

**SECTION 26 35 26
HARMONIC FILTERS**

SPEC WRITER NOTES:

1. Delete between //____// if not applicable to project. Also, delete any other item or paragraph not applicable to the selection and renumber the paragraphs.
2. Harmonic mitigation equipment is suggested for adjustable frequency drives 30 HP and above, and for areas in an electrical distribution system that are unusually rich in switch-mode power supplies and other non-linear loads.
3. It is suggested that the A/E model the harmonic-producing loads and use the load kVA, the harmonic profile of the load current, and the configuration of the electrical system to determine the type(s) of active and/or passive filters to be employed.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of harmonic mitigation filter equipment, indicated as filters in this section.

1.2 RELATED WORK

- //A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of nonstructural components.//
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and for providing a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

- a. Submit sufficient information to demonstrate compliance with drawings and specifications.
- b. Include electrical ratings, dimensions, weights, mounting details and materials, terminations, and connection diagrams.
- c. Complete nameplate data including manufacturer's name and catalog number.

SPEC WRITER NOTE: Include the following paragraph for projects in seismic areas of moderate-high, high and very high seismicities as listed in Table 4 of VA Handbook H-18-8, Seismic Design Requirements. Coordinate with the structural engineer.

//d. Certification from the manufacturer that the filters have been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.//

2. Manuals:

- a. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certification: Two weeks prior to the final inspection, submit the following.

- a. Certification by the manufacturer that the filters conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the filters have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the

extent referenced. Publications are referenced in the text by designation only.

- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 519-14.....Harmonic Control in Electrical Power Systems
 - 1100-05.....Powering and Grounding Electronic Equipment
- C. International Code Council (ICC):
 - IBC-15.....International Building Code
- D. National Fire Protection Association (NFPA):
 - 70-17.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
 - 508-99.....Industrial Control Equipment

SPEC WRITER NOTE: Edit the paragraphs below to conform to project requirements. Select type(s) of filter best suited to the project. Choose type of filters based on the harmonic line and neutral current profile of the load. Choose HP, kVA, or A rating of filtering equipment appropriate to the load requiring harmonic mitigation, and show on the drawings. Show series or parallel connection to the load.

PART 2 - PRODUCTS

//2.1 PASSIVE HARMONIC FILTER

- A. Provide each //adjustable frequency drive// //set of two adjustable frequency drives// //nonlinear load// as shown on drawings with a three-phase, three-wire external harmonic filter with the following requirements:
 1. The filter shall treat low frequency harmonics (5th, 7th, 11th, 13th, etc.) by a passive inductor/capacitor network.
 2. All internal wiring shall be copper.
 3. NEMA //1// //3R// enclosure.
 4. //kVA rating// //HP// //A// and V ratings of the filter shall be as shown on drawings.//

//2.2 ACTIVE HARMONIC FILTER

SPEC WRITER NOTE: Edit the paragraphs below to conform to project requirements. Three-wire filters are typically used for harmonic filtering with large adjustable frequency drive loads. Four-wire filters are typically used for harmonic filtering on the grounded conductor for triplen harmonics introduced by switch-mode power supplies.

- A. Provide each //adjustable frequency drive// //set of two adjustable frequency drives// //nonlinear load// as shown on drawings with a three-phase, //three-wire// //four-wire// external harmonic filter with the following requirements:
1. The filter shall treat low frequency harmonics (3rd, 5th, 7th, 11th, 13th, etc.) by microprocessor-controlled active power electronics which switch the AC power to control the output.
 2. Touchscreen display shall show harmonic spectrum data, line voltage and current, harmonic current, and reactive current, at a minimum.
 3. //kVA rating// //HP// //A// and V ratings of the filter shall be as shown on drawings.//

SPEC WRITER NOTE: Delete between
// ---- // if not applicable to project.
Also delete any other item or paragraph
not applicable to the section and
renumber the paragraphs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The filters shall be installed and connected in accordance with the approved shop drawings and manufacturer's instructions.
- //B. In seismic areas, filters shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.//

3.2 ACCEPTANCE CHECKS AND TESTS

- A. An authorized representative of the filter manufacturer shall technically supervise and participate during all of the field tests. The manufacturer's representative shall certify in writing that the equipment has been installed and tested in accordance with the manufacturer's recommendations.
- B. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage, required area clearances, and correct alignment.

- d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
- e. Verify grounding connections.
- f. Vacuum-clean filter enclosure interior. Clean filter enclosure exterior.
- g. Verify the correct operation of all indicating devices.
- h. Use a three-phase harmonic analyzer to measure voltage and current total harmonic distortion levels, with filter connected to and disconnected from the bus using the circuit protective device.
- i. Check doors for proper alignment and operation.

3.3 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the filters are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

- A. Furnish the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the filters, on the date requested by the //Resident Engineer// //COTR//.

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