RJ45 Modular SCS Solution

Installation Standard

"Generic Specification"

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INSTALLATION SPECIFICATIONS

INTRODUCTION

This 'Installation Standard' provides a reference to ratified industry standards, telecommunication authority codes and acceptable installation practices associated with the design, specification, installation, testing and certification of Integrated Telecommunications Cabling Systems for Customer Premises.

For ease of use of this 'Installation Standard', Structured Cabling Systems (SCS) has the same meaning as Integrated Telecommunications Cabling Systems for Customer Premises.

The word 'Customer' may also mean, Building Owner, Building Manager, Prime Contractor, Construction Manager, Project Manager, SCS Consultant etc.

This 'Installation Standard' describes many items that are generic to most SCS solutions and also provides additional information distinctive to one of the **'RJ45 Modular'** SCS Solutions.

This 'Installation Standard' provides a detailed overview of the important factors that should be considered by Stakeholders involved in a project. All Stakeholders should understand their role to ensure the successful delivery of a high quality SCS installation to the client's satisfaction. Involvement of the Stakeholders includes conceptual design and specification, installation and project management right through to the administration and maintenance of the installed system.

The SCS cabling industry is full of technical jargon, marketing hype and continually changing standards that struggle to keep up with the technological growth of the industry. This 'Installation Standard' sets out to cut through the 'smoke and mirrors' approach that many players within the industry have adopted. This 'Installation Standard' provides a user-friendly tool that refers to important fundamental requirements when designing, specifying, installing, testing and certifying SCS installations.

This text has been written in simple laymen's terms to allow a wide range of readers, many of those who may not have specialist knowledge within this particular field, to easily understand the intent of the various sections and clauses. The intended readers include:

- Building Owners & Managers
- Architects & Interior Designers
- Building Contractors
- Electrical Contractors (*who do not specialise in SCS*)
- Network Managers and Support Staff
- Telecommunications Systems Integrators
- SCS End users

Within the first seven sections of this 'Installation Standard', analogies have been included to help the reader understand the importance of a section, clause or feature.

For those that are industry specialists this 'Installation Standard' may assist by highlighting the areas of their responsibility during the delivery of the project:

Industry specialists include:

- SCS Infrastructure Consultants
- SCS Infrastructure Contractors
- Electrical Engineering Services Consultants
- SCS Manufacturers

This 'Installation Standard' does not contain site-specific information such as: types, models, brands, locations, routes and quantities that are unique to each project. This 'Installation Standard' is an accompanying document that shall be read in conjunction with the 'Project Specifications' documentation and drawings provided by the SCS Designer.

This 'Installation Standard' highlights the important roles and responsibilities to be considered by those that have a stake in the project by pointing the reader to the most current mandatory or recommended industry standards for the region. The associated clauses described within the industry standards shall become the minimum requirement for the installation.

The sections of this 'Installation Standard' are organised to follow the usual order that key elements of an installation project follows and includes the following:

- The **Installer's responsibilities** before, during and post installation
- The **installation documentation** that shall adhere to the relevant standards and regulatory requirements for the region
- All **standards** shall be ratified to the most current version (*Draft versions of standards are not acceptable*)
- The Designers and other stakeholders should consider the important design features during the **design & specification phase** of the installation project
- The **Pathways & Spaces** that cabling is reticulated through is critical to the installation as it forms the foundation of the SCS and assures the future performance of the cable
- The **Installer Installation Practices** that are used when reticulating cable are very important to assure that the performance of the installed cable remains within the manufacturer's original performance specifications
- The installed SCS shall be installed in such a manner to ensure that the cabling system is **safe from electrical and other hazards** for those that will use and maintain the system
- The SCS should **be immune to and should not cause electromagnetic interference** that degrades SCS and Telecommunication System performance
- The Installer work practices and manufacturer guidelines that are deployed when **terminating the cables** should provide simple standards based interface methods between the equipment and the users of the SCS

- A comprehensive **Quality Control program** that clearly indicates project management, acceptance testing & documentation, site audits & inspections, warranty & certification requirements shall be implemented

By implementing the fundamental principles of this 'Installation Standard', Designers, Installers, Customers and Users of the SCS will be assured that the solution will provide:

- Uniformity in design and user interface to SCS
- Compliance with the physical layer objectives of the telecommunications industry internationally accepted Open Systems Interconnection model (*OSI*)
- Flexibility to utilise a wider range of information technology and applications such as Data, Voice, Video, Imaging & Building Management Systems
- A known set of parameters for Telecommunication System equipment vendors to allow for the seamless introduction of new technologies
- Centralisation and optimisation of Telecommunication System equipment
- A secure and dedicated environment for Telecommunication Equipment
- Simplified fault diagnosis with less system downtime for individual users
- Reduced costs associated with adding, moving or changing the installed SCS

REFERENCE INFORMATION

As the Installer reads through this 'Installation Standard' they will find many clauses that make reference to other information sources. Reference *Sections* or *Clauses* are in *Bold Italics* and have been inserted to direct the reader to other parts of this 'Installation Standard' or to other industry documents such as 'Mandatory Regulations', 'Performance & Design Standards', 'Recommended Standards' and 'Project Specifications'. It is the Installers' responsibility to locate the associated clauses in other industry documents and comply with the directions.

UNITS OF MEASUREMENT

This 'Installation Standard' uses words such as: length, distance, temperature, radius, size, capacity, depth, height, width, dimension, quantity, amount, intervals, weight, load, space, clearance, tension, area, circumference, diameter, span, etc. to describe units of measurement.

Where there is reference to an item or design factor that specifically identifies the requirement of a unit of measurement, the Installer shall refer to the list of standards and guidelines provided in *Section 3*.

The Installer shall read the standards listed in *Section 3* to determine the value of the unit of measurement that is applicable to the item or design factor. Where values conflict between different standards then the standard that is highest in hierarchy shall be used.

The Designer may insert more explanatory notes regarding the values of unit measurements that are applicable to certain design factors within the *'Project Specifications'*.

DOCUMENT VERSION & CONTROL

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ABBREVIATIONS

SCS	Structured Cabling System
ISO	International Organization for Standardization
IEC	International Electro technical Commission
OSI	Open Systems Interconnection
ACA	Australian Communications Authority
ACIF	Australian Communications Industry Forum
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference

INSTALLER RESPONSIBILITIES

In many regions the SCS industry is becoming more self-regulated and less managed by government regulators. In other words more responsibility is being placed upon the Installer and other parts of the industry to assure the quality and safety of installations in Customer premises. In many cases the Installer may have to comply with the following industry advice within their region:

- Mandatory Regulations
- National and International Performance and Design Standards
- Recommended Standards
- Manufacturer Installation Requirements
- Site Specific Requirements

This section describes the many responsibilities that the Installer should consider when completing SCS installations.

INSTALLER RESOURCES

It does not matter how large or small an organisation is, the responsibilities listed in this section should be considered and implemented by all to assure that the customer receives a safe and standards compliant solution.

In larger organisations these responsibilities could be borne by different members of the installation team that may comprise of managers, designers, estimators, supervisors, team leaders, tradesmen, apprentices, trainees and trades assistants. For smaller organisations the responsibilities may be borne by only a few.

The major tangible difference between smaller and larger organisations is not the quality of the installation but the organisation's capability to provide enough resources to match the size of the project and meet the installation schedule.

Historically, Installers/organisations who have taken on installations that they have not been suitably resourced to manage put themselves under pressure that has resulted in a sub standard installation.

Therefore a responsible Installer/organisation should always match their available resources to the requirements of the particular project.

If an Installer has either knowingly or otherwise handed over to the Customer an installation that is not compliant to 'Mandatory Regulations' then they have put themselves at risk of prosecution by government agencies and have exposed their organisation to commercial litigation by the Customer.

COMPLIANCE TO MANDATORY REGULATIONS

'Mandatory Regulations' are usually directives written by or on behalf of the government of a region. Some governments may have written 'Telecommunication Acts' that empowers their regulators with the responsibility to provide documented 'Mandatory Regulations' with special consideration to personal and Carrier network safety issues.

In general terms 'Mandatory Regulations' provide a set of rules that must be adhered to by Installers. Full compliance should ensure that:

- The installation and normal use of SCS cabling does not expose any person to any possible dangers inherent with SCS.
- The installation and normal use of SCS cabling does not adversely affect the proper functioning of Customer or Carrier Telecommunication Systems.

Not all regions have the same 'Mandatory Regulations' therefore the list that is provided in *Section 3* will differ depending on the local region or country that the Installer is operating within.

The Installer shall ensure they are fully conversant with any 'Mandatory Regulations' that are applicable to the installation of SCS cabling within their region of operation.

The Installer shall also ensure that they check the currency of 'Mandatory Regulations' regularly to update their documentation and read all amendments.

Ignorance of the region's latest ratified 'Mandatory Regulations' is not deemed a suitable defence by government regulators.

More information regarding the 'Mandatory Regulations' that are applicable to the local region is included in *Section 3* of this document.

Product Compliance

An important consideration for Installers is to ensure that the cabling products they propose to install within a Customer premises is compliant with the technical standards described within the 'Mandatory Regulations' of their region.

The aim of 'Product Compliance' is to ensure that:

- Health and safety of all persons is protected
- Integrity of the Carrier network or facility is protected
- Emergency voice system services are always operational

In some regions it is the responsibility of the manufacturer to ensure that their products meet the relevant technical standards before being made available for purchase. However, the contractor also has an obligation to ensure the product meets the required standard before installing SCS cabling products.

In some regions, government agencies have the mandated power to inspect and penalise Installers and manufacturers for breaches of mandatory codes and/or could in conjunction with the Carrier disconnect all Carrier services connected to the SCS installation.

Installers will find more information within the 'Mandatory Regulations' of their region regarding Product Compliance labelling, marking and gazetting.

Carrier Network Interface

Knowledge of the Carrier Network Interface is another important aspect that Installers should be aware of. It describes the point of demarcation between 'Carrier' and 'Customer' SCS networks.

In some regions the 'Mandatory Regulations' may differentiate which group of Installers are allowed to work upon different parts of the SCS on the Customer's side of the Carrier Network Interface. Installers should ensure that they have the appropriate licence, registration or endorsement for the work they are undertaking.

