



# **ABU DHABI SEWERAGE SERVICES COMPANY (ADSSC)**

## **GENERAL SPECIFICATION FOR ELECTRICAL WORKS**

### **DIVISION 16 ELECTRICAL**

### **SECTION 16080 POWER FACTOR CORRECTION CAPACITORS (PFCC)**

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## 1. GENERAL

- a) All items described within this section shall comply with the provisions of Section 15001: General M&E Requirements.
- b) Power Factor Correction Capacitors (PFCC) shall be provided to improve the overall power factor of the plant/equipment to 0.93 lagging (or better) to meet ADDC regulations.
- c) PFCC shall be designed and manufactured for automatic centralised operation for site-wide Power Factor compensation by employing multiple steps. It shall be contained within a standalone Factory Built Assembly (FBA) in a minimum Form 2 Enclosure as described under Section 16020: Factory Built Assembly (FBA).
- d) The enclosure shall be of equal height of the associated MCC and located adjacent to it or at other suitable location within the MCC room.
- e) The PFCC enclosure shall be fitted with forced ventilation fan and louvres as necessary. The IP rating when fitted with forced ventilation shall be at least IP43.
- f) The PFCC equipment shall be disconnected whenever the associated MCC is fed by a generator set.
- g) The PFCC enclosure shall be sized to accommodate an additional spare step of equal rating for future use.
- o) Internal wiring within the PFCC enclosure shall be fire-retardant to 105°C.
- h) The design of the PFCC shall take into account any harmonic filter installations connected to the same power distribution system so as to avoid any LC resonance with these and any upstream transformer reactances.

## 2. UNIT CAPACITORS

- a) Power Factor Correction Capacitors shall be self-healing type conforming to BS EN 60831.
- b) The PFCC shall be modular in design, highly reliable, dry, self-healing and use a metallised polypropylene film element, fully encapsulated in plastic housing.
- c) Capacitors shall have low losses (typically less than 0.5 watts per kVA),
- d) Capacitors shall be fitted with overpressure disconnect device and a wire-wound discharge resistor sized to automatically discharge the capacitor to less than 50V in less than one minute.

- e) Capacitors shall be used with capacitor-rated duty contactors specifically designed for switching of capacitive current.
- f) Each capacitor step shall be protected by quick-disconnect type fuseswitch fitted with recommended HRC fuses disconnecting all the 3 phases simultaneously.
- g) HRC fuses shall have built-in blown fuse indicator feature.
- h) Capacitors shall be designed to carry 135% of rated current and 110% of rated voltages continuously at 50°C.

### 3. DETUNED REACTORS/HARMONIC FILTERS

- a) Where required by the particular specification, the Contractor shall provide anti-resonance detuned reactors or filters deemed necessary to reduce the harmonic content in accordance with ADDC Regulations.
- b) International standards describing techniques for limiting harmonics are:
  - i. IEEE Std '519-1992 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems', or
  - ii. 'Engineering Recommendation G5/4-1 (Planning levels for harmonic voltage distortion and connection of non-linear equipment to transmission and distribution networks in the UK)'.

They shall be used, as appropriate, to ensure compliance with ADDC Regulations.

- c) Where Converters, Inverters or other significant contributors to harmonics are being installed, their anticipated additional harmonic content shall be summated with those of the existing load. Should the totals exceed those stipulated in ADDC Regulations the following shall be undertaken:
  - i. A survey, before the commencement of any installation activities, to determine the actual existing background harmonic levels present on site.
  - ii. A design exercise to assess the likely harmonic contributions of the new equipment together with those of the existing equipment.
  - iii. Suitable harmonic corrective devices, if required, shall be designed, sized and installed to reduce the Total Harmonic Distortion (THD) to within allowable limits.
  - iv. A failure of, or maintenance on, a single corrective harmonic device shall not cause the THD to rise to a point that the integrity of the system is challenged.
  - v. After completion of all installation activities, a further harmonic survey to determine the actual harmonic levels present on site to confirm the THD is within allowable limits.

### 4. POWER FACTOR REGULATOR

- a) The minimum number of capacitor switching steps shall be four (4) as far as practically possible for smaller rating capacitor banks and between 6 to 12 steps for others. The capacitors' kVAr shall be so chosen to provide maximum programming flexibility such as switching sequence 1:2:2:2, 1:1:1:1 etc. in order to maintain the power factor within the set limits for most of the operating time.
- b) An alphanumeric LCD, microprocessor-based automatic power factor correction regulator shall be provided to control steps and display measurement of the following:
  - i) Power Factor.
  - ii) Number of steps connected.
  - iii) Step connection and disconnection time.
  - iv) Actual current.
  - v) Reactive current.
  - vi) Active power.
  - vii) Reactive power.
  - viii) THD voltage.
  - ix) Alarm conditions as listed below.
- c) The regulator shall have built-in alarm relay for remote indication and following alarm conditions locally:
  - i) Low power factor.
  - ii) Abnormal power factor.
  - iii) Leading power factor.
  - iv) Overcurrent.
  - v) Overtemperature.
  - vi) Overvoltage.
  - vii) THD high.
  - viii) Capacitor overload etc.
- d) The regulator shall provide facility to manually energise/de-energise capacitor steps for the purpose of testing and verification of the required/set power factor.

### 5. FIELD TESTS

- a) The PFCC assembly shall be tested at site during commissioning as described under Section 15001: General M&E Requirements.
- b) The results so obtained shall be verified with the actual requirements and ADWEA Regulations. Modifications if any shall be carried out at no extra cost to ADSSC.

**END OF SECTION**

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