

TWEED SHIRE COUNCIL

**ELECTRICAL
DESIGN
SPECIFICATION**

EL05

INSTALLATION OF FIBRE OPTIC EQUIPMENT

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INSTALLATION OF FIBRE OPTIC EQUIPMENT

1 CITATION

This document is named “Tweed Shire Council, Electrical Design Specification EL05 - Installation of Fibre Optic Equipment”

2 ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally produced for Tweed Shire Council. This document is copyright to Tweed Shire Council.

3 VERSIONS

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

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 3000	Wiring Rules
AS	Telecommunications Handbook ;
AS/NZS 3080	Telecommunications Installations-Integrated telecommunications cabling systems for commercial premises;
AS/ASIF S008:2001	Requirements for Authorised Cabling Products;
AS/ASIF S009:2001	Installation Requirements for Customer Cabling (Wiring Rules);
AS	Communications Cabling Manual, Part 6, Separations.

The relevant clauses of all relevant Australian Standards and Codes of Practice, or in their absence, with the relevant IEC or British Standards.

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5 OPERATING CONDITIONS AND POWER SUPPLY SYSTEM

All equipment must be suitable for continuous satisfactory operation within the limits of operating conditions detailed in the specifications nominated within the scope of works for site conditions.

6 CABLE SPECIFICATION

Unless specified otherwise, the fibres and fibre cable must comply with the Standards Australia [AS/ASIF S008:2001](#). - Ray, can you check this

The fibre cable, in aerial installations, must be installed and attached to poles and buildings with appropriately specified parts designed for supporting ADSS cables

The construction of all fibre optic cables and quality of the fibres must be fully specified. The full specifications must be submitted to Council for final approval before any cable purchases can be made.

Minimum cable construction specifications must include:

- 1 cable description and or construction diagram;
- 2 relevant standards (if applicable);
- 3 construction details;
- 4 overall diameter;
- 5 mass per unit length;
- 6 minimum bending radii installed;
- 7 minimum bending radii during installation;
- 8 maximum tensile strength;
- 9 maximum temperature of operation;
- 10 maximum crush resistance;
- 11 maximum span (for aerial cables).

Minimum fibre specifications must include:

- 1 maximum attenuations at both standard wavelengths appropriate for the fibre;
- 2 minimum bandwidths (Mhz.km) at 850/1300nm for MM fibres;
- 3 chromatic dispersion coefficient for SM fibres (ps/nm.km) at both wavelengths;
- 4 numerical aperture;
- 5 cut off wavelength;
- 6 fibre core, cladding and coating diameters.

All fibre cables must be fully colour coded. Unless specified elsewhere, the colour scheme must be as per the standard telephone cable colour coding scheme.

1. All tubes within a loose tube cable must be colour coded.

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2. All fibres within the cable must be colour coded.

7 CONDUITS AND DUCTS

Where conduits and/or ducts are installed as part of the fibre cable installation, the requirements of all specifications nominated in the scope of works must be complied with.

All new conduits and ducts installed as part of the fibre cable installation, must be white, as per technical standard AS/ASIF S008:2001.

All new conduits and pipes installed as part of the fibre cable installation, must comply with AS/NZS 2053, as per technical standard AS/ASIF S008:2001.

All conduits and pipes used by the communications cable must comply with technical standard AS/ASIF S009:2001.

8 BRACKETS, SUPPORTS AND FIXINGS

Where brackets, supports and/or fixings are installed as part of the fibre cable installation, the requirements must comply with specifications nominated in the scope of works.

9 INSTALLATION

9.1 General Requirements

All fibre cables must be installed as per manufacturer's requirements.

The onus is on the contractor for the correct installation and compliance to the manufacturer's specification for all fibre optic cable runs.

In addition the onus is on the contractor to comply with the relevant Australia Standards and requirements listed within this specification.

If in doubt the contractor is required to seek written clarification from Council. Failure to do so could result in the contractor to rectify the problem(s) at their expense.

9.2 Buried Cable Installation

Where buried cable installations form a part of the fibre cable installation, the requirements of specifications nominated in the scope of works must be complied with.