In some regions, government agencies have the mandated power to inspect and penalise Installers for breaches of this mandatory code.

Cabling on the Carrier's side of the Carrier Network Interface belongs to a carrier and no work should be undertaken on this cabling without written permission of the Carrier.

Electrical Protection, Grounding & Bonding

It is important for Installers to know their responsibilities regarding the electrical protection, grounding and bonding of the installed SCS cabling and termination hardware.

Once telecommunications systems are operating and utilising the installed cabling, there is the possibility of hazardous voltages existing within the cabling and termination hardware. These voltages may occur during the normal operation of some SCS or could occur as a fault attributed to SCS equipment or other electrical installations.
The aim of providing electrical protection, grounding and bonding is to protect against:

- Injury to personnel who may come in contact with live SCS cabling
- Faults that may cause the destruction of electronic equipment attached to the cabling
- SCS and personnel resources downtime
- Lightning protection

In some regions, government agencies have the mandated power to inspect and penalise Installers for breaches of this mandatory code.

Occupational Health & Safety

All Installers have a responsibility to plan and conduct their work in a safe manner so they do not place themselves, fellow workers or the public at risk during an installation.

The Installer shall check the *Project Specifications* and/or Customer's Safety Policy for any special Occupational Health & Safety requirements.

Installer Licences and Registrations

The 'Mandatory Regulations' in some regions require the Installer to be specially licensed or registered before they are allowed to independently install SCS cabling within a customer premises. The licence or registration is usually obtained after the Installer has completed extensive industry training and has registered within the licensing or registration regime of the regional government regulator.

By training, registering and obtaining a licence or registration the Installer has also accepted full liability to ensure that all SCS installations they are responsible for are compliant to the 'Mandatory Regulations' and associated technical standards outlined in the licensing or registration agreements.

Some regions have different grades of licence or registration and specialist endorsements that delineate the scope and type of work that an Installer is allowed to undertake.

The licensing agreement may also hold the Installer responsible to keep their licences or registrations current and regularly update their knowledge of the 'Mandatory Regulations'.

In some regions, government agencies have the mandated power to randomly inspect an Installer for proof of licence or registration and impose penalties for breaches of this mandatory code.

Supervision of Unlicensed or Unregistered Personnel

The deregulation of the SCS industry allows cabling organisations to utilise unskilled and/or unlicensed/unregistered labour to assist with installations in some regions. Organisations may choose to use Installer Assistants and/or Trainees & Apprentices to supplement an installation team led by one or a number of skilled and licensed/registered personnel. The SCS industry requires this type of arrangement to allow for the future development of well trained Installers.

However, the 'Mandatory Regulations' in some regions require the licensed/registered Installer to supervise the work of other unlicensed/unregistered personnel. This supervision may require the licensed/registered Installer to be responsible for the following:

- Ensure the unlicensed/unregistered Installer is under direct supervision at all times
- The quality of the unlicensed/unregistered work is compliant with 'Mandatory Regulations'
- If the work completed by the unlicensed/unregistered Installer is inspected by authorities then that component of the SCS cabling will normally be attributed to the responsible licensed/registered Installer regarding any notices or penalties applied

In some regions, government agencies have the mandated power to randomly inspect an Installer for proof of licence/registration and impose penalties for breaches of this mandatory code.

Installation Compliance Declaration

Some regions require licensed/registered Installers to complete 'Installation Compliance Declaration' forms that assist in the tracking of the quality of workmanship and compliance to 'Mandatory Guidelines'.

In general terms, this is a job sign-off form that is an essential requirement of the licensing/registration conditions. The Installer must insert all relevant details of each different installation and provide the completed form to the Customer.

The information that may be requested within the 'Installation Compliance Declaration' form could include:

- Installer name, contact details & current address
- Customer name, contact details & installation premises address
- Detailed description of the scope of works performed by the Installer
- Installer licence/registration number and other relevant details

In some regions, the Customer may also have a responsibility to ensure that they obtain from the Installer an 'Installation Compliance Declaration' form for each SCS installation that they authorise. This requirement shifts some of the responsibility of industry regulation back to the Customer.

If in the future, there is a fault that damages SCS equipment or injures personnel and the fault can be attributed to a poorly installed SCS cabling installation then insurers and government regulators may use proof of the 'Installation Compliance Declaration' form in litigation.

In some regions, government agencies have the mandated power to randomly inspect an Installer and/or premises for proof of 'Installation Compliance Declaration' forms.

Inspections by Authorities & Penalties

Although many regions may have adopted a model for self-regulation of their SCS cabling industry, most have retained some type of government regulator whose role it is to scrutinize the activities of the industry.

The regulator is usually empowered by the regional government and is mandated to act on the government's behalf to ensure that the industry acts in the best interests of personal safety and Carrier network integrity.

The regulator may employ Inspectors who have similar authority to that of the police when dispensing on the spot speeding fines or initiating litigation. Depending on the severity of the mandatory code breach, Inspectors have the right to issue disconnection notices, which removes the attachment of the SCS cabling to the Carrier networks.

If an Installer does not comply or re-offends then the Inspector has the right to issue a writ that will be heard in court and could result in penalties such as monetary fines, enforce rectification and/or suspension of the Installer/s licence.

The agency may schedule an inspection by:

- A designated number of inspections nominated by the government to be carried out by the regulator annually. The choice of Installer and/or the installation is usually at random
- Complaints from customers regarding the quality of an installation or no provision of the correct sign off forms
- Complaints from other Installers who find non-compliant work in their customer's premises that are not their responsibility

COMPLIANCE TO DESIGN & PERFORMANCE STANDARDS

Another important responsibility for Installers is to ensure that they follow the principles described in the 'Design & Performance Standards' applicable to their region.

'Design & Performance Standards' are industry written guidelines that describe the minimum fundamental design considerations for manufacturers and Installers of SCS cabling. The following industry groups generally write them:

- International Standards Organizations
- International Telecommunication Associations
- National (regional) Standards Organizations
- Manufacturers.
- Project Designers/Specifiers.

The difference between 'Mandatory Regulations' and 'Design & Performance Standards' is that 'Mandatory Regulations' are focussed on protecting people from injury and SCS networks from damage (especially where customer cabling interacts with the Carrier networks). 'Design & Performance Standards' are more focussed on the design, performance and installation practices within the Customer premises.

Deregulation of the SCS industry is a slow process and as a result some SCS projects may be handed over to customers well below the performance criteria set out in the 'Design & Performance Standards' and in some cases 'Mandatory Regulations'.

This has occurred because government regulators may only have the resources to inspect a minority of Installers and projects and are focused on safety and effects on Carrier network services. There is a much lower occurrence of independent inspections funded by the industry/customers to check that Installers comply with 'Design & Performance Standards'.

There is no doubt that deregulation will be successful as long as those within the private sector of the SCS industry accepts their role. Independent inspections and auditing will become more commonplace as more Customers learn that quality SCS cabling is the underpinning element required to assure the effective operation of high performance Telecommunication Systems.

Industry Standards

Industry Standards such as 'Design & Performance Standards' and 'Recommended Standards' are written by International and National Standards Organisations.

The major purpose of these standards is to provide the following:

- Benchmark the minimum level of the physical construction and design of the SCS cabling and termination components
- Benchmark the minimum level of electrical transmission performance requirements of the SCS cabling and termination components
- Provide an industry wide, generic design methodology for SCS
- Allow for interoperability between different SCS manufacturers and a wide range of Telecommunication Systems equipment and applications
- Provide a set of guidelines for Installers to follow that should facilitate repeatable quality for all Customers

Many countries adopt International Standards but some have their own set of 'Industry Standards' applicable to the SCS industry in their region. More information regarding the 'Industry Standards' applicable to the local region is included in *Section 3*.

Clipsal Certification & Warranty Program

Clipsal Australia provides a 'Manufacturer Certification & Warranty Program'. This type of program provides Customers with additional protection against poor quality installations because the manufacturer assumes some of the responsibility.

Clipsal Australia undertakes to the Customer that they will guarantee the quality of the installation and assure the SCS cabling and associated components will perform to the nominated level of service for a period of time. The Customer must choose an installation partner approved by the manufacturer who will install only those cabling and termination products endorsed by the Clipsal Australia.

Installer's who are not officially approved by a Clipsal Australia to offer Certification & Warranty Agreements to the Customer shall not undertake installations that are specified for inclusion into a Clipsal Australia Certification & Warranty Program.

It is the Installer's responsibility to become an Approved Installer by formally applying to Clipsal Australia and gaining acceptance into the Clipsal Australia's Certification & Warranty Program. Acceptance shall be through successfully completing Clipsal Australia's application process and entering into a written and signed agreement that promises full compliance with Clipsal Australia's Certification & Warranty Program and their minimum Design and Installation requirements.

