

## SECTION 01 78 23

### OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Post operating instructions.
- B. Manual description.
- C. Submittal requirements.
- D. Submittal of final Operation and Maintenance (O&M) Manuals.
- E. Liquidated damages in regard to O&M Manual submittals.
- F. Off-the-Shelf Equipment Manuals.
- G. Native electronic file format for System Manuals
- H. Format and technical content for System Manuals.
- I. Printed Manual requirements.
- J. Electronic version of Manual (eManual) for System Manuals.
- K. Manual revision control.

##### 1.02 RELATED SECTIONS

- A. Requirements related to spare parts, maintenance materials, keys, special tools, and test equipment are specified in Section 01 78 44, Spare Parts and Maintenance Materials.
- B. Training manuals required for classroom and on-site instruction and training are specified in Section 01 79 00, Demonstration and Training.

##### 1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

##### 1.04 REFERENCES

- A. American National Standards Institute (ANSI)
  - 1. ANSI Y14.5 – Geometric Dimensioning and Tolerancing Standards

## 2. ANSI Y32.2 - Graphic Symbols for Electrical and Electronics Diagram

## B. BART Facilities Standards, Appendices/District Technical Manuals (BFS Appendix):

1. BFS Appendix Contract Drawing CADD Requirements (available from the Engineer upon request).

**1.05 POSTED OPERATING INSTRUCTIONS**

- A. Provide, where directed, printed sheets under framed clear acrylic plastic, giving brief, concise operating and maintenance instructions for all items of mechanical and electrical equipment and similar equipment and specialty items, as applicable, at their respective locations.

**1.06 OPERATION AND MAINTENANCE MANUAL DESCRIPTION**

- A. Manuals shall be provided for all equipment and systems furnished under the Contract that require maintenance, operation, or modification including testing and training equipment. Manuals shall also be provided for other items, such as finishes, when specified in the Contract Specifications. Provide Manuals for each item of equipment and its component parts.
- B. Prepare Manuals in English.
- C. Manuals will be subject to revisions, updates, and other alternations as determined by the District.
- D. Manuals shall be provided in one of the three following formats:
  1. Off-the-Shelf Equipment Manuals shall be provided for off-the-shelf items. Such equipment includes sub-assemblies and components that will be replaced instead of repaired or has no need for modifications, drawings, or manual revisions. Off-the-Shelf Equipment Manuals shall conform to the requirements specified in Articles 1.07, 1.08, 1.09 and 1.10 herein.
  2. System Manuals shall conform to the requirements specified herein. System Manuals shall be provided whenever stipulated in the Contract Specifications. Typically, such systems and equipment will include systems and equipment which have been specifically built for the District and which require repairs and modifications beyond the scope of manufacturer's pre-existing operation and maintenance instructions. Systems Manuals shall be BART specific and not include copies of manufacturer's operation and maintenance instructions and catalog cuts. Submit manufacturer's operation and maintenance instructions, if required, separately. System Manuals shall conform to the requirements specified herein with the exception of Article 1.10.
  3. Manuals for Elevators: Manuals containing manufacturers' operation and maintenance instructions and catalog cuts are acceptable for elevator manuals provided the manuals meet the technical content requirements set forth in Article 1.12 in addition to the requirements specified for Off-the-Shelf Equipment Manuals.

- E. Instructions and manuals from suppliers of District-furnished equipment will be furnished to the Contractor.

