

^{A16}**SECTION 40 95 13.16 – PROCESS CONTROL HARDWARE FOR FIRE FIGHTING CONTROL SYSTEMS (FFCSs)**^{A16}

1.01 SUMMARY:

A. **General:** This Section covers the performance requirements, design, installation, and commissioning of industrial process control systems for the standpipe fire protection system and the locks foam concentrate / water systems [as part of the Works](#). This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 40 95 13.16-1.

B. **Related Sections:**

Table 40 95 13.16 – 1: Related Sections		
1.	Section 01 81 26	- Communications, Control, Safety, and Security Systems.
2.	Section 01 86 13	- Plant-Mechanical Systems and Equipment.
3.	Section 25 11 00	- Data Processing Equipment.
4.	Section 26 13 00	- Medium Voltage Switchgear.
5.	Section 26 24 19	- Motor Control Centers.
6.	Section 40 00 00	- Process Systems Integration.
7.	Section 40 95 13	- Process Control Hardware.
8.	Section 40 96 45.16	- Process Control Software for FFCS.

1.02 REFERENCES:

A. **Applicable Publications:** Refer to Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.02.

1.03 REQUIREMENTS:

A. **General:**

1. The Contractor shall meet all applicable requirements of Section 40 00 00 (*Process Systems Integration*), Paragraph 1.03, and Section 40 95 13 (*Process Control Hardware*), Paragraph 1.03.
2. FFCSs in Atlantic and Pacific lock complexes shall be independent from each other.
3. Locks foam concentrate / water systems shall operate to protect the North and South entrance areas of the locks facility. The standpipe fire protection system shall provide fire hydrants along the lock. The FFCS shall control, monitor and operate the standpipe fire protection system and the locks foam concentrate / water systems.
4. The siren or sirens shall have a different siren sound for each entrance to allow easy identification of active protection area.

B. Control Architecture:

1. A master programmable logic controller (PLC) shall be used to coordinate the system's operation. A redundant master PLC is desirable but not required. Each firefighting equipment room (FER) shall use a slave PLC.
2. A single Ethernet link via fiber optics shall be used to communicate the master PLC and the slave PLCs. The fiber optic modems in the equipment room of the main control building shall be installed together in a chassis rack and rack mounted.
3. The non-redundant master PLC for the FFCS shall be application redundant with the master PLCs of the locks machinery control system (LMCS). Thus, if the FFCS master PLC fails, the LMCS master PLCs shall take over the operation of the FFCS, and vice-versa.
4. Architecture shall be a star configuration as shown in Figure 40 95 13.16 – 1, conceptual FFCS architecture.

