

SECTION 48 19 16 – INVERTERS

1.01 SUMMARY:

- A. ^{A17}**Scope:** This Section covers the performance requirements, design, supply, installation, training, testing, and commissioning of complete inverters, as required for uninterrupted 120 VAC power supplies in main control buildings as part of the Works.^{A17} This Section of the Employer's Requirements shall be read in conjunction with the sections listed in Table 48 19 16-1.

B. **Related Sections:**

TABLE 48 19 16-1: RELATED SECTIONS		
1.	Section 01 81 26	- Communications, Control, Safety, and Security Systems.
2.	Section 26 20 00	- Electrical Low Voltage Distribution Work.
3.	Section 26 33 00	- Direct Current Equipment.
4.	Section 26 33 43	- Batteries.
5.	Section 27 11 16	- Cabinets, Racks, Frames, and Enclosures.
6.	Section 28 13 00	- Access Control Systems.
7.	Section 28 16 00	- Intrusion Detection Systems.
8.	Section 40 91 00	- Primary Process Devices
9.	Section 40 96 45.13	- Process Control Software for LMCS

1.02 REFERENCE:

- A. **Applicable Publications:** Refer to 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).
- b. Associated electrical work shall be in accordance with Section 26 20 00 (Electrical Low Voltage Distribution Work).

2. **Inverters:**

- a. Inverters shall be always turned on (not standby) and supplying AC to critical equipment operable on 120 VAC in control and equipment rooms of the new Locks main control buildings, including Data Processing

Equipment (DPE), emergency lights, process control system (PCS) hardware, video walls, and other loads as required.

- b. Units shall be protected against overload and short circuit, including circuit breakers. Redundancy shall be N+1 or better.
- c. Inverters shall be compliant with UL 1012 and UL 60950, and shall be new. Refurbished, repaired, or used units are unacceptable.
- d. Inverters shall be designed for heavy-duty industrial service, and for ease of maintenance and serviceability.

B. Equipment and Materials:

1. Inverters:

- a. Inverters shall be modular, expandable, static, capable of synchronizing with the AC line, and designed for heavy-duty industrial service.
- b. Units shall have a digital control and supervision panel capable of storing calibration, operations, and configuration parameters in non-volatile memory. Digital control and supervision panel indications shall be available to the machinery diagnostics station (MDS) human-machine interface (HMI) as described in Section 40 96 45.13 (Process Control Software for LMCS) by means of any of the fieldbuses listed in Section 40 91 00 (Primary Process Devices).
- c. Cable terminals shall be sized for conductors with maximum allowable ampacity.
- d. Units shall be suitable for rack mounting and have the required number of fans and air filters for forced air ventilation. The loss of one fan shall not cause an inverter over-temperature failure, and fans shall be redundant to ensure maximum reliability/availability. The cooling system shall be easily replaceable without the use of special tools.
- e. Units shall have local and remote alarms for warning and shutdown failures, as well as local and remote indicators to provide status information for DC input power and AC output power.
- f. Inverters shall have the following or better characteristics:

TABLE 48 19 16-2: INVERTER CHARACTERISTICS	
Audible Noise	≤ 65 dbA at 1 meter, in accordance with ISO 7779
Cabinet	NEMA 1, metallic
Conversion Efficiency	92%
EMI (Electromagnetic-Interference) Suppression	< 32 dBmC and in accordance with FCC rules and regulations (47 CFR Part 15)

TABLE 48 19 16-2: INVERTER CHARACTERISTICS		
Indicators	Audiovisual	Overload and over-temperature
	Visible	Main/AC bypass operation
Input	Nominal	125 VDC
	Range	107 – 140 VDC
Meters		Output current and voltage, AC bypass input voltage
Output	Frequency	60 Hz \pm 0.02%
	Power Factor	0.7 leading or lagging
	Rating	As required per calculations, but no less than 2 kVA per module
	Regulation	\pm 2%
	THD	\leq 5%
	Voltage	120 VAC, sinusoidal, single phase, two-wire, grounded.
Overload Capacity	1 cycle	250%
	10 seconds	200%
Protection		Over-current, over-voltage, and under-voltage

2. **Automatic and Manual AC Bypass Switches:**

- a. Inverters shall have automatic and manual bypass switches. Units shall be static, sized as required to transfer AC loads to either commercial or inverted AC source without interruption of service.
- b. Transfer shall be imperceptible to users, and shall not exceed 4 mS.

C. **Installation:**

1. **AC Bypass Switches:** Automatic and manual switches shall be rack or wall mounted.
2. **Inverters:**
 - a. Units shall be rack mounted in main control buildings' electrical room.
 - b. Inverters shall be normally on-line with DC input. AC output shall be synchronized to bypass AC input.
 - c. -48 VDC battery banks for communications equipment shall not have inverter loads.

1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:

A. **General:**

1. **Problem to be Solved:** Inverters shall solve the following business needs:

- a. Provide high power quality, uninterrupted AC power to critical equipment operable on 120 VAC. This includes the following loads at both floors of the Main Control Buildings:
 - 1) CCSS devices that do not run on direct current.
 - 2) Lighting systems.
 - b. Depending on the Contractor's design, inverters and transfer switches may be required to provide reliable 120 VAC to access control systems (ACSs) and intrusion detection systems (IDSs), in accordance with Sections 28 13 00 (Access Control Systems) and 28 16 00 (Intrusion Detection Systems), respectively.
2. **Restrictions to be Considered:** (reserved)
- B. **Design Criteria:** Design shall be in accordance with Section 26 33 00 (Direct Current Equipment) and the applicable requirements of UL 1778.
- C. **System Performance:**
 1. Normally, inverters shall continuously generate clean, harmonic free, and stable AC power with a nominal power factor of 1 from DC input.
 2. The units shall provide means to bypass AC output automatically and manually. Bypass switch(es) shall transfer AC load automatically upon the following events:
 - a. When battery is discharged (low DC voltage shutdown or Low Voltage Battery Disconnect (LVBD) signal).
 - b. When DC input becomes unavailable.
 - c. When AC load becomes excessive.
 - d. When temperature goes beyond design limits.
 - e. When inverter fails.
 3. Inverters shall automatically revert to normal operation upon disappearance of the cause for automatic bypass.
- 1.05 SUBMITTALS:** Shall be in accordance with Section 26 33 00 (Direct Current Equipment), Paragraph 1.05.
- 1.06 QUALITY ASSURANCE:** Shall be in accordance with Section 26 33 00 (Direct Current Equipment), Paragraph 1.06.

END OF SECTION