9.3 Cable Installation Requirements

Unless specified elsewhere, fibre cable installation must comply with Standards Australia Telecommunications Cabling Handbook, Section 5 and EL05 - Installation of Fibre Optic Equipment.

Unless specified elsewhere at least 15 metre of spare cable must be left at the start and terminating points of all cables. This is in addition to any spare cable loops designated on the contract drawings.

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The minimum bending radius and the maximum installing tensile force, as detailed within the manufacturer's cable technical information, must not be exceeded.

Should a cable be damaged or suspected of being damaged at any point during installation, the installation work must cease and the Council must be notified. The Council must determine the repair required.

The cable must be separated from other services (i.e. water/sewerage pipes, air/gas lines, etc.). The cable must be installed in separate trays/pipes/conduits and separately supported away from such services. Under no circumstances must the cable be tied to or installed with such services.

9.4 Terminations

Unless specified elsewhere, termination of the fibres and fibre cable must comply with the Standards Australia ACA TS008, Section 5.8, Optical Fibre Connectors Hardware.

The installed attenuation for connections must be:

1. Average Maximum (Notes 2 and 3).
2. dB 1.0 dB Connector to connector interface. (Note 1).
3. 0.2 dB 0.4 dB Mechanical through splice.
4. dB 0.2 dB Fusion through splice.

Notes:

1. The average initial installed connector loss (for the batch of new connectors) must approach 0.5 dB per mated pair. All connectors must be individually guaranteed (including over time aging effects) to NOT exceed the maximum of 1.0 dB loss per mated pair.
2. The average losses of all the new connections must approach the average figures listed above. Individual connections that greatly exceed the average measured losses (within the group of new connections), will require explanation and possible correction.
3. The Contractor, subject to written approval from Council, can submit their own average performance and maximum loss limits for their equipment.

All cable glands must be shrouded.

Cable entries in switchboards and panels, must be installed in such a manner as to permit the orderly accommodation of the total potential requirement for cable glands at each location.

The uses of junction boxes, other than those shown on the drawings, are to be approved by Council prior to installation.

All fibre through adaptors (for mating fibre connectors) must be specified for Single Mode applications, and must have Zirconia alignment sleeves. Even for ALL multimode fibre connection applications, Single Mode adaptors must be used.

Unless specified elsewhere, all patchable fibre links and terminal equipment must use ST connectors.

All patch cord and pigtail connectors must have ceramic ferrules.

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All patch cords and pigtails are to be of the 3 mm tight buffered type.

All fibre splice trays must be as per EL01 – General Requirements and Information..

Where different fibre termination organisation methods are used in the same enclosure (i.e. splice trays, fan outs, etc) they must be mounted separately. Under no circumstances can they be bundled/strapped together.

The following applies to loose Tube Cables:

1. Within an installation specification, some tubes can be reserved for future applications (i.e. spare tubes). These spares must have sufficient tube length (appropriate for the junction box) and must be cleaned and coiled up within the junction box, ready for future termination.
2. Where fibres are terminated (or splice through) in a particular tube, then all fibres must be terminated (or spliced through) within that tube.
3. Unless specified elsewhere, all fibres terminated on a splice tray, must be terminated with pigtails or connectors. Recommend that the tube and pigtails must be strapped at opposite ends of the splice tray.
4. Multiple tubes must only be strapped to one end of the splice tray. Multiple tubes strapped at opposite ends of the splice tray is NOT allowed.
5. All tubes and pigtails must be strapped twice onto the splice tray.
6. Having through splices and pigtails/connectors on the same tray is NOT allowed. EITHER all fibres are through spliced OR all fibres have connectors/pigtails on the one tray.
7. Tubes from three or more cables attached to the one splice tray is NOT allowed.
8. When through splicing is required, the tubes from the two cables (two cables being the maximum number of cables permissible) must be attached to the one splice tray.
9. When terminating pigtails or connectors, the tube from only one cable (One cable being the maximum permissible) must be attached to the one splice tray.
10. Through splicing between cables are allowed only when:
 - a. all fibres between the two cables are fusion spliced, such as an inline enclosure;
 - b. all fibres in a tube from one cable are spliced to the fibres within a tube of another cable.
11. At the rear of the splicing tray enough room must be left to allow for the bending radius of the fibre cable prior to entry into the tray.