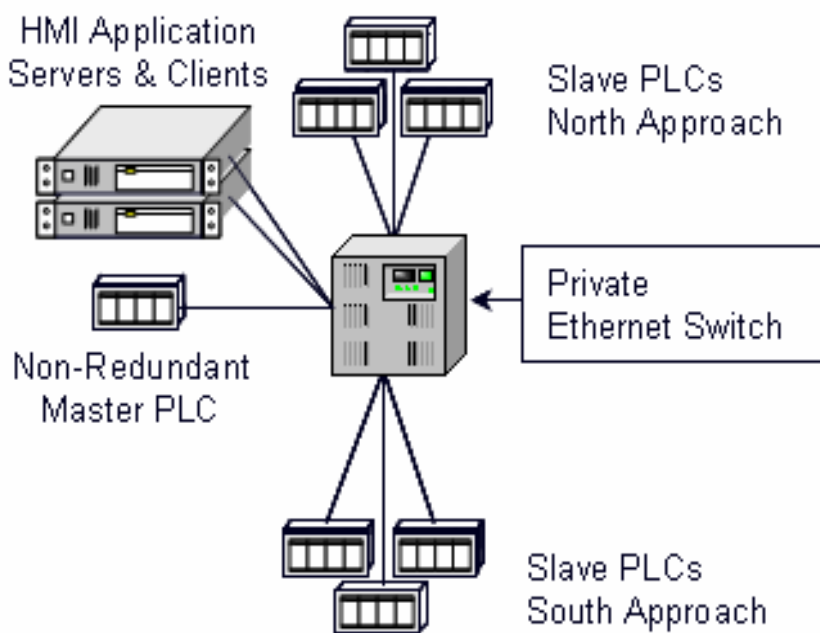


Figure 40 95 13.16-1: Conceptual FFCS Architecture

C. Equipment:

1. Data processing equipment shall be in accordance with Section 25 11 00 (*Data Processing Equipment*).
2. Process control hardware shall be in accordance with Section 40 95 13 (*Process Control Hardware*).

D. Software: Shall be in accordance with Section 40 96 45.16 (*Process Control Software for Fire Fighting Control Systems*).

E. Installation:

1. **General:** FFCSSs shall be installed by a certified body.
2. **Pressure Transducers:** Shall be installed on both sides of each conduit valve.
3. **Workstations:** FFCSS clients do not require dedicated workstations. Instead, FFCSS application shall be integrated in Locks Machinery Control System (LMCS) Machinery Control Stations (MCSs) for operations and LMCS Machinery Diagnostics Stations (MDSs) for maintenance.

1.04 DESIGN CRITERIA/ SYSTEM PERFORMANCE:

A. General:

1. **Problem to be Solved:**
 - a. To provide FFCSSs compliant with NFPA standards specified in Section 01 86 13 (*Plant - Mechanical Systems and Equipment*) for the corresponding mechanical counterpart, and with all other relevant requirements of that Section.
 - b. Provide FFCSSs that are reliable and capable of withstanding the harsh environment within the locks complex.
 - c. Seamless integration of FFCSSs with the corresponding LMCS and electrical distribution control system (EDCS) hardware and software.
 - d. Use of standard fault tolerance and common failure mode avoidance concepts applied across the locks complex.
 - e. Ability to discharge lake water through the FER monitors and hydrants after foam concentrate supply ends, to keep protecting locks' Plant, tugboats, and fire fighting personnel.
 - f. ^{A3}Provide capability to discharge lake water through the monitors, hydrants, and fire department connections (FDCs).
 - g. Provide capability to discharge foam solution through monitors, FDCs, and foam chambers.
 - h. Provide capability to discharge foam concentrate through the FDCs. ^{A3}
2. **Restrictions to be Considered:** (reserved).

B. Activation Sequence:

1. **Activation Warning:** When an FFCS quadrant is activated, an audible siren shall sound and a warning timer shall start. The warning timer shall be user adjustable up to 60 seconds. When this warning time expires, both FERs at the lock entrance shall begin the water pump sequence. The activation sequence shall be cancelable at any time while the warning timer is timing, by the same activation station that initiated the activation. If the activation is cancelled, the siren and both pumps shall be shutdown.
2. **Water Pump Sequence:** When the water pump sequence is initiated, a foam warning timer shall start. This timer shall be user adjustable up to 60 seconds. When this warning time expires, the foam pump sequence shall begin at both pump rooms of the lock entrance. The water pump sequence shall be cancelable at any time while this warning timer is timing, by the same activation station that initiated the activation. If the water pump sequence is cancelled, the siren and both pump rooms shall be shutdown. Every time the water pump sequence is active, the standpipe system shall also be active.
3. **Foam Pump Sequence:** The foam pump sequence may be cancelled at any time, by any activation station. If the foam pump sequence is cancelled, both foam pumps shall be shutdown, and the water pump sequence shall remain active until another cancellation request is received. While the water pump sequence is active, the foam pump sequence shall also be able to be reactivated from any activation station.

