

SECTION 230170 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS**PART 1 - GENERAL****1.1 SUBMITTAL REQUIREMENTS**

- A. Closeout
 - 1. Operation and Maintenance Manual: For equipment and systems to include in operation and maintenance manuals.
 - 2. As-Built Drawings: For recording installed conditions that deviate from design documents.

1.2 OPERATING AND MAINTENANCE MANUALS

- A. The contents of operating and maintenance manuals shall include the following:
 - 1. Project Information Cover: Title of Project; Name and address of Owner, Design Professionals, Contractor of Record and Subcontractor; System name and specification references.
 - 2. Index: Contents of the manual.
 - 3. Warranty Statements: Furnish a warranty statement for each system, reiterating the terms of warranty identified within the Contract Documents, and identifying how the Owner is to obtain warranty service. Clearly identify which products are covered by Manufacturer warranties beyond the Contractor required minimum warranty period. The term of manufacturer warranty shall also be identified (e.g., 1-year parts and labor). Identify the date that the warranty for the system starts. This date shall be the date listed on the Certificate of Substantial Completion (if one was issued to the contractor specifically for the system) or the date listed on the Notice of Final Completion. Supply standard out-of-warranty service rates and service contact information.
 - 4. Bill of Materials: List of products supplied, and serial numbers of each product.
 - 5. Product Datasheets and Shop Drawings: Manufacturer datasheets and shop drawings for each product and system supplied.
 - 6. Manufacturer Owner / User Manuals: Manufacturer's Owner's or User's manual for each product, and Manufacturer's Installation instructions and other documentation supplied with the product.
 - 7. Spare and Replacement Parts Schedule:
 - a. Complete spare parts schedule for components of equipment furnished, which are not factory generic information, but accurate for the equipment provided.
 - 8. Maintenance Procedures: Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; testing, aligning and adjusting instructions.

9. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments. Function and Operating Descriptions: Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 10. Operating Procedures: Manufacturer's printed operating procedures including start-up, break-in, normal operating instructions, regulation, control, stopping, shutdown, and emergency instructions.
 11. Test Reports and Checklists: Test reports, checklists, and other forms generated and completed for the Project.
 12. Training Information: Copy of training outlines/agendas, training session handouts, training sign-in sheets, and signed delivery receipt for each training session recording; Separate USB drive, labeled, for audio/video-recorded instructions to Owner, for operations and maintenance for each system.
 13. As-Built Drawings.
- B. Organization - A manual of such purpose shall be arranged in two parts, with Part I dealing with information pertaining to systems and Part II covering information pertaining to equipment. These may be bound in as many volumes as may be required for convenience of use and reference.
1. Part 1 - Systems:
 - a. The systems volumes shall be organized into Divisions wherein each Division represents a generic function. Systems shall be classified under appropriate Divisions. An example of such an arrangement is as follows:
 - b.

Division Title	Division No.
1) Cooling	1.0
a) Air Conditioning	
2) Heating	2.0
3) Ventilating	
a) Kitchen Exhaust	
b) Toilet Exhaust	
 - c. The material for each system shall be organized in sections descriptive of the following basic areas of information:
 - 1) Descriptive Information.
 - 2) Operating Instructions.
 - 3) Inspection and Maintenance Instructions.
 - d. Sections could be organized to include the following categories of information:
 - 1) Descriptive Information
 - 2) Function of service.
 - 3) Classification.
 - 4) Design capability.
 - 5) Performance characteristics.

- 6) Principal components.
 - 7) Distribution arrangement.
 - 8) Schematic diagram.
 - 9) Control diagram.
 - 10) Equipment Data.
 - 11) Inventory designation.
 - 12) Manufacturer and model.
 - 13) Size and rating.
 - 14) Pressure, speed and temperature limitations.
 - 15) Operating Instructions.
 - 16) Starting and stopping procedures.
 - 17) Adjustment and regulation.
 - 18) Seasonal start-up.
 - 19) Seasonal shut-down.
 - 20) Logs and records.
 - 21) Inspection and Maintenance.
 - 22) Inspection schedule and checklist.
 - 23) Schedules and procedures for lubrication, replacements, adjustment, cleaning, painting, protection and testing.
 - 24) Inspection and maintenance records.
- e. Reference Documents:
- 1) Construction drawing list.
 - 2) Construction specifications.
 - 3) Record drawings.
 - 4) Test and balance records.
2. Part 2 - Equipment:
- a. This part of the manual shall be composed of manufacturers and fabricators data on equipment and materials organized into divisions wherein each division represents a generic classification of equipment such as:
 - b. Division Title
 - 1) Air Conditioning and Ventilating
 - 2) Controls
 - 3) Instrument and Accessories
 - c. Each division shall be organized in sections wherein each section would represent a specific type of equipment in Division 1, the sections shall include the following:
 - 1) Air Conditioning and Ventilating
 - a) Coils - Cooling
 - 2) Fans
 - a) centrifugal
 - d. Each section shall include the following manufacturer information:
 - 1) Descriptive Literature

- a) Catalog cuts, brochures or shop drawings
- b) Dimensional drawings
- c) Materials of construction
- d) Parts designations
- 2) Operating Characteristics
 - a) Performance tables and charts
 - b) Performance curves
 - c) Pressure, temperature and speed limitations
 - d) Safety devices
- 3) Equipment Startup Sheets
 - a) Complete equipment configuration settings
- 4) Operating Instructions
 - a) Pre-start check list
 - b) Start-up procedures
 - c) Inspection during operation
 - d) Adjustment and regulation
 - e) Testing
 - f) Detection of malfunction
 - g) Precautions
- 5) Inspection Instruments and Procedures
 - a) Normal and abnormal operating temperature, pressure and speed limits
 - b) Schedule and manner of operation
 - c) Detection signals
- 6) Maintenance Instructions and Procedures
 - a) Schedule of routing maintenance
 - b) Procedures
 - c) Troubleshooting chart
- 7) Parts List
 - a) Spare Parts
 - b) Essential inventory
 - c) Distributor directory
- 8) Service and Dealer Directory
- 9) Service Contracts

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTRUCTIONS FOR THE OWNER'S PERSONNEL

- A. Train or engage for factory-authorized service representative to train Owner's operating and maintenance personnel. Provide instruction in the proper operation and maintenance of equipment that requires routine servicing. Include the following:
 - 1. Review of operation and maintenance manuals.

2. Required tools.
3. Lubricants.
4. Spare parts.
5. Cleaning.
6. Hazards.
7. Warranties and maintenance agreements.

B. Demonstrate equipment and systems operation including the following:

1. Start-up.
2. Shut-down.
3. Emergency conditions.
4. Safety procedures.
5. Setpoint and schedule adjustments.
6. Economy and efficiency adjustments.

END OF SECTION 230170