

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including:
 - 1. Manuals, General.
 - 2. Emergency Manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Maintenance manuals for care and maintenance of products, materials, and finishes.
 - 5. Systems and Equipment Maintenance Manuals.
- B. See Division 02 through Division 49 sections for additional operation and maintenance manual requirements for Work in those sections.

1.2 SUBMITTALS

- A. Manual: Submit one electronic copy at least 60 calendar days before performance demonstration begins. Contracting Officer (CO) will return copy or edit version with comments within 15 calendar days of receipt.
- B. Format:
 - 1. Submit operations and maintenance manuals in following format:
 - a. PDF (portable document format) electronic file. Assemble each manual into composite electronically indexed file. Submit on digital media acceptable to Contracting Officer.
 - 1) Include bookmarks in the PDF file that coincide with all indexed sections and attachments.
 - 2) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - 3) Enable inserted reviewer comments on draft submittals.
 - b. Hard Copy Manual: In accordance with Part 2 of this section.
 - c. Correct or modify each manual to comply with Contracting Officers comments. Submit four copies of each corrected manual within 15 days of receipt of Contracting Officers comments.

1.3 QUALITY ASSURANCE

- A. Coordinate with Section 01 91 15, Total Building Commissioning. Commissioning Agent shall review Operation and Maintenance Manuals for commissioned systems.

PART 2 PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system. Manual shall contain title page, table of contents, and manual contents.
- B. Title Page:
 - 1. Enclose title page in transparent plastic sleeve. Include:
 - a. Project title.
 - b. Location.
 - c. Park.
 - d. Contract number.
 - e. Prime contractors name and address.
 - f. Date of Substantial Completion.
 - g. Binder volume number.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to content of the volume, and cross-referenced to specification section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. Assemble instructions for subsystems, equipment, and components of one system into a single binder if needed.
 - 1. Binders: White, commercial quality, hard back, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-inch by 11-inch (215 by 280-millimeter) paper; with clear plastic window sleeve on front and spine to hold label describing contents and pockets inside covers to hold folded oversize sheets.
 - a. Cover Sheet: Identify binders on front and spine, with project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet into clear plastic view pocket on spine with title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. When contents of a single tabbed section cover more than one item, provide colored paper sheets to separate the data for each item.
 - a. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. No copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps. Include only sheets that apply to items installed; cross out inapplicable data.
 - b. Vendor Furnished As-Built Drawings: Maximum 24-inch by 36-inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if reproductions are clear and legible. If reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.
 - c. Custom Data: Data supplemented by drawings and schematics necessary to describe systems adequately.
 - d. Equipment Data Sheet: Data, using form at end of this section.
 - e. Schedules: Schedules reflecting final, as-installed conditions.
 - f. Poorly reproduced or illegible data will be rejected.
3. Dividers: Divider sheets with Mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Include typed list of products and major components of equipment included in section on each divider, cross-referenced to specification section number and title of Project Manual.
4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into separate section for type of emergency, emergency instructions, and emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of National Park Service (NPS) operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Operation Requirements:

- 1. Content: In addition to requirements in section, include operation data required in individual specification sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
- 2. Descriptions:
 - a. Include:
 - 1) Product name and model number.
 - 2) Manufacturer's name.
 - 3) Equipment identification with serial number of each component.
 - 4) Equipment function.
 - 5) Operating characteristics.
 - 6) Limiting conditions.
 - 7) Performance curves.
 - 8) Engineering data and tests.
 - 9) Complete nomenclature and number of replacement parts.
- 3. Operating Procedures: Include startup, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- 4. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
- 5. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

B. Maintenance Requirements for Systems and Equipment:

- 1. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, and equipment data sheets as described below.

2. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference specification section number and title in Project Manual.
3. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment.
4. Maintenance Procedures: Test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, detailing essential maintenance and environmental procedures.
5. Maintenance and Service Schedules: Service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
6. Spare Parts List and Source Information: Lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
7. Warranties and Bonds: Copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference specification section number and title in Project Manual.
- C. Product Information:
 1. Include:
 - a. Product name and model number.
 - b. Manufacturer's name.
 - c. Color, pattern, and texture.
 - d. Material and chemical composition.
 - e. Reordering information for specially manufactured products.