C. Automated Features:

1. **Maintenance Testing:** System wide tests shall be possible without wasting foam concentrate by inhibiting the foam pump sequence. Other automated tests shall be designed to allow testing without monitor tower output and aimed at safely diagnosing:
 - a. Motor, motor starter or variable frequency drive (VFD) operation.
 - b. Relief valve operation.
 - c. Motorized valve operation.
 - d. Manual valve position.
 - e. Flowmeter calibrations.
 - f. Pressure transducer calibrations.
2. **Pipe Purging:** Control system shall automate pipe purging where required, and maintain pipe pressure when required.
3. **Water Flushing:** Control system shall include an automated procedure for water flushing pipe segments that handle foam concentrate after each foam pump sequence. This procedure shall be manually invoked.

D. **Control Areas:** The FFCSSs shall have the following control areas:

1. **Activation Stations:** The FFCSSs shall be activable from any of these locations:
 - a. Main control building, using the MCS HMI. One or more quadrants may be activated.
 - b. Lock master booths, using a push button with light indication per quadrant in a controls cabinet. This cabinet shall also include an emergency stop type button for canceling an activation command.
 - c. FERs, using a push button with light indication on the PLC control cabinet for the FER only. This cabinet shall also include an emergency stop type button for canceling an activation of a pump only.
2. **Control Center:** The control center shall operate the FFCSS through the MCS HMI and monitor the FFCSS through the MDS HMI in accordance with Section 40 96 45.16 (*Process Control Software for FFCSSs*).
3. **Monitoring and Annunciation:** At applicable facility entrances, FFCSS annunciation stations shall be provided, consisting of an operator interface flat panel as specified in Section 40 95 13 (*Process Control Hardware*), for the purpose of monitoring active quadrants and informing emergency personnel of updated status when they arrive at the facility.
4. **Firefighting Equipment Rooms (FERs):** Shall include all components in accordance to Section 26 13 00 (*Medium Voltage Switchgear*) and Section 26 24 19 (*Motor Control Centers*), respectively.

E. **Fail Safe Conditions:**

1. While system is idle, if a slave PLC loses communications with the master PLC, an alarm shall be activated and indication shall appear in both the machinery diagnostics station (MDS) human-machine interface (HMI) and the machinery control station (MCS) HMI. Under these conditions it shall be acceptable that the FER cannot be remotely started.
2. ^{A3}After the system has been activated, if a slave PLC loses communications with the master PLC, then the monitor tower controlled by this FER shall go into oscillation mode spreading extinguishing agent within water in the quadrant area.
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3. All control signals sent by the non-redundant master PLC shall be validated by the slave PLC at the FER prior execution of the control request with the purpose of avoiding false commands, by including a secure digital code with each instruction.

F. Instrumentation:

1. **General:** Flow and pressure instrumentation shall be as specified in Section 40 91 00 (*Primary Process Measurement Devices*).
2. **Actuated Valves:** All actuated valves shall have the following:
 - a. A position transducer to measure the valve aperture.
 - b. A pressure transducer before and after the valve.
 - c. A flow meter after the valve.
3. **Foam Concentrate Tanks:** A level gauge shall be provided in accordance to liquid level transducers in Section 40 91 00 (*Primary Process Measurement Devices*).
4. **Manual Valves:** All manual valves shall not require tamper switches or other instrumentation.
5. **Relief Valves:** All relief valves shall have limit switches to indicate relief operation.

G. **Emergency Shutdown:** FFCSSs shall have panic button(s) so that upon a false alarm, firefighting personnel can request emergency shutdown to avoid wasting foam concentrate and saving its high cost.

H. **Firefighting Equipment Room Testing:** By means of a setting at the MCS HMI, or by means of a keyed switch at each pump room, the foam pump sequence shall be inhibited for FFCSS testing purposes. Status indication of this feature shall be annunciated at the MCS HMI and the FER control cabinet.

I. ^{A3}**Extinguishing Agent Selection:** FFCSSs shall allow users to select between foam and water as the extinguishing agent. ^{A3}

1.05 SUBMITTALS: Shall be in accordance with Section 40 00 00 (*Process Systems Integration*), Paragraph 1.05.

1.06 QUALITY ASSURANCE: Shall be in accordance with Section 40 00 00 (*Process Systems Integration*), Paragraph 1.06.

END OF SECTION