## **1.07 SUBMITTALS**

- A. General: Refer to Section 01 33 00, Submittal Procedures, for submittal requirements. Schedule submittal of manuals in coordination with other submittals for the subject system or equipment.
- B. Submit 6 sets of hard copy originals for review of each draft manual and for District's use of each final approval manual. For System Manuals, concurrently submit electronic media samples in native electronic file format with submittal of each draft and final approved manual with the exception of the Outline.
- C. System Manuals shall be submitted in accordance with the following requirements:
  - 1. Submit Outline, Complete Draft, and Pre-Final submittals for review before submitting final version.
    - a. Outline – Submit manual layout, sections and headings after final design of system or equipment has been approved.
    - b. Complete Draft – Submit all text and illustrations. Sample of binder and electronic files prior to first delivery of system or equipment.
    - c. Pre-Final – Submit complete manual in accordance with criteria specified herein.
  - 2. Pre-Final O&M Manual Review: Submit for approval prior to final acceptance tests for the particular system or equipment and no later than 30 days prior to initial training course for BART personnel.
    - a. Information gathered during final acceptance testing and training courses shall be used to develop final draft version of the manual.
- D. Off-The-Shelf Equipment Manuals:
  - 1. Submit draft Manual for review prior to initial delivery of particular equipment.
  - 2. For elevator Manuals prior to submittal of draft Manual, submit and obtain approval of the proposed Table of Contents including chapter numbers and titles.
- E. One set of each manual will be returned to the Contractor, marked with review-stamp-action-block marks as described in Section 01 33 00 – Submittal Procedures.
- F. Any non-compliant portions of the manual will be noted in the manual or otherwise communicated to the Contractor in writing by the Engineer.
- G. Revise manual returned to the Contractor marked “NOT APPROVED” and resubmit 6 sets for review within 30 days.

If the Engineer returns a manual to the Contractor that is marked “Approved” or “Approved as Noted”, make any noted corrections and submit copies of manual to the Engineer in its final printed form.

**1.08 SUBMITTAL OF FINAL OPERATION AND MAINTENANCE MANUALS**

- A. Schedule: Submit final manuals no later than 30 days following the satisfactory completion of Acceptance tests for the subject system or equipment.
- B. The requirements specified in this Article apply to both System and Off-the-Shelf Equipment Manuals.
- C. Submission of each Manual (except for Off-the-Shelf Equipment Manual) in its final form shall include two CD-ROMS of the electronic version (eManual) along with all native electronic files required to create the submitted Manual. Electronic files shall include a matrix or document showing how the files are set up and how to access them. Include no extraneous files.

**1.09 LIQUIDATED DAMAGES IN REGARD TO O&M MANUAL SUBMITTALS**

- A. Failure of Contractor to obtain approval within the required schedule of milestones for manuals will make the Contractor liable for liquidated damages. Milestones and liquidated damages are specified in the Contract Specifications Section 01 11 00 – Summary of Work.

**1.10 OFF-THE-SHELF EQUIPMENT MANUALS**

- A. Obtain through the Engineer a book number assigned by the District Technical Publications Administrator for each manual.
- B. Manuals shall consist of a legible copy of the manufacturer’s operating instructions and other operation and maintenance information available from the manufacturer.
- C. Manuals shall include legible copies of manufacturer’s catalog cuts with specific items bubbled or clearly marked with arrows. When it would be clearer to cross-out irrelevant portions of a page, neatly cross-out irrelevant information using a straight-edge. Manuals shall include catalog pages, manufacturer’s pre-printed maintenance and operations instructions, wiring diagrams, parts lists, warranty slips, and manufacturer’s certificates, as applicable and as required by the Engineer.
- D. Manuals shall contain a Table of Contents that reflects all procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters and/or sections of each manual.
- E. Divide each chapter or section of the manual using divider pages that comply with the requirements specified in Article 1.13 herein.
- F. Manuals for HVAC, Plumbing and Fire Protection equipment shall list the following information:
  - 1. Equipment identification

2. Make and model
3. Location of equipment
4. Filter sizes and quantities
5. Service and dealer directory including the authorized dealer name, phone number, address, email address, and web site for each piece of equipment.
6. Valve directory including the valve number, type, size, location and function.
7. Damper certification and verification.
8. Domestic water system cleaning and disinfection test results and report.
9. Air and water system balance reports.
10. Controls operation and maintenance data with wiring diagrams.
11. Approved seismic restraint inspection report, certified by professional licensed Seismic Engineer or approved representative.
12. Warranties: Submit effective date, expiration date, extent of warranty, name and contact information of firm providing warranty.

