

## SECTION 35 10 00 – WATERWAY AND MARINE SIGNALING AND CONTROL EQUIPMENT

### 1.01 SUMMARY:

- A. **Scope:** <sup>A17</sup>This Section covers the performance requirements, design, supply, installation, testing, and commissioning of complete marine signaling systems, as required for waterway safety in parts of the Works. <sup>A17</sup> This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 35 10 00-1.
- B. **Related Sections:**

Table 35 10 00-1: Related Sections		
1.	Section 01 81 19	- Lock Gates.
2.	Section 01 81 26	- Communications, Control, Safety, and Security Systems.
3.	Section 26 50 00	- Lighting Systems.
4.	Section 28 16 46	- Vehicular Control Systems.
5.	Section 35 12 00	- Vessel Detection Systems.
6.	Section 40 91 00	- Primary Process Devices.
7.	Section 40 94 43	- Programmable Logic Controllers.
8.	Section 40 95 13.13	- Process Control Hardware for Locks Machinery Control Systems.
9.	Section 40 96 45	- Process Control Software.
10.	Section 40 96 45.13	- Process Control Software for LMCSs.

### 1.02 REFERENCE:

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

### 1.03 REQUIREMENTS:

A. **General Requirements:**

1. **General:**

- a. The Contractor shall meet all applicable requirements of Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.03.
- b. Equipment and materials shall be rainproof, corrosion-protected, and minimum maintenance type under continuous operating conditions.
- c. Equipment performance shall not be affected by rain, fog, and sunlight.
- d. The systems shall be easily accessible for maintenance jobs.

2. **Coordination and Interoperability:**

- a. Operation of vehicular control devices specified in this section shall be coordinated with that of rising arm barriers (RABs) and road blockers (RBs) of Section 28 16 46 (Vehicular Control Systems).
- b. Navigational aid semaphores shall be coordinated with vessel detection systems (VDSs), in accordance with Section 35 12 00 (Vessel Detection Systems).
- c. Pedestrian crossing semaphores shall be coordinated with bridgeways, handrails, and walkways in accordance with Section 01 81 19 (Lock Gates).
- d. A locks machinery control system (LMCS) safety interlock shall disable moving a rolling gate (RG) with vehicle(s) on it.

B. **Equipment and Materials:**

1. **Alignment Lights:** Shall be used to guide vessels entering the locks chambers and shall be based on long life light emitting diodes (LEDs) or better light source, with high efficiency marine navigation lighting, and a high resistance to chipping and breaking.
2. **Arrow Signs:**
  - a. **General:**
    - 1) Arrow length shall be 3.3 m (10 ft) long or as required for viewing from distances up to 1,609 m (1 mile), whichever is the largest.
    - 2) Arrow signs shall be high contrast and two sided as required for clear visibility by the Employer's Personnel (pilots on board approaching vessels and lock operators in the control room).
    - 3) Arrow signs shall include local control cabinet with control hardware for both remote (from machinery control station (MCS) human-machine interface (HMI) display), local control, and support base.
    - 4) Brightness and colors for the arrow and associated lighting shall be coordinated with the Employer's Representative.
    - 5) Arrows signs shall be either electromechanical or electronic, as specified below.
  - b. **Electromechanical Arrows:**
    - 1) Arrow contours shall have neon lighting for nocturne viewing. The signs shall include a suitable motor for rotation.

- 2) Position feedback shall be provided by a 1 turn resolver, with 4 to 20 mA current loop output.
- c. **Electronic Arrows:**
  - 1) Unless other suitable technology is submitted by the Contractor and approved by the Employer's Representative, arrows shall be based on long life LEDs.
3. **Bells for Pedestrian Crossings:**
  - a. Units shall have high sound output, a rainproof enclosure with opening for directivity, flashing light, and warning sign with approved message.
  - b. Units shall be suitable for outdoor conditions.
4. **Hazardous Cargo Signal Lights:** Shall be as specified on Section 26 50 00 (Lighting Systems).
5. **Semaphores:**
  - a. Each lamp shall have 2,650 mm or higher mounting post, 300 mm or larger circular lens, black face finish, and mounting attachments as required. Lamps for vehicles and pedestrians shall have cap type visors.
  - b. Lamps shall be based on long life LEDs or better light source, and sealed airtight to protect from dust and humidity.
  - c. Controllers shall have NEMA 4X cabinet, and shall support flashing.
- C. **Software:** Shall be furnished in accordance with Sections 01 81 26 (Communications, Control, Safety, and Security Systems) and 40 96 45 (Process Control Software), and as required for system management and operation.
- D. **Installation:**
  1. **Alignment Lights:** Shall be installed in the center of the rolling gates on both sides, pointing the light beam horizontally.
  2. **Arrow Signs:**
    - a. Signs shall be installed at both extremes (lock approach structures) of Atlantic and Pacific locks complexes on the side that would become the center wall should a fourth lane be built in the future.
    - b. Signs shall be located where no Vessel can possibly collide with them.
  3. **Bells:** Shall be installed near all eight pedestrian and two vehicular crossings over the locks chambers, so that ringing sound points towards the corresponding crossing.

