upward). The drawing blocks are defined by this grid system. Details, note blocks, and other drawing elements are placed on the sheet based on the grid system.
 - c. The location of the drawing blocks and the note block are shown. Text styles for the note block, title block, and related information are also included in the prototype drawing. A key plan, when used, is to be located in the lowest module of the note block, adjacent to the title block.
 3. Delete the section entitled “Production Data Area” and replace it with the following:

A day stamp (plot stamp) will be placed in the lower lefthand corner of each sheet, immediately outside the title border, aligned vertically. The day stamp (plot stamp) will include the drawing path, filename, save/plot date, and save/plot time.



4. Delete the section entitled "Cover Sheet" and replace it with the following:

The cover sheet may vary from this format. It will be given the appropriate sheet identifier. It will not contain technical information related to the project such as details and notes.

D. Module 3 - Schedules.

Delete appendices A–C.

E. Module 4 - Drafting Conventions.

1. Under the Subsection entitled "Scale" disregard all references to numeric scales. All scales will be expressed graphically only.
2. Delete the table in the Subsection entitled "Lines" and replace it with the following:

LINE WIDTHS AND APPLICATIONS		
Width Descriptor	Line Width (inches)	Applications
Extra Fine	0.002	Material indicators, hatch lines, patterns, and leaders.
Fine	0.007	Text less than 0.10" (minimum height in the drawing area is 0.04"), dimension lines, and extension lines.
Thin	0.010	Break lines, hidden objects, dotted lines, dashed lines, setback lines, center lines, grid lines, and schedule grid lines.
Medium	0.014	Text between 0.10" and 0.14", object lines, property lines, terminator marks, door and window elevations, and schedule grid accent lines.
Wide	0.020	Text between 0.15" and 0.19", titles, edges of interior and exterior elevations, profiling, cut lines, property lines, section cutting plane lines, and drawing block borders.
Extra Wide	0.028	Match lines, footprints, title block, borders, sheet borders, and schedule outlines.

3. Line widths for both existing and proposed drawing objects shall be consistent for similar object types. Existing objects will be differentiated from proposed objects by screening the lines to 50 percent. Additionally, the text labels for proposed objects will be 0.10" in height. Text labels for existing objects will be 0.08" in height.



4. Text height will vary from 0.04" (minimum) to 1.0" (maximum). Arial font will be used for any text 0.20" or larger and for all text within the Title Block. 2ROMANS font will be used for all other text. All text located in Model Space will be scaled accordingly when viewed in Paper Space. For example, if the desired text size is 0.012", and the scale is 1" = 20', the Model Space text size will be 2.40 (0.012 x 20).

5. Add the following text at the end of the Subsection entitled "Drawing Identification" on page 33:

When references are used within a detail in the Drawing Library it is not possible to provide a sheet designator as reference. In these cases, a blank reference symbol shall be used followed by a brief description of the item referenced in italicized text. When the detail is inserted on a project sheet, the appropriate reference information will be placed in the symbol and the descriptive text deleted.

6. Add the following Subsection immediately after the Subsection entitled "Symbols" on page 33:

Revision Call Outs—Revisions on a sheet shall be surrounded by a line in the shape of a cloud. The cloud shall have a triangle at the upper right-hand location with the revision number in it. The number shall appear in the revision table in the title block with a description of the revision.

F. Module 5 - Terms and Abbreviations:

Refer to Drawing Library for refinements. New abbreviations shall be created in a manner consistent with the UDS and submitted to the Project Manager for review, approval, and incorporation into the drawing standard.

G. Module 6 - Symbols:

Refer to Drawing Library for refinements. New symbols shall be created in a manner consistent with the UDS and submitted to the Project Manager for review, approval, and incorporation into the Drawing Library.

H. Module 7 - Notations:

No refinements.

I. Module 8 - Code Conventions:

No refinements.



III. Drawing Requirements By Discipline

A. Mechanical Drawings.

1. Pipe shall be shown on the drawings as follows:
 - a. Piping systems four inches and larger shall be shown by two lines.
 - b. Piping systems smaller than four inches shall be shown as a single line.
 - c. Piping systems three inches and larger shall be shown by:
 - 1) 3-D pipe system schematic.
 - 2) Dimensioned layout of pipe runs on the drawings. Dimensions shall be shown for all pipe appurtenances.
 - d. Piping systems smaller than three inches shall be shown by:
3-D pipe system schematic.
 - e. General routing shown on the drawings with dimensions provided where the location is not intended to be determined during construction. Dimensions shall be provided at a minimum for:
 - 1) Pressure-reducing valves
 - 2) Backflow preventers
 - 3) Control valves
 - 4) Instruments
 - f. All pipes shall be identified on the drawings using identification scheme set forth in the Process Identification, Finishes and Labeling Design Standards.
 - g. All instruments located in pipe runs, regardless of pipe size, shall be shown and located to scale by dimensions on the drawings.
 - h. Connection details for all instruments and pipe appurtenances shall be detailed on the drawings for the specific instrument or appurtenance installed. Connection requirements for instruments and pipe appurtenances shall not be left to the Contractor to determine or coordinate.
 - i. All pipe appurtenances shall be drawn to scale. Layout shall provide sufficient space in order to accommodate all manufacturers listed in the specifications.