G. Binders for each Manual shall comply with the requirements specified in Article 1.13.

#### **1.11 NATIVE ELECTRONIC FILE FORMAT FOR SYSTEM MANUALS**

- A. The native electronic file formats are the programs used to create the Operation and Maintenance Manual.
- B. Text pages shall be created using MS Word, latest release in use by the District.
- C. Parts Lists created for Chapter 7, titled "Illustrated Parts Catalog"(all Volumes), shall be created using MS Excel, latest release in use by the District.
- D. Illustrations and drawings, including technical illustrations, shall be created using AutoCAD, latest release in use by the District, in accordance with the BFS Appendix Contract Drawings CADD Requirements.
- E. Text pages containing illustrations shall have the AutoCAD files inserted into the MSWord file as an object. AutoCAD files shall have a white background.

#### **1.12 FORMAT AND TECHNICAL CONTENT FOR SYSTEM MANUALS**

- A. Each Manual shall meet the following requirements:
  1. Be developed in conjunction with maintainability requirements.
  2. Be organized so that each major subsystem is treated as an integrated system and not as a grouping of disassociated parts.

3. Contain data required to maintain equipment during equipment service life.
4. Contain data required to operate and maintain test equipment during equipment service life.
5. Contain no extraneous information, such as advertisements or company or manufacturer's logos. Any reference to the manufacturer or contractor, other than necessary references to the equipment in the text, is considered advertisement. Manufacturer or contractor's name shall not appear in the page titles, headers, footers or anywhere else in the document.
6. Contain all operating instructions. If required, provide a separate operating manual.
7. Drawings and illustrations shall include details necessary for the installation, maintenance, and repair of equipment provided.

B. Numbering and Content Minimum Requirements:

1. Obtain through the Engineer a book number assigned by the District Technical Publications Administration for each Manual.
2. Each Manual shall be composed of one or more volumes titled and organized by subject matter. Each volume may be contained in one or more binders, if necessary, and shall be designated accordingly (i.e. Volume 1A, Volume 1B, Volume 1C, etc.). Manuals for complex, multi-component systems may be organized into volumes with each volume covering a subsystem or component of the greater system. Multiple volumes shall be used when specified in the Contract Specifications, when required by the Engineer, or when proposed by the Contractor and accepted by the Engineer.
3. Each volume shall be consecutively numbered (i.e. Volume 1, Volume 2, Volume 3, etc.).

C. Manual (or Volume in the case of multi-volume Manuals) shall contain a Table of Contents and be organized into nine specific chapters as outlined herein.

1. Chapter 1 – General Information and Specification
2. Chapter 2 – Theory of Operation
3. Chapter 3 – Troubleshooting
4. Chapter 4 – Primary Repair
5. Chapter 5 – Secondary Repair (Component Level)
6. Chapter 6 – Preventive Maintenance
7. Chapter 7 – Illustrated Parts Catalog
8. Chapter 8 – Miscellaneous
9. Chapter 9 – Wiring Diagrams

- D. Table of Contents shall reflect procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters, and sections of each manual, as applicable. Table of Contents shall list and contain the following:
1. Chapter titles
  2. Section titles
  3. Sub-section titles and corresponding page numbers
  4. Drawing titles, numbers and corresponding page numbers
  5. Figure titles, numbers and corresponding page numbers
  6. Table titles, numbers and corresponding page numbers
  7. Procedure numbers and corresponding page numbers.
- E. Each chapter shall have a Table of Contents which include the following:
1. Section Titles
  2. Sub-section titles and corresponding page numbers
  3. Drawing titles, numbers and corresponding page numbers
  4. Figure titles, numbers and corresponding page numbers
  5. Table titles, numbers and corresponding page numbers
- F. Chapters shall comply with the following requirements:
1. Chapter 1 – “General Information and Specifications”
    - a. A “List of Acronyms and Abbreviations” in the form of a table.
    - b. General non-technical description of equipment, including interface relationships and general functions.
    - c. Pictorial views of the subassembly components and parts described.
    - d. Tables listing the performance specifications of equipment.
  2. Chapter 2 – “Theory of Operation” shall provide a technically detailed description of equipment, by subsystem, including:
    - a. Location of parts in subassembly or component being discussed.
    - b. Location, function, and operation of pertinent controls, gauges, indicators, and switches.
    - c. Subsystem setup and shutdown procedures.