The Customer has considered the following key elements when choosing a Clipsal Australia lifetime warranty:

Clipsal Australia Lifetime Warranty Agreement:

- Clipsal Australia has a complete list or catalogue that documents the group of products that are covered under the Certification & Warranty Agreements. The list of approved products are available on the Clipsal Australia's Website

- The Installer shall purchase all products that are to be included in the Certification & Warranty Agreements

- The Installer shall be authorised by the Clipsal Australia to offer a Clipsal Australia Lifetime Warranty. The authorisation shall take the form of a signed agreement between the two parties

- The Installer shall have proven and documented capabilities to comply with all Installer Responsibilities as defined in *Section 2* of this Installation Standard

- Those SCS products that will form the electrical transmission connectivity circuits between Equipment and the User shall meet and exceed the relevant Performance & Design Standards listed in *Section 3*

- The Certification & Warranty Agreements shall be for the '**Lifetime**' of the product in the Customer premises. For example, if the original Customer defined on the Certification & Warranty Agreement moves from the premises where the products are installed. Then the Warranty is void unless otherwise agreed with Clipsal Australia. If the original Customer defined on the Certification & Warranty Agreement remains in the premises where the products are installed then the obligations of the agreement will stand for that amount of time

- The Certification & Warranty Agreements shall provide a superior level of protection by random inspections of installed projects to ensure that the Installation Practices and SCS Design Methodology complies to the minimum standards as listed in this Installation Standard and *Section 3*. Clipsal Australia have defined methods to implement any remedial actions from the Installer where the minimum level of quality has not been maintained

- Where there are instances that the products are or become faulty while under the Certification & Warranty Agreement, then Clipsal Australia have a documented program to inspect the situation and repair or replace the product. Clipsal Australia will rectify the situation at their cost if the fault is attributed to defective manufacture of the product arising from acceptable operational conditions not exceeding the product design. Situations that are deemed to be unacceptable operational conditions that exceed the expected use of the product will not be repaired or replaced at Clipsal Australia's cost

Clipsal Australia Products Covered by the Certification & Warranty Agreements:

- 100% of SCS Components as defined in the Installation Standard:
    - Horizontal Cabling
        - Unshielded Twisted Pair Cable
        - Telecommunication Outlets
        - Face Plates
        - Modular Enclosures
    - Distributor Equipment
        - Communication Cabinets
        - Wall Mounted Patch Frames
        - Cabinet Mounted Patch Frames
        - Disconnection Modules
    - Equipment Cabling
        - LAN Equipment Cabling
        - Voice Equipment Cabling
        - BMS Equipment Cabling (where applicable)
    - Cross-Connect Cabling
        - Work Area (Patch Cables)
        - Distributor (UTP Jumper & Patch)
        - Distributor (Fibre Optic Patch)
        - Equipment (Manufacturer supplied only)
    - Building & Campus UTP/Fibre Backbone Cabling
        - Connectors
        - Adapters
        - Termination Enclosures
- Pathways & Spaces:
    - Catenary Systems
    - Cable Trays/Ducts
    - Conduits/Ducts

- o Designed and installed to meet the recommendations in this Installation Standard and the Manufacturer's installation guidelines
- Administration & Labelling:
  - o Products sourced from Clipsal Australia that is designed and installed to meet the recommendations in the Installation Standard
- SCS Documentation:
  - o Documentation that has been compiled to meet the recommendations in the Installation Standard
  - o The Installer shall provide Certification & Warranty documentation as required by Clipsal Australia
- SCS Testing:
  - o 100% of the Installed UTP Horizontal Cabling Permanent Links shall be tested
  - o 100% of the Installed UTP Backbone Cabling Permanent Links shall be tested
  - o 100% of the Installed Fibre Optic Backbone Cabling Links shall be tested
  - o The longest and shortest UTP Horizontal Cabling Channel (Class D channels only) shall be tested from each Distributor
  - o Test Reports are compiled and added to the SCS Documentation and the Certification & Warranty Agreements
  - o Testing shall be completed by Installers that have been especially trained and accredited by Clipsal Australia's endorsed training regime to Test, Certify and Document the SCS

Applications Assurance

The Assurance program covers any applications in accordance with the Performance and Design standards listed in *Section 3* that applied to the originally installed SCS at the date the installation was accepted into Clipsal Australia's Certification & Warranty Program.

The applications that are assured by Clipsal Australia shall be listed within the Customer's Certification documentation.

Claims:

In the event of a claim for a site, the Customer will notify Clipsal Australia.

Clipsal Australia will verify the claim and determine resolution to the claim.

Coverage:

This '**Lifetime Warranty**' is only for the benefit of the original Customer and the original premises as listed on the Certification & Warranty Agreement provided to the Customer.

Moves and Changes:

All moves and additions to the SCS that requires inclusion into the Certification & Warranty Agreement shall be fully documented and sent to the Clipsal Australia.
An Authorised Installer shall carry out all moves and additions to the SCS that is included in the Certification & Warranty Agreement.
All product used must be Clipsal Australia's approved product as listed in Clipsal Australia's catalogue. Any other brand of products used may void this warranty and systems assurance.

Audits:

Clipsal Australia shall select a percentage of new installations to be audited by their own staff or third parties to ensure quality and compliance of the Installer's demonstrable Installation Practices on an annual basis.

Circumstances that shall not be covered by the Certification & Warranty Agreements:

The Certification & Warranty shall not cover the failure of the Installer to follow this Installation Standard for the appropriate Performance of product used in the installation in either design or installation.

The Certification & Warranty shall not cover any other product that is not part of the product range as listed in Clipsal Australia's SCS Product range. In the event that unauthorized products are used then the Certification & Warranty shall be voided completely.

The Certification & Warranty shall not cover any installation work subsequent to the original installation that is not carried out by an Authorised Installer.

The Certification & Warranty shall not cover any installation work subsequent to the original installation that has not been submitted for site amendment and updated certificate issued.

The Certification & Warranty shall not cover any accidents, damage in transit, failure to follow instructions, misuse, fire, flood, acts of god, civil unrest or wars.

The Certification & Warranty shall not cover any product not purchased from an Authorised Distributor or product without purchase receipt from the Authorised Distributor.

Any product reinstalled at any other site other than the address listed in the Certification & Warranty Agreements automatically makes the Certification & Warranty null and void.

The Certification & Warranty shall not cover any loss of time, inconvenience, loss of use of the product or any associated product, property damage caused by failure of the product to work or any other incidental or consequential damages.

Project Specifications

This 'Installation Standard' is the major accompanying document that shall be read in conjunction with the unique 'Project Specifications' of each installation.

Where this 'Installation Standard' provides the Installer with the minimum expectations for quality and compliance, the 'Project Specifications' provide the actual site-specific requirements for the Customer premises.

The 'Project Specifications' could provide the Installer with the following information:

- Building plans marked up with:
    o Legend describing the meaning for all symbols used
    o Telecommunication Outlet locations
    o Distributor locations
    o Cable reticulation Pathways & Spaces
- Installation Schematics describing:
    o Backbone Cabling types, sizes and termination points
    o Distributor Termination Hardware layouts
- Additional information could include:
    o Required level of transmission performance required of the SCS
    o Types and sizes of hardware to be installed for Pathways & Spaces
    o Cross-connect cord requirements
    o References to existing SCS
    o Special considerations for other trades
    o Special considerations for working on site such as OH&S
    o Hierarchy of the specification documentation
    o Designer contact details
    o Project manager contact details
    o Installation schedule, staging and practical completion requirements
    o Payment terms and maintenance periods
    o The architectural drawings describing the structural design of the building
    o Other 'building services' plans that may share similar areas with the SCS Pathways & Spaces

Site Inspections by the Installer

It is the responsibility of the Installer to complete a thorough 'Site Inspection' during the proposal and quotation phase of the Customer project.

This is impossible for new building construction projects. In these cases it is important to study the architectural drawings, SCS services floor layouts and the plans associated with other building services that may share the same Pathways & Spaces as the SCS.

Those projects that are based within existing buildings and/or redevelopment projects should make an appointment with the site contact and check for the following:

- Proposed or existing locations of Distributors
- Pathways & Spaces that may be utilised
- Existing Electrical Outlet heights
- Existing SCS that will be disturbed or relocated by the project
- Security and access requirements
- Other special requirements that should be considered that may impact the delivery of the project

Installers that conform to this 'Installation Standard' shall take into consideration the following items:

- The location of equipment as shown on the drawings is approximate only, except where dimensions determining the locations are shown
- Mounting heights of Telecommunication Outlets (TO) that are located adjacent to electrical outlets shall be the same height unless advised otherwise
- The Installer shall determine the final location of SCS Pathways & Spaces, Distributors and TOs on site, coordinating this location with all other services located in the area and having regard to any other restrictions on locations
- The Installer shall visit site prior to pricing to become familiar with the access, site conditions, and the existing installations Ignorance of the existing conditions or installation will not be accepted as justification for claims
- All products supplied and installed shall be new and undamaged
- It is the Installers' responsibility to ensure that all members of the installation team are conversant with the intent of the 'Installation Standard' & 'Project Specifications'
- The Customer has first option over salvaged materials

Specification Conflicts

The Installer has a responsibility to report or query any perceived conflicts, ambiguity and design faults found within the 'Project Specifications' to their Customer/project contact. Clarifications and/or resolutions are to be sought in writing from the Customer/project contact prior to undertaking any related works.

Normally, the documentation higher in the 'hierarchy of the documentation' will take precedence. Refer to *Section 3* and the *Project Specifications* for more information regarding 'hierarchy of the documentation'.

The Installer does not have the right to waiver their responsibility to comply with industry standards and guidelines because others may have designed the project.

Installer Proposals

The Installer has a responsibility to provide their Customer with a clear and concise proposal document that describes in detail the complete scope of works they promise to deliver. The Customer should be able to easily identify and confirm what they will receive for the price.

Options should be listed and priced separately and non-conforming items or proposals should be highlighted and separated from the conforming proposal.

Each Customer/project contact may have different views regarding the information they require that assists with proposal evaluations. Refer to the *Project Specifications* for more information regarding the exact format for 'Installer Proposals'.

TRAINING & EXPERIENCE

Apart from the mandatory licensing requirements outlined in *Section 2*, Installers who comply with this 'Installation Standard' shall also have a responsibility to meet the 'Training & Experience' criteria set out in this clause. For the purpose of differentiating who should be trained, this clause uses the terms 'Qualified Installer' and 'Unqualified Installer'.

This 'Installation Standard' does not require Installers who have already completed an accepted level of industry training to be trained again just because they may install a different manufacturer's product.

Most education facilities, industry associations and product manufacturers base their training programs on the latest International or regional 'Design & Performance Standards'. This 'Installation Standard' requires the Qualified Installer to have documented proof that they have satisfactorily completed an acceptable training program.