D. Environmental Requirements:

1. Identify environmentally preferable products incorporated into Project. Include: product model; manufacturer's name, address, phone, and website; and local technical representative.
 - a. Verify plastic products to be incorporated into Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
 - 1) Type 1: Polyethylene Terephthalate (PET, PETE).
 - 2) Type 2: High Density Polyethylene (HDPE).
 - 3) Type 3: Vinyl (Polyvinyl Chloride or PVC).
 - 4) Type 4: Low Density Polyethylene (LDPE).
 - 5) Type 5: Polypropylene (PP).
 - 6) Type 6: Polystyrene (PS).
 - 7) Type 7: Other. Use of this code indicates that package in question is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.
 - b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and approved Integrated Pest Management (IPM) plan.
 - 1) Include potential environmental impacts of recommended maintenance procedures and materials.
 - 2) Include potential indoor air quality impacts of recommended maintenance procedures and materials.
 - 3) Where proposed maintenance procedures incorporate composting of plastics, assess potential effect of each type of plastic to be included in composting process in accordance with ASTM D5509 or ASTM D6002.
 - c. Identify take-back programs and appropriate contact information for:
 - 1) Ceiling tile.
 - 2) Office equipment.
 - d. Material Safety Data Sheets (MSDS): Include MSDSs as specified.

2. Develop environmental management programs for facility as follows:
 - a. Waste Management Program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
 - b. Indoor Air Quality (IAQ) Management Program: Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of VOCs (volatile organic compounds) in indoor air in accordance with ASTM D6345.
 - c. Water Management Program: Develop water monitoring program for surface and ground water on Project Site in accordance with ASTM D5851 and consistent with water management program utilized during construction operations.
- E. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference specification section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation:
 1. Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - a. Standard maintenance instructions and bulletins.
 - b. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

- c. Identification and nomenclature of parts and components.
 - d. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures:
 - 1. Include the following and items detailing essential maintenance procedures:
 - a. Test and inspection instructions.
 - b. Troubleshooting guide.
 - c. Precautions against improper maintenance.
 - d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - e. Aligning, adjusting, and checking instructions.
 - f. Demonstration and training video recording.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.
 - 1. Include procedures and required notifications for warranty claims.

PART 3 EXECUTION

3.1 GENERAL

- A. At start of Project, begin accumulating operation and maintenance data and initiate index. Install and index data in binders within 30 days after delivery of items. As custom written data and test results are produced, add to operation and maintenance data file.

- B. List of Operation and Maintenance requirements has been attached at end of specification for your convenience. Intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the Contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list.
- C. Keep operation and maintenance data current. Make operation and maintenance binders available to Contracting Officer for inspection at time of monthly progress payment requests. If operation and maintenance binders are not current, Contracting Officer may retain an appropriate amount of the progress payment.

3.2 MANUAL PREPARATION

A. Manual Types:

- 1. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and by NPS operating personnel for types of emergencies indicated.
- 2. Product Maintenance Manual: Assemble complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into Work.
- 3. Operation and Maintenance Manuals: Assemble complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

B. Manual Contents:

1. Including:

- a. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark sheet to identify product or component incorporated into Work. If data include more than one item in a tabular format, identify each item using appropriate references from Contract Documents. Identify data applicable to Work and delete references to information not applicable.
- b. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide startup and shutdown instructions.
- c. Equipment Data Sheets: For each item of equipment included in operation and maintenance data, provide Equipment Data Sheet using form at the end of this section. For equipment consisting of a driven machine and a

driver (for example, a pump and a motor), equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing individual equipment items.

d. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.

- 1) For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on control devices. Show control wires and devices remote from control panel.
- 2) For each control panel, provide general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include materials list of panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
- 3) For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
- 4) In addition to control wiring schematic, provide power wiring schematic drawing showing power flow to each motor. Identify each power conductor. Show over-current protection and motor starting devices.

C. Comply with Section 01 77 00, Closeout Procedures, for schedule for submitting operation and maintenance documentation.

D. Closeout and Operation & Maintenance (O&M) Requirements List: A Closeout and O&M Requirements list has been attached to the end of section. The intent is to provide an overall summary of the requirements and not a comprehensive list. The requirements of the individual specification sections, terms and conditions of the Contract still apply regardless of what is shown on the A Closeout and O&M Requirements list.

3.3 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Equipment Data Sheet.
2. Closeout-Operation Maintenance Requirements Template + Sample.

END OF SECTION

EQUIPMENT DATA SHEET	
Equipment Item: _____ Designation: _____ Function: _____ Location: _____ Project: _____ Model Number: _____ Serial Number: _____	
Manufacturer Address and Phone: _____ 	Supplier Address and Phone: _____
Preventive Maintenance Tasks: 	
Nameplate Data: 	
Spare Parts Furnished and Other Information: 	