- d. Trouble symptoms and first-response diagnostic methods.
  - e. Emergency procedures and safety requirements.
  - f. Electrical wiring diagrams, electronic schematics, and mechanical configurations.
  - g. Block diagrams of provided subsystems, signal flow diagrams, including interface connections to other subsystems.
  - h. Applicable charts, figures and drawings to be located at the end of text for each subsystem.
3. Chapter 3 – “Troubleshooting” shall contain:
- a. Necessary information for troubleshooting and fault isolation.
  - b. Charts and tables as applicable listing symptoms and probable causes of improper operation or failure of subsystem and probable remedies.
4. Chapter 4 – “Primary Repair” shall contain the following information to allow maintenance to be performed at equipment location site:
- a. Detailed corrective maintenance procedures to be performed on equipment shall include particulars on testing alignment, adjustment and tuning. Include detailed views of mechanical parts or schematics for tests.
  - b. Step-by step procedures of installation and removal of components and subassemblies (field replaceable units).
  - c. Procedures for use of special test equipment.
  - d. Warning and caution notes as required.
  - e. Applicable charts, figures, and drawings to be located at the end of text for each subsystem.
5. Chapter 5 – “Secondary (Component) Repair”, shall contain the following in regard to maintenance to be performed in a shop other than equipment location site:
- a. Detailed corrective maintenance procedure to be performed on subassemblies and components shall include particulars on testing alignment and tuning. Include detailed views of mechanical parts or schematics.
  - b. Step-by-step procedures for installation and removal of parts in assemblies and components.
  - c. Procedures for use of special test equipment.
  - d. Incorporate warning and caution notes, as required.
  - e. Applicable charts, figures and drawings to be located at the end of text for each subsystem.

6. Chapter 6 – “Preventive Maintenance”, shall contain:
  - a. Preventive maintenance procedures, schedules, and tables including lubrication requirements and frequency of application.
  - b. Inspection and maintenance standards, including wear limits, settings, tolerances, and criticality of tolerances.
  - c. Storage instructions for spare parts, special tools and test equipment.
7. Chapter 7 – “Illustrated Parts Catalog”, shall contain:
  - a. Instructions for use of Illustrated Parts Catalog.
  - b. Index by subassembly.
  - c. Illustrations which are exploded views of assemblies, components, and parts with leader lines and circled callout numbers to each item.
  - d. Detailed Parts List, including:
    - 1) Figure Number
    - 2) Part index number, not to exceed 19 alphanumeric characters
    - 3) Space to allow for insertion of the District’s nine-digit stock number (group, subgroup, part no.)
    - 4) Description of part, including manufacturers and vendor’s part number
    - 5) Equivalent parts available from other manufacturers.
    - 6) Disposition of part (repairable, non-repairable, etc.)
    - 7) Quantity required per assembly
8. Chapter 8 – “Miscellaneous”, shall contain information that is deemed inappropriate for any other chapter including descriptive brochures, manufacturer’s certificates and warranty slips.
9. Chapter 9 – “Wiring Diagrams”, shall contain:
  - a. Applicable electrical, electronic, pneumatic, and schematic diagrams.
  - b. Wiring diagrams, including wire color code, size, and rating; terminal and connector pin numbers; and plug and socket numbers.
  - c. Pin-to-pin description of each wire, using wire-marking format. Additionally, wires at each terminal block and each connector shall be independently identified and cross-referenced at the next terminating point.
  - d. Diagram size in accordance with that previously stated in these specifications.

