

## SECTION 01 78 23

### OPERATIONS AND MAINTENANCE DATA

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Scope:
1. Submit operation and maintenance data, in accordance with this Section and in accordance with requirements elsewhere in the Contract Documents, as instructional and reference manuals by operations and maintenance personnel at the Site.
  2. Required operation and maintenance data are listed in the Contract Documents. If not otherwise listed, at minimum, submit operation and maintenance data for:
    - a. All equipment and systems.
    - b. Valves, gates, actuators, and related accessories.
    - c. Instrumentation and control devices.
    - d. Electrical gear.
  3. For each operation and maintenance manual, submit the following:
    - a. Preliminary Submittal: Printed and bound copy of and electronic copies of entire operation and maintenance manual, except for test data and service reports by Supplier.
    - b. Final Submittal: Printed and bound copy and electronic copies of complete operations and maintenance manual, including test data and service reports by Supplier, with electronic copies.

##### 1.2 SUBMITTALS

- A. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data
    - a. Submit the operations and maintenance data as required by the Contract Documents.
- B. Quantity Required and Timing of Submittals:
1. Preliminary Submittal:
    - a. Printed Copies: one copy provided to the ENGINEER, exclusive of copies required by CONTRACTOR.
    - b. Electronic Copies: three copies.
    - c. Submit to ENGINEER by the earlier of: ninety days following approval of Shop Drawings and product data submittals, or thirty days prior to starting training of operations and maintenance personnel, or thirty days prior to field quality control testing at the Site.
  2. Final Submittal: Provide final submittal prior to Substantial Completion, unless submittal is specified as required prior to an interim Milestone.

- a. Printed Copies: one copy to be provided to OWNER.
- b. Electronic Copies: three copies.

### 1.3 FORMAT OF PRINTED COPIES

#### A. Binding and Cover:

1. Bind each operation and maintenance manual in durable, permanent, stiff-cover binder(s), comprising one or more volumes per copy as required. Binders shall be minimum one-inch wide and maximum of three-inch wide. Binders for each copy of each volume shall be identical.
2. Binders shall be locking three-ring/"D"-ring type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front of each volume.
3. Do not overfill binders.
4. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
5. Provide the following information on cover of each volume:
  - a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
  - b. Name or type of material or equipment covered in the manual.
  - c. Volume number, if more than one volume is required, listed as "Volume \_\_\_ of \_\_\_", with appropriate volume-designating numbers filled in.
  - d. Name of Project and, if applicable, Contract name and number.
  - e. Name of building or structure, as applicable.
6. Provide the following information on spine of each volume:
  - a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
  - b. Name or type of material or equipment covered in the manual.
  - c. Volume number, if more than one volume is required, listed as "Volume \_\_\_ of \_\_\_", with appropriate volume-designating numbers filled in.
  - d. Project name and building or structure name.

#### B. Pages:

1. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.
2. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of the manual, reinforcing of pages within booklet or pamphlet is not required.
3. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.

#### C. Drawings:

1. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing specified for pages.
2. Documents larger than 11 inches by 17 inches shall be folded and inserted into clear plastic pockets bound into the manual. Mark pockets with printed text indicating content and drawing numbers. Include no more than three drawing sheets per pocket.

- D. Copy Quality and Document Clarity:
1. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals that contain copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.
  2. Clearly mark in ink to indicate all components of materials and equipment on catalog pages for ease of identification. In standard or pre-printed documents, indicate options furnished or cross out inapplicable content. Using highlighters to so indicate options furnished is unacceptable.
- E. Organization:
1. Coordinate with ENGINEER and OWNER to develop comprehensive, practical, and consistent indexing system for operations and maintenance data. ENGINEER will review indexing system before operations and maintenance data is submitted.
  2. Table of Contents:
    - a. Provide table of contents in each volume of each operations and maintenance manual.
    - b. In table of contents and at least once in each chapter or section, identify materials and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near beginning of each volume. Using material or equipment model or catalog designations for identification is unacceptable.
  3. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

#### 1.4 FORMAT OF ELECTRONIC COPIES

- A. Electronic Copies of Operation and Maintenance Manuals:
1. Each electronic copy shall include all information included in the corresponding printed copy. Cover page shall include the following:
    - a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
    - b. Name or type of material or equipment covered in the manual.
    - c. Project name and building or structure name.
  2. Include drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size.
  3. Clearly mark to indicate all components of materials and equipment on catalog pages for ease of identification. In standard documents, indicate options furnished or cross out inapplicable content.
  4. Coordinate with ENGINEER and OWNER to develop comprehensive, practical, and consistent indexing system for operations and maintenance data. ENGINEER will review indexing system before operations and maintenance data is submitted.

