Systems Manual: The Most Neglected Cx Deliverable

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Learning Objectives

1. Understand Systems Manual format and content
2. Understand Commissioning Team Roles and Responsibilities in relation to the Systems Manual
3. Reduce Systems Manual production costs to increase CxA profitability.
1. Key steps to developing a useful Systems manual
2. The format and information included in a systems manual.
3. Keys to obtaining useful information for the building operators and users
4. Contractual requirements for successful system manual development
5. Roles and Responsibilities of Systems Manual Contributors


7. Systems Manuals need to be updated throughout the life of the building as systems and buildings change. Demonstrate ways to make the Systems Manual editable and usable for Facility Operators
Keys to a Useful Systems Manual

O&M Manual vs System Manual
Keys to a Useful Systems Manual

O&M Manual vs System Manual

Front Control Assembly

1. Disconnect the negative battery cable.
2. Remove the ashtray.
3. Remove the retaining screws over the ashtray cutout in the dashboard.
4. Remove the finish panel by grasping the outer edges and pulling outward until the retaining clips have been disengaged.

Climate Control

A. Fan Speed Control. Rotate the knob to adjust the volume of air circulated in the vehicle.
B. Temperature Control. Rotate the knob to adjust the temperature of the airflow inside the vehicle.
C. MAX A/C. Uses recirculated air to quickly cool the vehicle. MAX A/C is noisier than A/C, but is more economical and efficient. This mode may reduce undesirable odors from entering the vehicle.
D. A/C. Uses outside air to cool the vehicle. Airflow will be from the instrument panel vents.
Provide Information Needed to Understand and Properly Operate the Building & Assemblies.

Make it Understandable to People who are Unfamiliar with Project.

Documentation Requirements and Responsibilities must be Included in the Contracts (Design and Construction)
Systems Manual Format and Information

MAIN MENU

- • EXECUTIVE SUMMARY
- • FACILITY INFORMATION
  o • Contact Information (Team Effort)
  o • Facility Description (Designers)
  o • Owner's Project Requirements (OPR) (By Owner)
  o • Basis of Design (BoD) and Design Calculations (Designers)
  o • Record Submittals (Contractors)
  o • Test and Balance Report (Contractors)
  o • Warranty Information (Contractors)
- • BASIC OPERATIONS & MAINTENANCE
  o • Expectations (Designers)
  o • Preventative Maintenance Schedule (Contractors)
  o • Manufacturer's Installation / O&M Manuals (Contractors)
  o • Safety Manual
  o • Site Events Log (By CxA)
- • COMMISSIONING RECORD AND RECOMMENDATIONS
  o • System Optimization Recommendations (By CxA)
  o • On-Going Commissioning Plan
    * • Blank Functional Performance Test Forms (By CxA)
  o • Final Commissioning Report (By CxA)
    * • Installation Checklists (By CxA)
    * • Functional Performance Tests (By CxA)
- • GENERAL CONSTRUCTION DOCUMENTS
  o • Record Specifications (Designers)
  o • As-Built Drawings [BIM] [Shop Drawings] (Designers, Contractors)
Systems Manual Format and Information

Organize by System

- System Diagrams
  - Equipment Sheets
    - Links to all related Information
      » Descriptions
      » OPR & BoD
      » Submittals
      » TAB Report
      » Warranties
      » ETC, ETC.
Systems Manual Format and Information

Navigation & Information Links

Information Links

Set Points (Info)
1. **SYSTEM DESCRIPTION**
   a. Chilled water is provided by the central plant via a heat exchanger with a local backup air cooled chiller. The system consists of:
      1) Variable speed pumps (P-01 and P-02) supply water from the central plant loop to a chilled water heat exchanger (CHX-1).
      2) Variable speed pumps (P-03, P-04 and P-05) circulate the water through CHX-1 and throughout the building.

2. **DESIGN CRITERIA**
   a. Parallel Lead-Lag-Standby variable speed pumps circulate chilled water through the Chilled Water Heat Exchanger and the primary Chilled Water loop.
Systems Manual Format and Information
Strategies for a Quality Systems Manual

Plan Early

• Define the Systems Manual in the OPR
• Spell it out in peoples contracts
  ○ Be specific
  ○ Put your requests in writing – What, When, How

Be Organized

• Make it easy for people to give you information
  – Electronic File Sharing,
    ○ FTP, Cloud
• Keep it organized
  ○ Template Directory Structure

Organization Tools

• Directory Templates
• FTP Sites
• Cloud Sharing – Dropbox, Google Docs, MS Office Web Apps

Systems Manual Formats

• Hard copy – Printed Binders
• Adobe Acrobat - PDF
• Web Browser based
  ○ HTML
  ○ PHP
• Other?
# Tools for a Quality Systems Manual

## Systems Manual Formats

<table>
<thead>
<tr>
<th>Technology</th>
<th>Ease of Use</th>
<th>Customizable</th>
<th>Production Costs</th>
<th>Updateable</th>
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Key:  Bad ★  Good ★★★★★  Low Cost $  High Cost $$$$$$$

Created by PHP Programming

MAIN MENU

- EXECUTIVE SUMMARY
- FACILITY INFORMATION
  - Contact Information
  - Owner’s Project Requirements
  - Basis of Design
  - Record Submittals
  - Test and Balance Report
  - Warranty Information
- BASIC OPERATIONS AND MAINTENANCE
  - Site Events Log
- COMMISSIONING RECORD AND RECOMMENDATIONS
  - Commissioned Systems
  - Installation Checklists
  - Functional Tests
  - Blank Functional Performance Test Forms
  - Final Commissioning Report
- CONSTRUCTION DOCUMENTS
  - Drawings

SYSTEM INFORMATION

PLUMBING SYSTEMS
- Systems Information

HYDRONIC SYSTEMS
- Systems Information

VENTILATION SYSTEMS
- Systems Information

ELECTRICAL SYSTEMS
- Systems Information

Typical System Manual Directory Structure

- Project Organization
- PHP programming can automatically generate most of systems manual

Typical System Manual Directory Structure

• Project Organization
• PHP programming can automatically generate most systems manual
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Thank-you!

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