- e. PCB layout diagrams (artwork) for non-standard and non off-the-shelf printed circuit (PC) boards.

#### G. Front Cover Page Specifications

1. Front cover page shall be on white bond paper, 8.5" x 11", 60-pound minimum.
2. The Engineer will provide artwork for the front cover page. Artwork will include the District's logo artwork, title of the manual, book number, volume, user name, issue date, and the District's name, address and phone number.
3. Reproduce provided artwork.

#### H. Paper, Page Layout and Page Numbers

1. Paper used for text and drawings shall be 40-pound bond grade paper. All pages, except for drawings, shall be 8.5 x 11 inches, portrait style. Drawing pages shall be 8.5 x 11 inches or 11 x 17 inches.
2. Pages shall be 3-hole punched.
3. Pages shall be printed double-sided except 11 x 17 inch drawings.
4. Left, right and top margins shall be set at one inch from edge of page; Last line of body text shall be set 1.5 inches from bottom of page; last line of footer text shall be set 0.75 inch from bottom of page.
5. Page numbering depends on the size of the manual. Larger manuals shall be broken up into volumes and have sectional page numbers while smaller ones may be in chapters and sections, and have sequential page numbers (1, 2, 3).
6. As a general rule, number pages Chapter-Section-Page. If the chapters are not broken down into sections, number pages Chapter-Page. Any drawings or illustrations within each chapter shall have figure numbers, also reflecting Chapter-Section-Figure. The same applies for tables.
7. The page number shall appear at the bottom of the page with the book number on the first line, the volume number (if applicable) on the next line and the page number on the last line. Example: Book 50, Volume 10, Page 4-9-1. If the book does not have a volume number, the book number shall appear first, the chapter number shall appear on the next line and the page number on the last line.
8. For double-sided pages, the book, volume, chapter and page numbers shall appear at the bottom of the page, alternately, beginning on the right side for the first and odd-numbered pages of each chapter or section, and the left side for the even-numbered pages. If the book is printed one-sided, the numbers shall appear on the bottom, right-hand corner of each page.
9. The revision date shall appear at the bottom center on all pages with Rev. and the month (first three letters) a forward slash, and the year (last two numbers). Example: Rev. Dec/94.

10. New sections and chapters shall begin on a right-hand facing page. At the end of each chapter or section if there is a blank left-hand page, print on the left-hand page, "This page intentionally left blank," in whatever font style the body text of the document is.
11. Fan-fold 11 x 17 inches pages to 8.5 x 11 inches. For pages larger than 8.5 x 11 inches, display page identification on last fold of folded page so as to be readable without unfolding.
12. Each 11 x 17 inch illustration shall be considered as one page. There shall be no double page numbering (Example: Page 11/12).

I. Font and Paragraph Layout: Samples will be provided upon request.

1. Body text shall be 10 pt. Arial font, except as otherwise specified.
2. Body text shall be left justified, ragged right and single-spaced, with 12 pt separating paragraphs.
3. Titles and first level headers shall be 10 pt. Arial, unless otherwise specified, bold and all caps. Second level headers or subheadings shall be 10 pt. Arial, bold, and upper and lower case.
4. Titles of procedures shall be all caps, bold, and centered on the page.
5. Bullets:
  - a. First level bullets shall be solid style and indented once under margin of last level text, with one space between bullet and beginning of text.
  - b. Next level bullets (used when listing information below a bullet) shall be dash style and indented twice with one space between dash and beginning of text.
6. Indents shall be 0.5" (five spaces).