5. Table of Contents:
    - a. Provide table of contents in each operations and maintenance manual.
    - b. In table of contents and at least once in each chapter or section, identify materials and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table included at or near beginning of each manual. Using material or equipment model or catalog designations for identification is unacceptable.
  6. Submit each electronic copy on a separate compact disc (CD), unless another electronic data transfer method or format is acceptable to ENGINEER.
  7. File Format:
    - a. Files shall be in “portable document format” (PDF). Files shall be electronically searchable; the use of scanned pages is to be minimized and is subject to ENGINEER approval.
    - b. Submit separate file for each separate document in the printed copy.
    - c. Within each file, provide bookmarks for the following:
      - 1) Each chapter and subsection listed in the corresponding printed copy document’s table of contents.
      - 2) Each figure.
      - 3) Each table.
      - 4) Each appendix.
- B. Copies of Programming and Configuration Files:
1. Provide on CD copy of all software programming, such as programmable logic controller programs, prepared specifically for the Project. Third-party, licensed, commercially available software is excluded from requirements of this Article; submit copies of commercially-available, licensed, third-party software, where required, in accordance with the Contract Documents.
  2. Submit on CD copies of system configuration prepared specifically for the Project, such as plant monitoring system and SCADA display configurations.
  3. Submit programming and configuration files together with electronic copies of operation and maintenance data.

## 1.5 CONTENT

- A. General:
1. Prepare each operations and maintenance manual specifically for the Project. Include in each manual all pertinent instructions, as-built drawings as applicable, bills of materials, technical bulletins, installation and handling requirements, maintenance and repair instructions, and other information required for complete, accurate, and comprehensive data for safe and proper operation, maintenance, and repair of materials and equipment furnished for the Project. Include in manuals specific information required in the Specification Section for the material or equipment, data required by Laws and Regulations, and data required by authorities having jurisdiction.
  2. Completeness and Accuracy:
    - a. Operation and maintenance manuals that include language stating or

implying that the manual's content may be insufficient or stating that the manual's content is not guaranteed to be complete and accurate are unacceptable.

- b. Operations and maintenance manuals shall be complete and accurate.
  - c. Operation and maintenance manuals shall indicate the specific alternatives and features furnished, and the specific operation and maintenance provisions for the material or equipment furnished.
3. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.
- B. Submit written explanations of all safety considerations relating to operation and maintenance procedures.
- C. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life. Instructions shall include:
1. Written explanations with illustrations for each preventive maintenance task such as inspection, adjustment, lubrication, calibration, and cleaning. Include pre-startup checklists for each equipment item and maintenance requirements for long-term shutdowns.
  2. Recommended schedule for each preventive maintenance task.
  3. Lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.
  4. Table of alternative lubricants.
  5. Troubleshooting instructions.
  6. List of required maintenance tools and equipment.
- D. Submit complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis. Bills of material shall indicate:
1. Manufacturer's name, address, telephone number, fax number, and Internet website address.
  2. Manufacturer's local service representative's or local parts supplier's name, address, telephone number, fax number, Internet website address, and e-mail addresses, when applicable.
  3. Manufacturer's shop order and serial number(s) for materials, equipment or assembly furnished.
  4. For each part or piece include the following information:
    - a. Parts cross-reference number. Cross-reference number shall be used to identify the part on assembly drawings, Shop Drawings, or other type of graphic illustration where the part is clearly shown or indicated.

- b. Part name or description.
  - c. Manufacturer's part number.
  - d. Quantity of each part used in each assembly.
  - e. Current unit price of the part at the time the operations and maintenance manual is submitted. Price list shall be dated.
- E. Submit complete instructions for ordering replaceable parts, including reference numbers (such as shop order number or serial number) that will expedite the ordering process.
- F. Submit manufacturer's recommended inventory levels for spare parts, extra stock materials, and consumable supplies for the initial two years of operation. Consumable supplies are items consumed or worn by operation of materials or equipment, and items used in maintaining the operation of material or equipment, including items such as lubricants, seals, reagents, and testing chemicals used for calibrating or operating the equipment. Include estimated delivery times, shelf life limitations, and special storage requirements.
- G. Submit manufacturer's installation and operation bulletins, diagrams, schematics, and equipment cutaways. Avoid submitting catalog excerpts unless they are the only document available showing identification or description of particular component of the equipment. Where materials pertain to multiple models or types, mark the literature to indicate specific material or equipment supplied. Marking may be in the form of checking, arrows, or underlining to indicate pertinent information, or by crossing out or other means of obliterating information that does not apply to the materials and equipment furnished.
- H. Submit original-quality copies of each approved and accepted Shop Drawing, product data, and other submittal, updated to indicate as-installed condition. Reduced drawings are acceptable only if reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.
- I. Submit complete electrical schematics and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.
- J. Programmable Logic Controllers: If programmable logic controllers are furnished under the Contract:
- 1. Submit complete logic listings in ladder logic format.
  - 2. Format Requirements:
    - a. For ladder diagram logic, include complete cross-referencing of all logic elements. Annotate all elements with clearly understandable tags or descriptive labels.
  - 3. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.
  - 4. Submit complete manufacturer's programming manuals.

- K. Submit copy of warranty bond and service contract as applicable.
- L. When copyrighted material is used in operations and maintenance manuals, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

++ END OF SECTION ++