4. **Hazardous Cargo Signal Lights:** Shall be controlled by LMCSs of Section 40 95 13.13 (Process Control Hardware for Locks Machinery Control Systems).
5. **Semaphores:**
  - a. **General:** Units shall be as high as required for good visibility by Employer's Personnel.
  - b. **Semaphores for Pedestrian Traffic Control:** Shall be installed where most visible to both ends of all eight pedestrian crossings across chambers on top of RGs.
  - c. **Semaphores for Vessel Detection Systems (VDSs):**
    - 1) **General:**
      - a) Semaphores shall be furnished in accordance with Section 35 12 00 (Vessel Detection Systems), to warn and alert when a vessel is too close to a chamber wall or RG.
      - b) VDS related semaphores shall face upwards so that the Employer's Personnel (pilots) can easily see the green/yellow/red status at all times from the bridge of the vessel when transiting the locks.
      - c) VDS semaphore indication shall be available to the MCS and machinery diagnostics station (MDS) HMIs described in Section 40 96 45.13 (Process Control Software for LMCS). Semaphore lights shall be controlled from the nearest LMCS input / output (I/O) concentrator, typically in each rolling gate machinery room, by means of any of the fieldbuses listed in Section 40 91 00 (Primary Process Devices).
      - d) Semaphores shall be recessed so that Vessel tie cables are not obstructed nor semaphores damaged by these cables.
    - 2) **VDS Semaphores for Rolling Gates:** Shall be located on top horizontal surface of each RG at the center, and shall only operate when a vessel is present in a chamber and the RG is closed.
    - 3) **VDS Semaphores for Side Walls:** Each locks chamber shall have a semaphore embedded in the locks horizontal concrete surface near its corresponding sensor, and on both side walls.

## **1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:**

### **A. General:**

1. **Problem to be Solved:** Signaling and control devices shall solve the following business needs:
  - a. Provide audio-visual alignment and warning signals as required for locks operation.
2. **Restrictions to be Considered:** (reserved)

### **B. Design Criteria:** Signaling systems shall comply with the applicable International Maritime Organization (IMO) and Permanent International Association of Navigation Congresses (PIANC) recommendations, requirements, and standards.

### **C. System Performance:**

#### **1. General:**

- a. Signaling systems shall increase locks throughput and safety of the lockage operations.
- b. Equipment shall send LMCS data as required to avoid moving any RG when a vehicle is on the RG.

#### **2. Alignment Lights:**

- a. When the RGs are closed and vessel presence is detected, these lights shall be used as navigation aids to provide a horizontal beam reference indicating the chamber's center line, to assist Employer's Personnel (transiting vessel pilots) in aligning the vessel's center line with the locks chamber's center line.
- b. Such lights shall turn on only in the vessel direction of travel (one side of the RG) when the pilot elects to navigate along the locks chamber's center. These lights shall be turned off when pilots elect to navigate close to one side wall.

#### **3. Arrow Signs:**

- a. Arrow signs shall indicate to approaching vessels the lane availability for passage (pointing down), tie up and wait for turn (pointing sideways) or wrong direction indication (pointing up). <sup>A17</sup>Wrong direction indication notifies approaching vessels that other ships are leaving the locks through this approach. <sup>A17</sup>
- b. Arrow signs shall preserve the communications style of the existing locks, with angles and meanings as follows:

Angle	Meaning
0° or 180°	Entering arrow (or ready to receive
45° or 135°	Vessel will be received within 10 minutes
90°	Stand off (or please standby)
225° or 315°	Tie up to approach structure
270°	Vessels cannot be received

- c. Arrows shall be capable of showing other angles, for example to indicate to pilots which way to take should a fourth lane be built in the future.

4. **Bells:**

- a. Bells shall be used for audible annunciation of change of status for go/no go conditions in pedestrian and vehicular crossings.
- b. Bells for pedestrian crossings shall sound at least two minutes before and until related semaphores turn red.

5. **Hazardous Cargo Signal Lights:** Shall flash to announce working personnel in the area that a Vessel carrying hazardous cargo is either approaching the locks or inside the locks. Flashing rate shall be slow when approaching or leaving the locks, and fast when vessels are in the locks.

6. **Semaphores for VDS Navigational Aids:**

- a. VDS related semaphores shall allow Employer's Personnel (pilots) to know at all times the position of the vessel with respect to the chamber and RG in front, especially when entering the locks.
- b. Visual annunciation shall be green (normal), red (alarm generated by distance, speed or offset), and yellow (warning).

7. **Semaphores for Pedestrian Traffic:** Visual annunciation shall be green for go, yellow or flashing red for warning, and red for no go conditions.

**1.05 SUBMITTALS:** The following shall be submitted for substantiation purposes:

- A. **Design:** The following shall be in accordance with Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.05 D:
  - 1. Critical path method (CPM) diagram, with monthly updates.
  - 2. Descriptive literature.
  - 3. Drawings.
  - 4. Protection methods for corrosion, electrostatic discharge (ESD), fungus/humidity, lightning/surge, power distortion and harmonics, radio frequency interference / electromagnetic interference (RFI/EMI), thermal, and vibration.

5. Specifications.
  6. Any other data required for review.
- B. **Re-submittals Just Prior to Purchasing Materials:** All items in A., above, that have changed from original submittal shall be resubmitted in a design conference in accordance with Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.05.
- C. **Upon Receipt of Shipped Items in Panama:**
1. Instruction manuals for administration, installation, maintenance, and operation.
  2. Packing lists.
- D. **Prior to Issuance of Taking Over Certificate:**
1. As-built drawings.
  2. List of recommended spare parts.
  3. Test reports.
  4. Training services.
- 1.06 QUALITY ASSURANCE:** Shall include the following in accordance with Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.06:
- A. Factory Quality Control Tests (FQCT).
  - B. Final Field Inspection Tests (FFIT).
  - C. Spare Parts.
  - D. Warranty.

**END OF SECTION**

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