J. Notice Messages:

1. Notice Messages: Warnings, Cautions and Notes are notice messages. They shall all be in bold type with no lines or borders around them. Notice messages shall be formatted as follows:
  - a. "WARNING!" is the most important. It denotes something that is life threatening or can severely damage the equipment or system if the procedure is not followed properly. Warnings shall be in all caps, bold, two points larger than the regular body text, and flush with the section in which they appear. Warnings shall end with an exclamation point.
  - b. "CAUTION:" is used when injury or equipment damage can occur if procedure is not followed properly. Cautions shall be all caps, bold, indented, two points larger than the regular body text, and flush with the section in which they appear. Cautions shall end with a colon.

- c. "Note:" flags important information. Notes shall be bold, two points larger than the regular body text, and in upper and lower case. Notes shall be indented under margin of last level text (but not underlined).

K. Technical Illustrations:

1. Draw illustrations, including "exploded" views and illustrated part breakdowns. Utilize illustrations to facilitate descriptions of assemblies and the relationships of components, subsystems, and systems. Illustrations shall conform to the requirements and the recommendations of referenced ANSI Standards.
2. Technical illustrations shall comply with the following requirements:
  - a. Illustrations shall include details necessary for the installation, maintenance and repair of all equipment provided.
  - b. Each illustration shall be designated as a "figure". The word "Figure," accompanying numerical designation and caption shall be the same size, style, and type as the written text. Its physical location shall be the same on each page.
  - c. Figure numbers and descriptions of figures shall be readable in the horizontal position as you read the page from left to right.
  - d. Figures containing graphics, illustrations, diagrams, and similar drawings, shall appear at the end of the applicable section or procedure.
  - e. Pages containing illustrations, charts and tables shall be size 8-1/2 x 11 inches or 11 x 17 inches (fan-folded to 8-1/2 x 11 inches). Pages which are 11 x 17 inches shall be landscape style. These also include Chapter 9 drawings.
  - f. Folded sheets shall display identification on last fold, readable without unfolding.
  - g. Whenever callout numbers are used in an illustration, they shall be circled.
  - h. Graphic symbols used for electrical and electronics shall conform to ANSI Y32.2.
  - i. Graphic symbols used for logic diagrams shall conform to ANSI Y14.5.
  - j. Drawing file and drafting requirements including line convention and lettering shall conform to the BFS Appendix Contract Drawing CADD Requirements.

L. Revisions to Text and Drawings:

1. Revisions shall be made for design changes, retrofits, and errors as required, and based upon changes generated during testing. These revisions shall be listed on a List of Effective Pages to be issued with each review submittal and revision of the manuals until expiration of the Contract.
2. Include at the beginning of each completed manual or volume, a Configuration Control Record form adhering to the format provided by the Engineer. Form shall

include columns for the chapter, page number, BECO number, revision number, revision date, and revision description.

3. Refer to Article entitled "Manual Revision Control" herein for revision requirements applicable to revisions to final draft and approved manuals.

### **1.13 PRINTED MANUAL REQUIREMENTS**

#### **A. Binder Specifications:**

1. Manuals shall be bound in three-ring, O-ring binders, ranging in thickness from one to three inches depending on the size of each volume. If the Engineer accepts use of binders with a thickness greater than 3 inches, binders shall be heavy-duty type acceptable to the Engineer. Binders shall be white in color and have clear plastic slip-in pockets on cover and spine. Cover material shall be virgin vinyl .014 ga. inside and out, sealed over 120 point chip board with serrated hinges. Binders shall be durable and capable of long-time service in maintenance shop environment. Covers shall be oil, water, and wear resistant. Rings shall not bend or misalign under normal shop conditions and should be able to hold contents without bending or misaligning. Binder rings shall be manufacturer's standard diameter designed to accommodate standard three-hole punching. Binders shall contain front and back plastic sheet lifters.
2. The Engineer will provide artwork for front cover and spine. Label cover and spine with slip-in printed sheets in accordance with format provided by the Engineer. Artwork for front cover and spine will include the name of the manual, volume, book number printed in a visible location. Artwork will include San Francisco Bay Area Rapid Transit District, 300 Lakeside Drive, Oakland, California 94612 printed in the lower left hand corner of the cover. Artwork on spine shall begin one inch from top of spine.
3. Maximum size of binders shall be 11.5 inches high and 11 inches wide.
4. Binders shall accept 8.5 x 11 inch pages.
5. Manuals shall lie flat when opened. Pages shall not bind or join when turned for normal reading.
6. Manuals shall allow enough space for insertion of revised pages.