UTP Installation & Termination

The Qualified Installer shall have documented proof that they have satisfactorily completed an acceptable training program specialising in the installation and termination of generic types of Unshielded Twisted Pair (UTP) cabling that has been provided by the following SCS industry groups:

- Government education facilities
- Independent training providers
- Industry associations & organisations
- Product Manufacturers

The Qualified Installer shall be responsible for the following:

- Liaison with the Customer and/or Project Manager
- Choice/confirmation of SCS cable reticulation Pathways & Spaces
- Obtaining necessary engineering sign off and the subsequent provisioning of Penetrations required for SCS cable reticulation Pathways & Spaces
- Fire sealing of Penetrations where required
- Installation of SCS cable support hardware relating to Pathways & Spaces
- Group leader of the SCS cable reticulation team
- Installation of SCS cable termination frames and cabinets
- Termination of all UTP cabling

The Unqualified Installer shall be allowed to complete the following works under the direct supervision of the Qualified Installer:

- Provision of Penetrations required for SCS cable reticulation Pathways & Spaces
- Installation of SCS cable support hardware relating to Pathways & Spaces
- Member of the SCS cable reticulation teams
- Installation of SCS cable termination frames and cabinets

Fibre Optic Installation & Termination

The Qualified Installer shall have documented proof that they have satisfactorily completed an acceptable training program specialising in the installation and termination of generic types of Fibre Optic cabling that has been provided by the following SCS industry groups:

- Government education facilities
- Independent training providers
- Industry associations & organisations
- Product Manufacturers

The Qualified Installer shall be responsible for the following:

- Liaison with the Customer and/or Project Manager
- Choice/confirmation of SCS cable reticulation Pathways & Spaces
- Obtaining necessary engineering sign off and the subsequent provisioning of Penetrations required for SCS cable reticulation Pathways & Spaces
- Fire sealing of Penetrations where required
- Installation of SCS cable support hardware relating to Pathways & Spaces
- Group leader of the SCS cable reticulation team
- Installation of SCS cable termination frames and cabinets
- Termination of all Fibre Optic cabling
- Safety Program that defines the collection and removal of all dangerous Fibre Optic cabling and glass filaments

The Unqualified Installer shall be allowed to complete the following works under the direct supervision of the Qualified Installer:

- Provision of Penetrations required for cable reticulation Pathways & Spaces
- Installation of cable support hardware relating to Pathways & Spaces
- Member of the cable reticulation teams
- Installation of cable termination frames and cabinets

SCS Testing & Documentation

Historically, SCS have been under utilised because the transfer rate of information between SCS users and services has been low. Widespread SCS applications such as PABX and Local Area Networks use electronic devices that transmit and receive data at rates that are much slower than the capabilities of the installed SCS.

The development of Telecommunication System applications is growing exponentially, and in some cases SCS cabling is being pushed to the limit and beyond. The Telecommunications Systems industry is currently manufacturing high performance equipment that has outgrown the capabilities of some existing SCS cabling installations.

This 'Installation Standard' places great importance on the latest developments and practises associated with acceptance testing of SCS cabling and the correct formatting of test result documentation.

Testing of the SCS is fundamental to the performance of any network. Testing provides the Customer with documented proof of the performance of the cabling work and eliminates the SCS as a cause of problems when implementing Telecommunication System equipment as part of a project.

Testing provides the Installer with a snapshot of the performance of the SCS at a point of time and provides the Installer with proof that can be presented to Project Managers and Customers that the installation meets or exceeds the level of performance criteria set out in the 'Project Specifications'.

Testing provides a framework that allows arbitration between the Installer, Customer and IT Personnel regarding performance issues that may raise the SCS as a potential cause of problems. This is possible because the performance level of SCS has been determined by International Standards Bodies that define the requirements for SCS. Telecommunication System equipment manufacturers, then utilise the minimum performance levels specified for SCS as a benchmark to design the electronic transmission systems of their equipment.

Given the importance of testing to establish the performance level of the installed SCS, Installers, Designers, Project Managers and Customers should consider independent verification of 'SCS Testing & Documentation' by a third party specialist.

The verification process consists of the independent review of UTP and Fibre Optic SCS Testing & Documentation provided by the Installer to the Customer and may also include independent re-testing of a percentage of the installation.

SCS Testing Standards

Internationally, there are two standards that apply to SCS testing, these being:

- IEC/ISO 11801, which is the International Standard
- ANSI/TIA/EIA 568 and associated TSB (*United States Based*)

Additionally, there are also regional or country standards that are normally based on either document. Refer to *Section 3*.

Clipsal Australia require testing to the Australian Standards as stated in AS/NZ3080:2003.

SCS 'Design & Performance Standards' are subject to change and as such the test parameters; calculations and accuracy of SCS Testers must be upgraded regularly.

Installers shall ensure they have a clear understanding of which testing standard is to be applied before they start testing. Additionally, they shall ensure that their testing equipment is regularly calibrated by the manufacturer, contains the latest versions of testing firmware and all testing components are in good working condition (*particularly the Patch Cords*).

More specific information regarding SCS Testing is provided in *Section 7-11* of this 'Installation Standard'.

The Installer shall check the *'Project Specifications'* for more information regarding the types of testing that is required for a particular project.

Inspections by Clipsal Australia

Earlier in this section, references were made regarding 'Clipsal Australia Certification & Warranty Program' that is an essential requirement of this 'Installation Standard'.

It was stated that Clipsal Australia shall enter into a legal agreement with the customer in partnership with the endorsed Installer to provide certain guarantees regarding the quality and the performance promised. As a result of providing written guarantees that shall be in place for many years the Clipsal Australia has accepted an amount of risk.

To minimise risk further the Clipsal Australia shall carry out random inspections of those projects that have been logged within the 'Clipsal Australia Certification & Warranty Program'.

The Installer shall be aware that every project they complete may be inspected by Clipsal Australia, and the installer shall implement good Installation Practises every time.

The customer reserves the right to withhold payment from the Installer until documentation is received.

Inspections by the Customer/Project Manager

Customers/Project Managers may organise their own independent inspections of SCS cabling for the following reasons:

- The customer have their own SCS specialist staff that carry out inspections during and at the completion of the project
- The customer may also hire a Professional SCS Consultants for this role to assure the quality of the installed SCS

The Installer should be aware that every project they are responsible for, may be inspected by either or all of the methods that have been described in this 'Installation Standard'.

REGULATIONS & STANDARDS

The Installer has a responsibility to own or have access to important industry documentation to obtain the knowledge required to assure that they are obeying government laws and adopting the minimum guidelines for acceptable work practises.

Additionally, Installers who have formally registered with a Clipsal Australia Certification & Warranty' program as described in *Section 2* have accepted their role as a SCS Installer and shall comply with this 'Installation Standard'.

The aim of this 'Installation Standard' is to provide a reference manual that highlights the many important factors the Installer should consider throughout all phases of an installation. 'Mandatory Regulations', 'Performance and Design Standards' and 'Recommended Standards' are subject to change, therefore this section of the document will change as new versions of standards are ratified.

As the Installer reads through this 'Installation Standard' they will find many clauses that make reference to other information sources. Reference *Sections* or *Clauses* are in *Bold Italics* and have been inserted to direct the reader to other parts of this 'Installation Standard' or to other industry documents such as 'Mandatory Regulations', 'Performance & Design Standards' and 'Recommended Standards' that are listed within this section. It is the Installer's responsibility to locate the associated clauses in other industry documents and comply with the directions.

The standards that are listed within this section are specifically applicable to the region or country that the Installer is operating in.

The Installer should be aware that industry documents are periodically reviewed and new editions published. Between editions, amendments may be issued and some standards withdrawn. It is the Installers' responsibility to ensure they have the correct and most recent versions and amendments of this 'Installation Standard' and other industry documents applicable to their region.

AUSTRALIAN & NEW ZEALAND STANDARDS

This 'Installation Standard' is for the use of Installers, Designers, Customers, Building Owners, and Building Managers or any organisation, group or individual that is interested in installing high quality and standards compliant SCS within **Australia or New Zealand**.

Hierarchy of Regulations & Standards

The Installer should be aware that certain standards will take precedence over others if the information is conflicting. The hierarchy of Regulations & Standards is as follows:

1.   Mandatory Regulations
2.   Project Specifications
3.   Australian & New Zealand 'Performance and Design Standards'
4.   Recommended Standards

Mandatory Regulations

In Australia, the Federal Government created legislation for the regulation of the telecommunication industry under the 'Telecommunications Act 1997'. The Act provided powers to the Australian Communications Authority (ACA) under the 'Australian Communications Authority Act 1997'.

The ACA is responsible for regulating the telecommunications industry by promoting industry self-regulation while protecting the integrity of telecommunication networks and assuring the safety of individuals who use or are associated with telecommunication cabling and systems.

The ACA calls up several Technical Standards that define the requirements for cabling products and the correct installation of those products within Customer premises. The documents are:

AS/ACIF S008: 2001   Requirement for Authorised Cabling Products

AS/ACIF S009: 2001   Installation Requirement for Customer Cabling (Wiring Rules)

More information regarding the ACA and these 'Mandatory Regulations' can be found at:

www.aca.gov.au

www.standards.com.au

www.standards.co.nz

www.acif.org.au

More information regarding Installer Licensing and Registration can be found at:

www.aca.gov.au/standards/cabling/registration_licensing

Performance & Design Standards

In Australia the standards that are applicable to the SCS cabling industry are written by Joint Technical Committees. These committees are made up of industry specialists who seek public comment, discuss, agree and document standards that benchmark performance criteria and design requirements. Once the documentation is prepared it is approved and published as a joint Australian/New Zealand Standard.

The 'Performance & Design Standards' that are applicable to this 'Installation Standard' are:

AS/NZS 3080:2003   Telecommunication Installations
Integrated telecommunication cabling systems for commercial premises

AS/NZS 3087:2003   Telecommunication Installations
Generic cabling systems - Specification for the testing of balanced communication cabling according with values set out in AS/NZS 3080:2003

More information regarding the 'Performance & Design Standards' can be found at:

www.standards.com.au

www.standards.co.nz

Recommended Standards

The joint committee of the Australian and New Zealand Standards bodies create or endorse a number of standards and handbooks that reflect good 'Installation Practises' and administration of SCS Installations.

The 'Recommended Standards' and handbooks that are applicable to this 'Installation Standard' are:

AS/NZS 3084:2003   Telecommunication Installations
Telecommunication pathways and spaces for commercial buildings

AS/NZS 3085.1:2004   Telecommunication Installations
Administration of communication systems – Basic requirements

HB 243-2000   Communications Cabling Manual, Module 1: Australian regulatory arrangements

HB 29-2000	Communications Cabling Manual, Module 2: Communications Cabling Handbook
AS/NZS 2211.1:2004	Laser safety - Equipment classification, requirements and user's guide
AS/NZS 2211.2:2006	Laser safety - Safety of optical fibre communication systems

More information regarding the 'Recommended Standards' can be found at:

www.standards.com.au   www.standards.co.nz

Occupational Health & Safety

Another important requirement for the Installer to observe is the Occupational Health & Safety (OH&S) regulations associated with their region. OH&S regulations are regulated by State Governments within Australia. The Installer shall ensure that they know their responsibilities regarding OH&S when carrying out installations.