- j. Locations in pipe racks or supports for future pipes and for open spaces shall be shown and noted on the drawings.
- k. Devices, hooks, eye bolts, etc., as required to lift and hoist pipe and pipe appurtenances shall be shown and dimensioned on the drawings.
- l. Pipe fittings as required for cleaning, flushing, and pressure testing of pipe runs shall be shown on the drawings for pipes four inches and larger. Fitting requirements shall not be left to the Contractor to determine or coordinate.

2. Pipe and device supports:

All vertical and horizontal supports for pipes four inches and larger shall be detailed and located on the drawings.

3. Valve operators:

- a. Supports for all valve operators shall be detailed and shown on the drawings.
- b. Chain loops for chain wheel–operated valves shall be shown on the drawings for coordination of building layouts.
- c. The orientation of all valve operators shall be shown on the drawings to scale and the position of the local controls and manual handwheel locations noted.

B. Electrical Drawings.

1. The Designer is responsible to coordinate efforts and deliverables with the other disciplines.
2. The Designer is responsible to become familiar with the facilities Design Standards, Master Guide Specifications, and Drawing Library. The Drawing Library contains many sample drawings and typical drawing details that shall be utilized and modified as needed to be project-specific.
3. Ensure that all the abbreviations, legends, and symbols shown throughout the drawing set are included in the abbreviation, legend, and symbol sheets.
4. One-line diagrams shall be provided to indicate all power distribution systems.
5. Separate electrical site plan(s) shall be issued for power, lighting, grounding, measurement and control, fire alarm, and security.
6. Separate floor plans shall be issued for power, lighting, grounding, measurement and control, fire alarm, and security.
7. Separate exterior equipment elevation drawings shall be issued for all electrical equipment such as MCCs, control panels, VFDs, start/stop stations, switchboards,



and lighting control panels showing to scale the area elevation, plan, and section details.

8. Separate interior elevation drawings shall be provided for custom built electrical equipment such as PLC control panels, DCS control panels, control panels enclosing relays, and selector switches.
9. Block diagram illustrating the networking connections involved in the new work and its interface with the existing system.
10. Conduit and conductor schedules for power, lighting, fire alarm, security, measurement and control will list conduit by tag, conduit size, wire count, and size and type, source, all junction and destination coordination, location drawing reference, and specification reference.
11. Power panel schedules shall include available fault current at main breaker, load calculations, arc flash rating, and required data.
12. MCC schedules are to include power distribution, section identification, and reference indication to external source of power.
13. Security equipment schedule will include line diagrams for power source from electrical power panels, local and remote sensor wiring and connection, access control, local and remote annunciation equipment, and provide for the interface with fire, measurement and control, life safety, and monitor systems.
14. Fire alarm equipment schedules will include device tagging, wire routing, interface connection, alarm output connections, local annunciation, and telephone/radio interface requirements.
15. Name plate identification schedules will be developed for each required area of use. This includes structure identification, equipment, control panels, wire marking, conduit marking, trace wire identification, panel labels, and alarm and fire control systems. The tag list developed will be per specifications and approved by the Project Manager with authorization for each area of use.
16. Scaled elevation drawings of electrical equipment, housekeeping pads, conduit placement, and its relationship to other equipment sharing the same space.
17. Provide drawing details necessary to clearly illustrate all the installation arrangements and requirements. The installation requirements shall not be left to the Contractor's discretion.
18. Separate motor control schematics for each motor in the project. Typical or shared schematics are not acceptable. Schematics will include the reference to the electrical power one-line, monitoring and control interfacing coordination, safety interface, and remote signal and operator control.



19. Security system schematics will include the location plan, elevation, signal routing, and location input and output coordination with system metering and control operations.
20. Fire alarm system schematics will include the location plan, elevation, signal routing, local monitor and control, entry system interface, and local equipment and process control interface to meet security and operation standards.
21. Process and instrumentation diagrams will include indication of the process flow source and continuation to and from other related drawings. The references for plan and control disciplines is to be included in drawing notes.
22. Control system power schematics will be coordinated to the related control system drawings to the electrical power one-line drawings. Power distribution to related I/O controls and instrument power sourcing will contain one-line indication of areas by use for local, junction, and remote power, discrete, control, analog, and data network interconnections.
23. Control system discrete input schematic diagrams will have reference notes to indicate the input power for use, reference drawing of the source of power, fusing per group or input, line numbers as indicated on the left side of each input card, tag and use of each input node, reference notes at each externally located device for location on site elevation drawings, and contact condition of power fail conditions.
24. Control system discrete output schematic diagrams will have reference notes to indicate the source for output power, electrical interlock for safety operation, fusing per group or output, line numbers as indicated on the left side of each output card, tag and use of each input node, equipment tag number, reference notes at each externally located device for location on site elevation drawings, and contact condition of power fail condition.
25. Control system analog input loop diagrams will have reference notes to indicate voltage of current source values, instrument tag designator, and cable wire, bundle, and shield connections, remote location junction, and equipment termination.
26. Control system analog output loop diagrams will have reference notes to indicate voltage of current source values, instrument tag designator, and cable wire, bundle, and shield connections, remote junction box, and equipment terminations.

—End of Section—

