# TWEED SHIRE COUNCIL

# ELECTRICAL DESIGN SPECIFICATION

EL17

## POWER FACTOR CORRECTION

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## 1 CITATION

This document is named "Tweed Shire Council, Electrical Design Specification EL17 - Power Factor Correction."

## 2 ORIGIN OF DOCUMENT, COPYRIGHT



## 3 VERSIONS

| VERSION | AMENDMENT DETAILS | CLAUSES AMENDED | DATE ISSUED (The new version takes effect from this date) | Authorised by the Director of Engineering Services |
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| 1.1 | Original version | | 1 November 2005 | |
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## 4 STANDARDS

The equipment and materials supplied under this Specification must comply with the latest relevant Australian Standards, or, in their absence, with the latest relevant IEC Standards, together with the requirements of competent Authorities having jurisdiction over all or part of their manufacture, installation and operation.

In particular, all equipment and materials supplied must comply with the relevant requirements of the following Regulations, Standards and Reference Specifications.

AS 1013 Shunt Capacitors for Connection to Power Frequency Systems

AS 2987 Power Capacitors – Shunt Rated Voltages above 660V ac IEC 831

## 5 GENERAL

The power factor correction equipment must also comply with Standard Specification EL14 General Switchboard Requirements.

The control of power factor correction equipment must be such that no leading power factor can occur.

Power factor correction equipment must be indoor type unless otherwise specified.

The capacitors, control equipment and switchgear must be housed in free-standing type cubicles with suitable lockable doors to gain access to the capacitors.

The power factor correction equipment must be complete with all equipment, internal wiring, busbars and labels.

The power factor correction equipment must be suitable for the fault level of the system.

A suitable gland plate with glands or cable end boxes for mounting and terminating cables must be provided.

## 6 POWER FACTOR CONTROL

Automatic power factor correction must be provided for major medium voltage switchboards and motor control centres, where specified in the scope of works.

The equipment must be arranged for stepped operation, each step normally being 50k VAR or as specified.

Where there is a need to provide correction for large motor drives, and the remainder of the low voltage load on the MCC is relatively small, the capacitors may be controlled by contactors operated in step with the motor starter. A motor load detecting control must switch one or two correction "trimming" steps in, according to motor load current and consequently, power factor.

Trim correction control needs to be damped to avoid hunting.

Where the load of a switchboard or MCC consists of a number of feeders, automatic correction control must be provided by means of a multi-step power factor correction relay. The operation of the relay must ensure equal usage of steps.

Wherever power factor correction is installed, there must be a power factor meter provided in the incoming section of the switchboard. In addition indicating lamps must be provided to show which correction contacts are closed.

It must be the objective of all power factor correction equipment to maintain 0.95 pf (lagging) or closer to unity pf.

A suitably rated air circuit breaker must be provided as a main power isolator.

## 7 CAPACITORS

Capacitors must be mounted in a dedicated cubicle compartment, behind a separate door. The compartment must be ventilated by meshed louvres.

Each capacitor bank must be protected by three HRC fuses in fully shrouded holders.

Capacitors must be provided with discharge resistors.

Capacitor banks must be connected in delta, unless otherwise specified.

The use of poly-chlorinated biphenyl (PCB) as the capacitor impregnation is not acceptable.

Current limiting reactors must be fitted to each capacitor step to limit excessive initial charging.

## 8 CONTROL EQUIPMENT

The rating of contactors and current transformers must be at least 1.3 times the rated current of the capacitor bank.

Fuses for the capacitors must be 25% to 50% higher rated current than that of the capacitors.

Circuit breakers or contactors for high voltage capacitor banks must be restrike free when breaking capacitive loads.

Equipment, in general, must be higher rated to allow for any possible harmonics.

## 9 HARMONICS

The reactors and capacitors must be rated to withstand any additional stresses caused by harmonic loading. As a minimum reactors and capacitors must be rated to withstand voltages 20% larger than the rated system voltage.

Reactors must be installed in series with each capacitor step to tune the step to avoid any harmonic resonance or similar problems. The steps must typically be tuned to act as a low impedance to a resonant frequency between the third (3rd) and fifth (5th) harmonic. For a 50Hz fundamental the steps must typically be tuned in the range 175Hz to 230Hz.

The design of the power factor correction system must ensure there are no problems caused by either parallel or series resonant conditions.

The capacitors must have sufficient dielectric voltage stress to avoid premature failure due to harmonic distortion.

## 10 COOLING

The power factor correction system must incorporate adequate natural or forced ventilation as required by the manufacturer.