10 LABELLING AND IDENTIFICATION

All junction boxes, terminal units, and cable ends must be labelled as detailed and specified in the contract drawings.

All cables must be labelled. Each label must be identified with the cable number or title as called for on the drawings and cable schedule. Labels must be affixed to cables at both ends.

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All single mode fibre pigtailed and patch cords must be yellow in colour.

All multimode fibre pigtailed and patch cords must be orange in colour.

All splice trays, fibre fans and fan out units must be marked with their respective cable numbers.

Only one pigtail or terminated connector must be assigned to any one termination panel number, within the enclosure.

Fibre Optic Caution labels must be installed at all fibre junction boxes, and fibre modem equipment racks/enclosures. The labels have black letters with gold background, and read: "Caution, Invisible Light Radiation Avoid Exposure, Do Not View Exposed Connectors or Fibre Ends Closely, Up to Class 3A Laser Products May Be Used".

11 FIBRE SAFETY AND HOUSE KEEPING

The Fibre Safety guidelines as detailed within the Telecommunications Cabling Handbook, Section 5.6.2 must also be observed.

Care must be taken to dispose of all exposed fibre ends using a 'sharps' container. Sticky paper must be used to ensure that all off-cuts are collected.

12 TESTING

12.1 Scope of Testing

Testing work carried out by the Contractor must include but not necessarily be limited to the following:

1. Unless specified elsewhere, testing must be in accordance with Standards Australia Telecommunications Cabling Handbook, Section 7, using an optical light meter and light source.
2. All tests must be performed in both directions. The accuracy and calibration of the test equipment must be specified in the final test report.
3. All terminated fibres, must be tested:
4. individually (i.e. Basic Cable Loss Tests; from connector to connector without intermediate patchable connections);
5. from device to device (i.e. System Link Loss Tests; with all intermediate patch cords in place, including end patch cords). ["Device", being all items requiring fibre connections as specified under the contract.]

All new cable's distance measurements, installed within the contract must be accurately recorded, by either using OTDR measurements or if available from the cable's own meter markings. These results must be detailed in the final test report.

Where specified, the Contractor must carry out all testing recommended by the equipment manufacturer.

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12.2 Test Results

For all tests, the following must be recorded as a minimum:

- the equipment used and their serial numbers;
- the test method used;
- the name of the test personnel;
- date of testing;
- the measured length of the fibres;
- the loss in dB;
- the wavelength used in the test;
- identifying numbers of the cable and fibres;
- All test reports must be signed by the testing personnel.

All test results must be tabulated and submitted to the Superintendent.

All cable numbers, junction box numbers and junction boxes termination details must be recorded and provided to the Superintendent.

All point to point terminated fibres theoretical losses must be calculated, assuming the maximum cable manufacturers specified loss (in dB/km), times the length of the fibre being tested, plus the sum of all the additional losses (for splices and connectors) using the average figures specified in [Section 10.4.2 – Ray, Don't know which section this should relate to](#) above.

If the measured loss (as determined in [Section 14.1 – Ray, Don't know which section this should relate to](#) above) exceeds the theoretical value calculated in [Section 14.2.3 – Ray, Don't know which section this should relate to](#) above, the connection is deemed to have failed, and must be explained and if appropriate rectified to the satisfaction of the superintendent.

If the measured loss (as determined in [Section 14.1 – Ray, Don't know which section this should relate to](#) above) is less than theoretical value calculated in [Section 14.2.3 – Ray, Don't know which section this should relate to](#) above, the connection is deemed to be acceptable.

12.3 Remedial Work

Any defects identified during testing must be rectified and documented by the Contractor. All testing must cease while remedial work is being carried out. The Contractor must repeat inspections and tests following completion of remedial work and document the results.