Within Australia, more information regarding OH&S can be found at www.nohsc.gov.au or on the web site of each State Government or Territory.

The New Zealand web site is www.osh.dol.govt.nz

SCS DESIGN CONSIDERATIONS

The preceding Sections included information that is important to all Stakeholders that are involved in the delivery of a quality SCS solution. Knowledge of the regional Mandatory Regulations and Installer Responsibilities is important to the Customer as they should be aware of their own responsibilities and should know how to select a SCS Installer that is suitably experienced and qualified for their project.

The aim of this section is to provide the reader with a general overview of the important considerations for planning and designing SCS as this phase of the installation is perhaps the most important to assure that the Customer ultimately receives a solution that best suits their unique requirements. From this section forward the information is especially aimed at SCS specialists who are involved in the hands-on Planning, Design, Specifications, Installation, Testing, Certification and Maintenance of the installed system.

SCS SUBSYSTEM COMPONENTS & DEFINITIONS

In simple terms, a Structured Cabling System (SCS) is a physical link between Telecommunication System 'Users' and the services that are available for their day-to-day information gathering and processing requirements.

This clause identifies the functional elements that make up a generic SCS and describes how they are connected together to form subsystems. All or some of the subsystems may be incorporated within the SCS design depending on the many unique factors associated with the Customer premises and implementation strategies.

Each subsystem has a number of different types of media (*cable and connection hardware*) that can be chosen to suit the current and future transmission performance requirements of a wide range of Telecommunication System applications and equipment. The SCS is designed as a hierarchical star structure that has the flexibility to expand or collapse to adapt to most campus, multiple level and/or single building scenarios. Refer to the Hierarchical Star Diagrams

Hierarchical Star Schematic

Campus Backbone

Building Backbone

Horizontal Cabling

CD

BD   BD

FD   FD   FD   FD

Equipment Interface Points
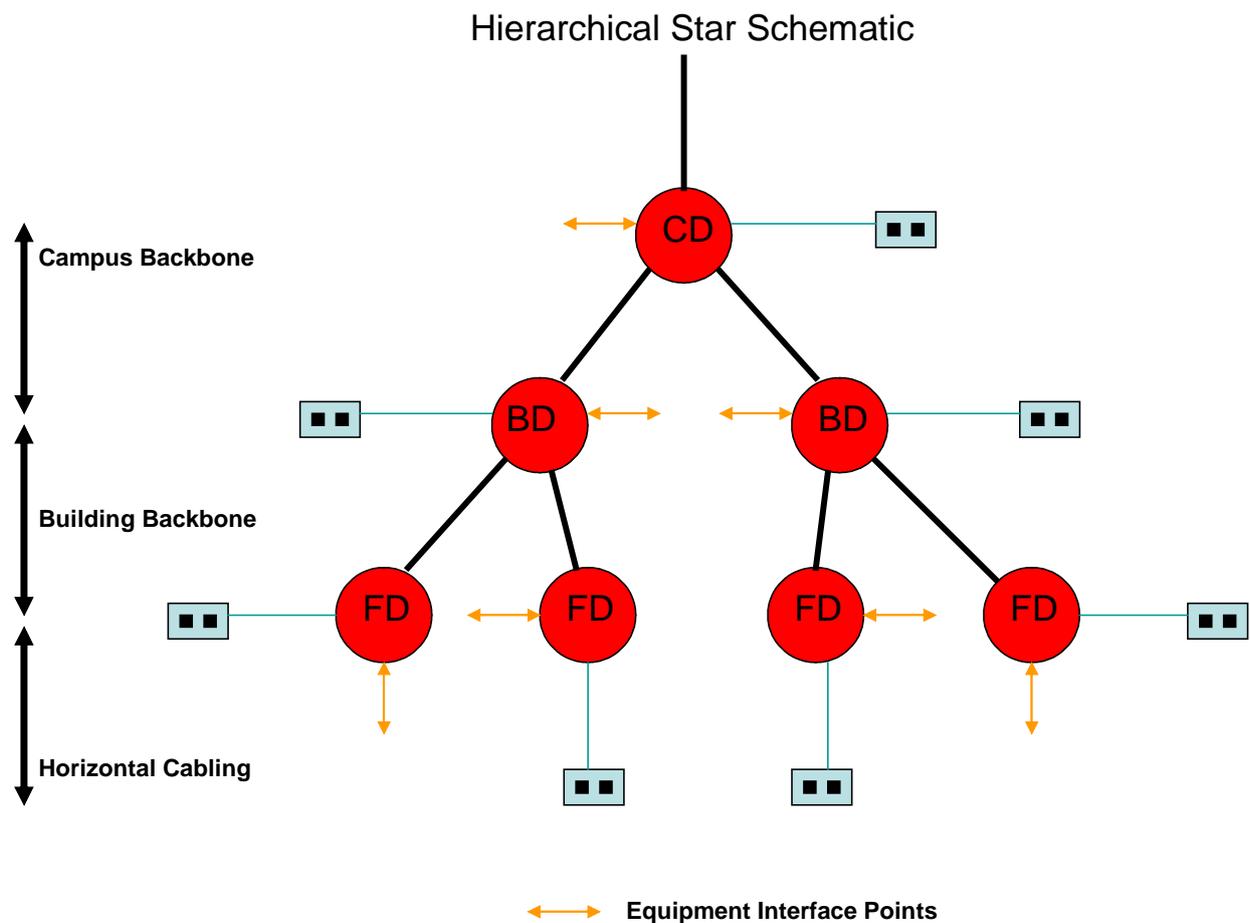
Telecommunication Closets

A Telecommunication Closet (TC) is an area within Customer premises that is set aside for the exclusive purpose of accommodating Telecommunication Systems equipment and provides a space for housing SCS Distributors and associated Cross-Connect equipment throughout the premises.

The number of TCs that are required in a Customer premises is based on the type of Telecommunication Systems that are used. Some Voice systems such as PABX can perform over long lengths of copper cabling, while some Data systems such as LAN applications can only perform for much shorter distances over copper cabling. More flexible administration and additional redundancy in the design could also affect the number of TCs required.

Refer to Hierarchical Star Diagrams for diagrammatic examples of the possible locations of Telecommunication Closets.

Customer Equipment Interface to SCS

Customer equipment is usually owned or leased by the Customer. Equipment for applications such as Data & Voice is mounted in cabinets or racks and may be connected to Users via the SCS.

The Customer Equipment Interface to SCS shall be located within the Distributor.

The connection from Customer equipment to Users is made by the following methods:

- By connecting a non-permanent patch cord from the equipment to a SCS distribution frame/panel
- By permanent equipment/harness cabling linking directly from the equipment to a SCS distribution frame/panel

Refer to Hierarchical Star Diagrams for diagrammatic examples of the possible locations of Customer Equipment Interface points.

Carrier Interface Distributor

The Carrier Interface Distributor is any distributor (CD, BD, and FD) that terminates a Carrier lead in cable within the Customer premises.

In most regions it is the Demarcation Point between the Carrier's and Customer's Telecommunication Systems. More information regarding the regulatory requirements and meanings are provided in *Section 2* and *Section 3*.

There may be a number of Carrier Interface Distributor locations within the Customer premises depending on the amount of different services and the locations of Users that need access to the services. But there are only two distinct types of Carrier Interface:

- The primary termination point of the Carrier cables/services that are brought into the building and owned by the Carrier. The demarcation point for this Carrier service is where the Carrier services interface the Customer SCS
- The Carrier Equipment that is supplied, installed, maintained and owned by the Carrier. The demarcation point in this case, is where the Carrier owned equipment interfaces with the Customer Equipment via the SCS (eg Cable Modem)

Carrier Equipment is usually owned by the Carrier and should only be installed, moved, maintained and disconnected by the Carrier's personnel or nominated agent.

The connection from Carrier equipment to Users is made by Cross-connecting subsystems of the SCS.

Refer to Hierarchical Star Diagrams for diagrammatic examples of the possible locations of Carrier Interfaces.

Horizontal Cabling

The overall SCS is designed in a Hierarchical Star topology, however the Horizontal Cabling is run in a star Topology with Users Telecommunication Outlets (TOs) located within a certain radius connected individually back to a Distributor to form a star configuration. Horizontal Cabling has a maximum length to assure systems performance. Depending on the physical size of the SCS design, other distributors (stars) may be added to provide similar services to all Users.

Where more than one distributor exists they shall be connected by Backbone cabling.

Refer to *Clause 4.1.1* for diagrammatic examples of the Hierarchical Star design.

Horizontal Cabling is the subsystem that connects the User's telecommunications devices to devices housed in the associated Distributor (eg Switches or Hubs) or via backbone cabling to remote equipment (eg Voice Services).

The Horizontal Cabling subsystem consists of a Telecommunications Outlet (TO) that is located close to the User. TOs are connected to Cross-connect equipment in a Distributor (FD, BD or CD). The cabling that connects the TO with the Distributor is Unshielded Twisted Pair (UTP) copper cable.

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Horizontal Cabling.

Floor Distributor

The Floor Distributor (FD) is usually located within a TC and accommodates the Cross-Connect hardware that terminates the Horizontal Cabling. The FD is the central termination point for all Users that are within the Horizontal Cabling length limits or radius of the FD.

Connections from the Telecommunication Systems to the User TO are made at the FD with a Cross-connection method.

The amount of FDs that may be designed into a SCS depends upon the distance between the User's TOs and the available Telecommunication Systems. There are other factors such as more flexible administration and additional redundancy that could be built into a SCS design that may influence the need for more FDs.

Small Customer's premises may only require one FD to connect all Users TOs. If Users TOs and services are further apart than the length restrictions of the Horizontal Cabling, then other FDs and/or a BD would be required.

A SCS design for a Multi-Level building may include a FD on each floor not because of the Horizontal Cabling distance limitations but to provide Users on each level a more simple and flexible solution to administer additions, moves and changes to the SCS.

Horizontal cabling shall be wired using the same generic termination sequence for all SCS projects.

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Floor Distributors.