#### **B. Divider Page Specifications: Each chapter including the table of contents shall have divider tabs. The chapter number and title shall be printed on both sides of the tab.**

1. Divider pages with tabs shall be white in color, 8.5 x 11 inches in size, card stock, and three hole punched for ring binders. Holes shall be reinforced with a strip of mylar.
2. Tabs shall be white in color with 3/8 inch extension with rounded corners and shall comply with the following requirements:
  - a. Have bold capital letters, Arial font, using black ink and printed on both sides.
  - b. Have five tabs per bank type with mylar-reinforcement on both sides of tab.

- c. Slide-in type tabs are not acceptable.
- 3. Sample of divider tab will be available upon request.
- C. Final Assembly: All hard copies shall be printed out, assembled, and placed in binders. Each volume (if applicable) or book shall be assembled in the following order:
  - 1. The first section for each volume or book shall contain the cover sheet for that volume/book, the BART Configuration Control Record for that volume/book and the master Table of Contents listing all of the chapters for the entire volume/book. When a volume is contained in more than one binder, each binder shall include a cover sheet, and master Table of Contents for the entire volume/book.

#### **1.14 ELECTRONIC VERSION OF MANUAL (eManual) FOR SYSTEM MANUALS**

- A. The eManual shall be created from the native electronic files, as specified in Article 1.11, herein, using Adobe Acrobat, (latest release in use by the District).
- B. Each PDF file shall contain a chapter and each file shall be named according to its book number, volume, and chapter (example: BkXXvol01chap01.pdf).
- C. Each item listed in the Table of Contents shall hyperlink to the corresponding sub-section, drawing, figure, or table.
- D. The Table of Contents shall have Bookmarks to all corresponding pages.
- E. Any references to Figures or Tables within text pages shall be hyperlinked to the referenced document(s).
- F. In Chapter 7, entitled “Illustrated Parts Catalog”, each item number callout in the illustration will be linked to the corresponding sub-assembly or line item number listed in the Parts List.
- G. Link properties shall be as follows unless otherwise noted or approved by the Engineer:
  - 1. Type: Invisible Rectangle
  - 2. Highlight: None
  - 3. Action Type: Go to View
- H. All Chapter PDF files for each Volume shall be on the same CD. The CD shall be labeled according to the book number, book title, volume number, volume title, and creation date.
- I. Each CD shall have a PDF file of the Volume’s Table of Contents. The file shall be named according to the book number, volume number, Table of Contents (example: BkXXvolXXTOC.pdf). The Table of Contents shall be linked from the Chapter listing to the Chapter PDF file. The links shall enclose the complete Chapter listing and use the same properties as described above with the exception being the Action Type shall be “Open File”.

**1.15 MANUAL REVISION CONTROL**

- A. Revisions of final draft and approved Manuals shall be listed on a Configuration Control Record form in the front of each Manual. The list shall be issued with each revision and shall show the date of each revision and the page reference.
1. Contractor shall maintain updated lists and revisions in the Manuals until the warranty period expires. Revisions shall be prepared prior to the arrival of altered components, and as soon as possible after procedures are changed or errors are found.
  2. Contractor shall provide revisions to the approved Manuals on a not less than quarterly basis during the first 12 months after the final Manuals are delivered, and then on a not less than semi-annual basis for the duration of the warranty period.
  3. Contractor shall issue revisions related to major alterations of principal subsystems or assemblies prior to the arrival of components.

**PART 2 – PRODUCTS**

Not Used

**PART 3 – EXECUTION**

Not Used

**END OF SECTION 01 78 23**