Work Area Inter-Connect Cabling (Cords)

Work Area Inter-Connect Cabling connects the TOs with the User device. It is a non-permanent lead or cord that can be constructed to suit specific types and performance levels of Telecommunication System equipment or devices (eg Telephone or Personal Computer).

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Work Area Inter-Connect Cabling.

Building Backbone Cable

Building Backbone Cable is reticulated between and connects Distributors such as CDs, FDs & BDs. Its use is normally limited to the internal pathways of the same building and should not be used to connect to other buildings through an external pathway.

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Building Backbone Cable.

Building Distributor

The Building Distributor (BD) is normally located within a TC and accommodates the hardware that terminates the Building Backbone Cabling to the FDs and the Campus Backbone Cabling from the Campus Distributor.

SCS designs that designate only two central distribution points in a building will usually designate the one with the most access to the Telecommunication Equipment/Services as the BD. The other will be the FD.

SCS designs that designate at least three central distribution points in a building will designate one as the BD as above. The others are designated as FDs and are individually connected to the BD in a star topology.

The BD is also the nominated Distributor where the SCS within one building may be connected to the Campus Distributor located in another building via Campus Backbone Cabling.

The BD may also function as a FD by facilitating the connection of Users TOs to system services via Horizontal Cabling. Connections from the Telecommunication Systems to Users are made at the BD using a Cross-connection method.

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Building Distributors.

Campus Backbone Cabling

Campus Backbone Cable is reticulated in a star topology between and connects the Campus Distributor to Building Distributors. It may reticulate through internal and external pathways either within or between buildings.

Campus Distributor

The Campus Distributor (CD) is normally located within a TC and accommodates the hardware that terminates the Campus Backbone Cabling to the BDs in other buildings. There is only one CD nominated for each campus.
SCS designs that designate only two central distribution points in a campus will usually designate the one with the most access to the Telecommunication Systems as the CD. The other will be a BD.

SCS designs that designate at least three central distribution points in separate buildings will designate one as the CD as above. The others are designated as BDs and are individually connected to the CD in a star topology.

The CD may also act as the BD for other FDs within the same building.

Connections from the Telecommunication Systems to Users are made at the CD, BDs and FDs using a Cross-connection method.

Refer to Hierarchical Star Diagrams for diagrammatic examples of the locations of Building Distributors.

Cross-Connect Cabling

Cross-Connection Cabling is non-permanent leads or jumper wires/cables that can be specific to a distinct type of Telecommunication System equipment or device. These cables are utilised by the SCS User to choose a system service and patch or jumper that service via the SCS cabling to connect to the selected User.

Cross-Connection Cabling provides Users with the flexibility to select between different services as User requirements change time and time again.

There are two distinct types of Cross-Connection Systems:

- **Jumper wire/cable** is used to connect from the Equipment Cross-Connect to the Backbone/User Cross-Connect by directly terminating the wire/cord with a tool onto the Cross-Connect equipment. This system provides a semi-permanent connection that can be removed as required. The length of the wire/cable is installed neatly through integral cable management and cut to suit the exact distance between the Equipment Cross-Connect and the Backbone/User Cross-Connect. As all Cross-Connects are made to measure this method is very neat and easy to identify and administer
- A **Patch Lead** is a cord that has a plug at each end. The plug is designed to connect to the Cross-Connect equipment by simply pushing it on instead of terminating with a tool. Patch Leads are non-permanent and very flexible to use and are produced in a number of different lengths. Identification and administration can become a problem if Patch Leads are not managed properly

The number of Cross-Connect Cables utilised to facilitate a connection path between the Telecommunication Systems equipment and the User TO is dependent on the system and application required by the User.

For example: LAN equipment is normally located at the Distributor end of the Horizontal Cabling. To connect a User to a LAN device should only require one Cross-connect Cable and one Work Area Cross-Connect cable.

Voice equipment can operate over longer lengths of cable and may use one Cross-Connect cable from remote equipment to the far end of Backbone Cabling and then another Cross-Connect cable from the close end of Backbone Cabling to Horizontal Cabling then one Work Area Cross-Connect cable.

Refer to *Clause 4.1.1* for diagrammatic examples of the locations of Cross-Connection Cabling.

Refer to *Section 7-10* for cabling schematics that describe the Cross-Connection Cabling unique to the SCS solution defined within this 'Installation Standard'.

Cross-Connect Equipment

Cross Connect Equipment is the actual component that facilitates the direct termination of the copper cable conductors and/or fibre optic cores. Cross Connect Equipment is integral to CD/BD/FD frames, racks, cabinets and TOs.

Cross Connect equipment provides the apparatus where the direct terminated cables from Systems Equipment, Backbone and Horizontal cables may be Cross-Connected.

DESIGN RESPONSIBILITIES

This clause provides information that the Customer should consider when deciding who should be responsible for the provision of a specific Standards based SCS design and installation solution.

Customer

The Customer has had an important role to play during the Design Phase and subsequently, have chosen the following:

- The performance level shall be category 6 and the product shall be of Clipsal Australia manufacture
- The Installer must be an authorised Endorsed Partner of Clipsal Australia
- The warranty shall be for a lifetime, and issued by Clipsal Australia
- NATA accreditation shall be issued as part of the warranty documentation

The Customer shall work closely with their Design Partner and communicate important information regarding their unique business drivers that will shape the SCS design.

Installer

The Installer has an important role to play when interpreting the Design although they may not have any input during the Design and Specification phase. Their minimum responsibilities during the quotation process shall be as follows:

- Know how to interpret the plans and specifications correctly
- Complete any visual inspections that are applicable to check the design against the physical realities of the proposed site
- Study architectural and other building service drawings to check that the design is practical and does not clash with other installations
- Report any suspected conflicts or mistakes in the design to the designated contact
- Provide a fully compliant and informative proposal
- Understand the size and proposed schedule of the installation and match their resources to suit

Designer

The Designer has the most important role to play as they have the greatest responsibility to provide their Customer with the most appropriate solution to ensure that their business objectives are not only achieved but also exceeded.

As the Telecommunications Industry evolves there is a widening gap between the technological advances of Telecommunication Systems available and the minimisation of government organised industry regulation.

The Customer has a lot of information to consider when making an informed decision regarding their SCS. Once a SCS has been installed within the building structure, it should be expected to be in service for many years while the Telecommunication Systems equipment may be upgraded several times during the same period.

The SCS is not something that the Customer can afford to install every time they select new systems technology.

The following groups shall complete the design of the SCS:

The Customer
The Customer has provided input into the general installation specification as outlined in this document

Professional SCS Installers
Professional SCS Installers shall have the knowledge required to design SCS.

These Professional SCS Installers shall have developed their business to the extent where they have the specialist personnel who are adequately trained and experienced to offer good quality design services. The Customer reserves the right to check the track record of any potential Design partner before committing themselves.

Professional SCS Consultant
The Customer reserves the right to consult a specialist in the SCS field to ensure any offer is to the satisfaction of the customer.

The customer may choose a Professional SCS Consultant with the following capabilities to their own business:

- A **vast experience** within the SCS Industry that covers a diverse range of projects incorporating different Telecommunication System technologies
- Complete **independence and objectivity** in regards to existing and new Technology, Manufacturers and Installers
- The **design capability** to identify the most suitable options and present several different scenarios to the client in layman's terms
- Auditing of **existing systems** to identify any cabling that could be retained or replaced at a later date when new technology is introduced to certain areas and/or when the budget allows
- Identification of incremental business objectives that may require a **staged solution**
- Advice about **emerging technology** and other long term issues
- **Accurate Budgetary** advice to assist with delineating implementation stages and support the Customer's decision making process
- The **specification documentation** capabilities to ensure that the project has been adequately defined so the installation flows smoothly and the original budgets are maintained
- The ability to call upon excellent **relationships with SCS Installers and Clipsal Australia** will also assist the successful delivery of the project and give the Customer access to the latest technologies
- The **project management** capabilities to develop a project schedule and reporting structure that keeps the Customer informed and the installation on track for critical dates such as cut-overs or moving in

- An **auditing procedure** to assure that the project is installed and handed over to the Customer to the highest possible quality
- The **flexibility** for the Customer to bring in external industry professionals committed to deliver quality solutions only as required
- **Relieve Customer staff** from the additional responsibilities of organising an SCS Project to concentrate on their usual tasks
- A Professional SCS Consultant should **save their Customer more than the cost** of their services during the delivery of the project

PROJECT SPECIFIC DESIGN RECOMMENDATIONS

This clause provides additional information that describes in more detail some important design issues and features that shall be considered when documenting SCS solutions.

General Issues

The following points describe some of the issues that have been considered in the conceptual planning phase of the project:

- Type and nature of the business
- Geographical location of the project
- Physical size of the Customer premises
- Number of Users
- Future expansion plans
- Existing telecommunication infrastructure
- Current and future Telecommunication Systems that will utilise the SCS
- Hazardous Situations that could affect safety and performance
- Environmental issues that may need special consideration
- Access to the building for the installation team
- Security of Telecommunication Systems and associated TCs
- Redundancy of the SCS for emergency situations
- Mission Critical nature of the information being carried
- Potential problems associated with electromagnetic interference (EMI) and electromagnetic compatibility (EMC)

Once the requirements have been presented, evaluated and agreed upon the Designer shall document the Project Specifications to define the scope of the installation. The Project Specifications may be used by the Customer to procure competitive bids from SCS Installers.

More information regarding important design factors considered when documenting a Project Specification is included in *Section 2*.

SCS Solutions

The Customer has reviewed the three distinct types of SCS solutions that are widely accepted throughout the industry. The solutions are reviewed are as follows:

- **RJ45**   Modular Patch Panel Solution
- **PDS**   Premises Distribution System Solution
- **PBE**   Patch by Exception Solution

This 'Installation Standard' calls for a Clipsal Titanium RJ45 solution.

Section 7-10 has more detailed information regarding the benefits, design and installation methods that are unique to each particular type of SCS solution.

Telecommunication Closets

Consideration shall be given when designing and installing Telecommunication Closets to the following:

- The TC shall be dedicated for the purpose of accommodating Telecommunication Systems equipment, Distributors, SCS and all associated support infrastructure
- The TC shall not share its space with any Electrical Distribution apparatus unless the Telecommunications Systems and SCS can be physically separated to assure that there are no potential problems with Safety, EMI and EMC
- The TC shall not share its space with other building services that are not associated with Telecommunication Systems
- The TC shall be located to cover an area that has a radius dictated by the maximum length of Horizontal Cabling
- The TC may be located closer together if the Customer requires more flexibility, redundancy and administrative capabilities built into the design
- The TC shall be designed to allow for future expansion of Telecommunication Systems and SCS
- The TC shall be located in a position that is free from the ingress of dust and moisture
- The TC shall be provided with adequate lighting

- The TC shall allow for the storage of site specific plans and records that relate to the administration of the Telecommunication Systems and SCS
- The TC shall allow for the storage of other items and/or spares that relate to the administration of the Telecommunication Systems and SCS
- The door/entrance/access point to the TC shall be prominently and permanently labelled and secured against unwanted access
- Adequate power outlets shall be provided

Customer Equipment Interface

Consideration shall be given when designing and installing facilities for the Customer Equipment Interface regarding the Carriers' equipment to the following:

- The Designer shall liaise with the Customer to define the types of Equipment that will be installed by the Customer
- The Distributor frames and/or cabinets shall be appropriately sized and constructed to accommodate the Customer Equipment
- The Distributor frames and/or cabinets shall be appropriately sized and constructed to protect the Customer Equipment from the ingress of moisture or dust
- The Designer shall define the SCS Cross-connect solution that will facilitate the connection of Users to the Customer Equipment via the SCS
- The Designer shall define the labelling, administration and Cross-Connect cable management solutions for the Customer equipment Interface

Carrier Interface Distributor

Historically, the location of the main Carrier Interface Distributor has been where the majority of the Carrier services such as PSTN lines etc. terminate in the Customer premises. Carrier lines would generally enter the building, reticulate through cable pathways and terminate to a Distributor.

A good SCS design will allow the Customer to have the flexibility of all Telecommunication Services being equally available to all Users. The optimum location of the main Carrier Interface Distributor is usually the Distributor that is highest in the Hierarchical star.

In campus environments the interface between SCS and the Carrier network would usually be the CD. In single building environments with multiple distributors the location would usually be the BD.

Most regions have explicit 'Mandatory Regulations' regarding the Carrier Interface Distributor that must be complied with by Designers, Installers and Customers. It is the Designer's responsibility to know the regional 'Mandatory Regulations' and must always take these into consideration when documenting a 'Project Specification'.

Consideration shall be given when designing and installing facilities for the Carrier Interface Distributor regarding the Carriers' cabling primary termination point to the following:

- The Designer shall liaise with regional authorities to design the cabling pathway for the Carrier cables
- The Designer shall liaise with regional authorities to position a suitable distributor for the termination of Carrier Cables
- The Designer shall allow space for suitable cabinets or racks to accommodate the Carrier equipment and specified clearances
- The Designer shall allow for enough termination space for the Carrier cables when sizing the designated Distributor

Consideration shall be given when designing and installing facilities for the Carrier Interface Distributor regarding the Carriers' equipment to the following:

- Some carrier services contain hazardous voltages and can interfere with operation of LAN equipment. Where remote power feeds are used to power carrier equipment adequate Pathways shall be included in the design for carriers to run dedicated cables
- The Designer shall allow for enough space in TCs and Distributors for Carrier Equipment

It is the Designer's responsibility to know the regional 'Mandatory Regulations' in regards to any demarcation and classification of Installers that are allowed to perform Cross-connection of Carrier cabling and/or equipment. There may be some special requirements regarding administration and labelling that may be built into the design.

Horizontal Cabling

Consideration shall be given when designing and installing Horizontal Cabling to the following:

- The amount and location of Users
- The amount of different services required by each User
- The performance capabilities of Horizontal Cabling to allow for migration to future technologies
- The length of the Horizontal Cabling from the nearest Distributor
- The length expectations of the Cross-Connect & Work Area cabling
- The space required at the Distributors for Horizontal Cabling terminations
- The Horizontal Cabling reticulation Pathways & Spaces
- The flexibility, administration and redundancy that the Customer requires
- The methods that will be adopted to interface Telecommunication Systems to Users
- The labelling and documentation conventions required

The Designer shall nominate the minimum transmission performance level required of the Horizontal Cabling and ensure that all termination hardware and cabling complies.

Refer to *Section 6* for generic information regarding the installation methods of Horizontal Cabling and *Section 7-10* as it applies to the particular SCS solution defined in this 'Installation Standard'.

Work Area Cross-Connect Cabling

Consideration shall be given when designing and installing Work Area Cross-Connect Cabling to the following:

- The Designer shall determine the different types of Telecommunication System that will be used by the Customer and Users
- The Designer shall determine whether the Work Area Cross-Connect cables are to be supplied with the Telecommunication System equipment
- The Designer shall determine if there is special wiring configuration of Work Area Cross-Connect cables unique to the equipment
- The Designer shall calculate the maximum allowable length of Work Area Cross-Connect cables considering the length of Horizontal Cabling
- The Designer shall allow for the provision of different quantities and lengths of each type of Work Area Cross-Connect Cable
- The Designer shall document a system that distinguishes between different Work Area Cross-Connect cables and performance levels
- The Designer shall document a storage system for spare Work Area Cross-Connect cables
- The Work Area Cross-Connect Cables shall have the ability to withstand frequent handling without degrading performance
- The Work Area Cross-Connect Cables shall have the ability to endure the Customer's unique environmental conditions

Refer to *Section 6* for generic information regarding the installation methods of Work Area Cross-Connect Cabling and *Section 7-10* as it applies to the particular SCS solution defined in this 'Installation Standard'.

Backbone Cabling

Consideration shall be given when designing and installing Backbone Cabling to the following:

- The different types of Telecommunication Systems equipment and the minimum transmission performance requirements of each
- The type of Backbone Cabling required (copper, fibre optic or a mixture)
- The different grades or performance levels of copper and fibre Backbone Cabling
- The maximum allowable length of Backbone Cabling considering the performance requirements of the Telecommunication System equipment
- The provision of enough capacity for current and future Users
- The performance capabilities that are built in to allow for migration to future technologies
- The amount of space required at the Distributors for termination hardware
- The locations of Backbone Cabling reticulation Pathways & Spaces
- The conductor size of the Backbone Cabling depending on the route length
- The construction of the Backbone Cabling depending on the reticulation Pathways & Spaces
- The amount of flexibility, administration and redundancy required by the Customer

- The methods that will be adopted to interface Carrier and Customer systems to Users

- The labelling and documentation conventions that are required

- The method of distinguishing between different Backbone Cabling and performance levels

- The ability of the Backbone Cabling to endure the Customers' unique environmental conditions

Refer to *Section 6* for generic information regarding the installation methods of Backbone Cabling and *Section 7-10* as it applies to the particular SCS solution defined in this 'Installation Standard'.

Distributors

Consideration shall be given when designing and installing Distributors (CD, BD and FD) to the following:

- The Distributor shall be installed in a position that is free from the ingress of dust and moisture

- If the Distributor must be located in an outdoor type situation then the mandatory or recommended codes for the region shall apply to the minimum requirements of protection against the elements

- The Carrier Interface Distributors shall meet the mandatory requirements for Distributors terminating Carrier lead in cables

- The Distributor shall be positioned in an easily accessible location for the Installer and/or Customer to perform additions, moves and changes

- The Distributor shall have adequate lighting

- The Distributor shall be structurally robust and have a life expectancy that matches the rest of the installed SCS components and 'Clipsal Australia's Certification & Warranty agreements

- The Distributor shall have enough capacity for current and future Users

- The Distributor shall have performance capabilities built in to allow for migration to future technologies

- The Distributor shall have enough capacity for termination hardware

- The Distributor shall be designed in conjunction with major SCS cable reticulation Pathways & Spaces

- The Distributor shall have flexibility, administration and redundancy as determined by the Customer

- The Cross-Connect methods that will be adopted at the Distributor to interface systems to Users

- The Distributor labelling and documentation conventions that is required

- The Distributor shall have the ability to endure the Customer's unique environmental conditions

Distributors shall not be located in the following areas or conditions:

- Ceiling spaces or under floors

- Ablution or Toilet facilities
- Boiler/plant/machines rooms
- Areas with corrosive fumes or liquids
- In fire escape stairways
- Near automatic sprinklers, unless the distributor is protected from moisture ingress
- In any area that may be subject to flooding
- Within a closet containing a fire hose reel
- Adjacent to electrical distribution systems

Refer to *Section 7-10* for more information regarding the installation methods of Distributors as it applies to the particular SCS solution defined in this 'Installation Standard'.

Cross-Connect Cabling

Consideration shall be given when designing and installing Cross-Connection Cable to the following:

- The different types of Telecommunication Systems that will be utilised at the Customer's premises
- The Designer shall determine if some of the Cross-Connect cables will be supplied with the Telecommunication System equipment
- The Designer shall determine if there is any special wiring configuration of Cross-Connect cables unique to the equipment
- The type of Cross-Connect Equipment solution shall be defined to interface systems to 'Users' Outlets (RJ45, PBE, and PDS)
- The maximum allowable length of Cross-Connect cables considering the length of Horizontal Cabling
- The maximum allowable length of Cross-Connect cables considering the length of Work Area Cabling
- The maximum allowable length of Cross-Connect cables considering the length of Backbone Cabling
- The provision of different quantities and lengths of each type of Cross-Connect Cable
- The method that distinguishes between different Cross-Connect cables and performance levels
- The storage system for spare Cross-Connect cables
- The ability of the Cross-Connect cable to withstand frequent handling without degrading performance
- The ability of the Cross-Connect cable to endure the Customer's unique environmental conditions

Refer to *Section 7-10* for more information regarding the installation methods of Cross-Connect Cabling as it applies to the particular SCS solution defined in this 'Installation Standard'.

Cross-Connect Equipment

Consideration shall be given when designing and installing Cross-Connect Equipment to the following:

- The Cross-Connect Equipment transmission characteristics shall match those of the highest performance rated cable that will terminate to the hardware
- Cross-Connect Equipment shall be installed in a position that is free from the ingress of dust and moisture
- Cross-Connect Equipment shall be positioned in an easily accessible location for the Installer and/or Customer to perform additions, moves and changes
- Cross-Connect Equipment shall be structurally robust and have a life expectancy that matches the rest of the installed SCS components and manufacturer certification and warranty agreements
- Cross-Connect Equipment shall be provided with enough capacity for current and future 'Users'
- Cross-Connect Equipment shall have additional performance capabilities built in to allow for migration to future technologies

- Cross-Connect Equipment shall provide the Customer with flexibility, be easy to administer and have some redundancy capabilities

- The type of Cross-Connect Equipment solution shall be defined to interface systems to 'Users' Outlets (RJ45)

- The type of Cross-Connect Equipment labelling and documentation conventions shall be defined

- Cross-Connect Equipment shall be constructed to endure the Customers' unique environmental conditions

- Cross-Connect Equipment shall provide a means to cross-connect permanently terminated cabling by using temporary jumpers, patch cords and special equipment cords

- Cross-Connect Equipment shall provide a means to permit orderly cross-connect cable management

- Cross-Connect Equipment shall provide a means of access that permits monitoring or testing of the applications and systems using the SCS

Refer to *Section 7-10* for more information regarding the installation methods of Cross-Connect Equipment as it applies to the particular SCS solution defined in this 'Installation Standard'.

Quality & Performance Assurance

SCS can be designed with varying levels of performance within each subsystem. For example voice grade copper cable is designed to transmit low frequency telephone calls where high-grade fibre optic cable can also transmit the same telephone call along with many other high frequency transmission applications.

SCS have several well-defined performance levels that different subsystems of connectivity products will conform to. Designers have a responsibility to their Customers to assure that the proposed SCS products and levels of performance for the installation are well defined and the associated products are fully compliant.

Designers shall achieve this by checking that the proposed manufacturer has adopted a Quality Control Program that allows industry endorsed third party laboratories to independently inspect and test connectivity products to the minimum transmission performance parameters set out in International & Regional Standard.

This clause makes specific reference to the SCS components that carry system transmission signals such as: Horizontal Cabling, Work Area Cross-Connect Cabling, Backbone Cabling, Termination Hardware, Cross-Connect Cabling and Equipment Cabling.

Refer to *Section 3* for more information regarding 'Performance & Design Standards'.

Electromagnetic Compatibility & Interference

Electromagnetic Compatibility (EMC) and Interference (EMI) are other factors that the Designer should be aware of.

EMC is the ability of a device, equipment or system to perform adequately in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment or being affected by the environment in an undesirable way.

EMI is any electrical or electromagnetic interference that causes undesirable signals on a device, equipment or system. The potential for EMI occurs when devices or systems share a common electromagnetic environment and their frequencies of operation overlap.

As electronic equipment becomes more sophisticated the required performance levels, operating speed and frequencies rise.

In many regions there are 'Mandatory Regulations' for EMC/EMI that are policed by government regulators. In most cases these rules apply to electronic equipment manufacturers. For example, if you remove the battery of your mobile phone you should find an EMC/EMI compliance marking.

The SCS is considered a Passive component of the overall system and as such is not bound by 'Mandatory Regulations'. The Designer is not directly responsible for the EMC of SCS but they should be properly informed and knowledgeable on the subject. The Designer should consider good installation design and practices that minimize the effects of EMC/EMI that could occur once the SCS and Telecommunication Systems are in full co-operation.

In some regions it is possible that the government regulators may, at some future time, extend the coverage of the EMC 'Mandatory Regulations' from the electronic products to installations and systems including the installed SCS.

The Designer may consider consulting with EMC specialists during the planning and designing phases of the installation.

Refer to *Section 6* for more information regarding acceptable SCS Installation Practices that may be implemented to minimise the effects of EMC/EMI.

Earthing & Bonding

Earthing and Bonding is an important personnel safety consideration, however, compliance with 'Mandatory Regulations' for SCS installations is a grey area in some regions.

In many regions the Earthing and Bonding sections of SCS regulations and guidelines are recommended only. The problem is who is responsible? The Designer who knows that at some stage the SCS will share accommodation with devices that use hazardous electrical voltages, or is it those parties that install the Electrical equipment after the SCS is completed?

The Earthing and Bonding requirements and 'Mandatory Regulations' for Electrical Workers are very clear but there scope works may only require them to install the power outlet onto the wall that is adjacent to a communications cabinet.

The cabinet, Telecommunication System (Electrical) equipment and associated SCS are not an OH&S risk until somebody plugs them into the power outlet and switches the power on.

The Designer shall liaise with all parties concerned and ensure that the SCS design has considered the types of equipment that others may install and facilitate an official decision regarding who is responsible to document the requirements for Earthing and Bonding of metallic structures that are installed as part of the SCS including Pathways & Spaces.

Where Earthing and Bonding is installed it shall meet the requirements mandated by the 'Mandatory Regulations'. Where compatible with required electrical codes, the earthing instructions and requirements of the equipment manufacturers should also be followed.

PATHWAYS & SPACES

The aim of this section is to assist SCS specialists who are involved in the planning and design of the physical Pathways & Spaces within and between buildings to accommodate Telecommunication Systems and SCS.

Pathways & Spaces may be considered as the support infrastructure of SCS. All SCS cabling, closets, distribution systems and termination hardware shall have specifically designed support and reticulation paths to assure that it is supported and can operate independently from other building services.

Well-designed Pathways & Spaces provide the Customer with the assurance that the installed SCS can perform to its optimum level. Poorly designed and/or installed Pathways & Spaces can degrade the performance of SCS considerably which in turn could inhibit or corrupt the data transmitted by Telecommunication Systems.

There are some fundamental concepts that are related to the interaction of Telecommunication Systems and the physical building structures that are unique to the Customer premises. These fundamental concepts are:

- Buildings are dynamic in nature as renovations are more the rule than the exception. This section provides important information that may lessen the impact on SCS Pathways & Spaces as changes to building utilisation occurs
- Telecommunication Systems and SCS are very dynamic as they are subject to staff redeployment and technology upgrades. Pathways & Spaces shall be designed as the enduring foundation of the SCS and provide the functionality for SCS cabling, distribution systems and termination hardware to be interchanged, replaced or upgraded as required
- Telecommunication Systems are always emerging and converging along with technological advances such that a broader range of low-voltage building services can utilise or share SCS Pathways & Spaces such as Voice, Data, Audio, Video, Security and Building Management Systems

This section provides some recommendations among the design alternatives available that shall be considered by the Designer of the SCS Pathways & Spaces.

Some of the recommendations also provide acceptable industry practises for the installation of the different components that form Pathways & Spaces.

Section 3 has more detailed information regarding the regional standards that are applicable to Pathways & Spaces.

The Customer has considered the benefits of engaging suitably qualified and experienced SCS Designers for this fundamental aspect of the SCS design process. Refer to *Section 4*.

It is the responsibility of the SCS Designer to properly select the alternatives based upon the system applications and the physical constraints that are unique to the Customer premises.

The specific requirements for the project shall be defined in the *'Project Specifications'*.

GENERAL DESIGN CONSIDERATIONS

Consideration shall be given when designing and installing Pathways & Spaces to the following:

- All designs shall provide a continuous and independent support route between the Telecommunications Systems, Distributors and TOs through all internal and external building spaces
- Pathways shall follow the major lines and contours of the building and walls
- Pathways & Spaces shall be located in areas of the building least likely to be renovated or disturbed by future projects
- Pathways shall follow routes that allow Installers the least obstruction for additional works
- Pathways shall follow routes that can offer the least disturbance to the Customer if/when Installers require access
- Pathways & Spaces shall allow for the future expansion of the SCS
- All SCS backbone cabling shall be supported by some form of purpose built Pathway
- SCS cabling shall not be supported by the support infrastructure of other services
- Pathways & Spaces shall be designed with special consideration given to other services that may potentially share or conflict with the SCS design
- All above ground Pathways are to be installed at a suitable height and location to prevent accidental or malicious damage and unwanted access
- All Pathways & Spaces shall be built to last for the proposed useful life of the building
- Spaces such as TCs shall be designed in accordance with Section 4
- Existing Pathways & Spaces may be used as long as the installed components satisfy the minimum requirements of this 'Installation Standard' and the list of standards and guidelines provided in Section 3
- Existing Pathways & Spaces may be used if they have enough spare capacity to accommodate all new and proposed SCS
- Special consideration shall be given to segregation and separation from hazardous services when designing Pathways & Spaces Refer to Section 3
- Special consideration shall be given to EMC/EMI for Pathways and Spaces that are in close proximity and/or parallel to Electrical equipment and/or cabling with high voltages for extended lengths Refer to Section 6

The specific requirements for the project are defined in the *'Project Specifications'*.

BUILDING STRUCTURES

This clause refers to essential structures that are common to most buildings and optional structures that are added to create Customer premises work spaces. These structures offer a wide range of functionality to the building and provide the infrastructure upon which Pathways & Spaces are built. The types of Building Structures that are generally used for SCS Pathways & Spaces are as follows:

- Ceiling Spaces
- Wall Cavities
- Risers
- Work Station Furniture
- Service Poles
- False Floors

Ceiling Spaces

Consideration shall be given when designing and installing Pathways & Spaces through Ceiling Spaces to the following:

- Pathways shall be as unobtrusive as possible. All cabling shall be reticulated and hidden from view in Ceiling Spaces where possible.
- Plaster or solid Ceiling Space may be utilised under the following circumstances:
  - The Ceiling Space has sufficient space for the Installer to enter and reticulate and fasten cabling with adequate provision of maintenance access hatches or removable roof tiles.
  - SCS cabling may be fastened to major building structures within a Ceiling Space as long as the location of the cabling cannot be damaged by Installers moving through spaces and upon structures in the future.
  - SCS cabling may be fastened to major building structures within a Ceiling Space as long as the additional weight of the cabling does not exceed the load bearing capacity of the building structure.
  - SCS cabling shall not be laid directly on top of the ceiling surface.
  - The temperature within the Ceiling Space does not exceed the recommended maximum operating temperature of the SCS cabling.
  - Ceiling Spaces that have no current or future access for cabling once built shall not be used unless conduits and draw through boxes with draw wires are installed as a means to access the SCS cabling and conduit system.
- Suspended/removable tile Ceiling Space may be utilised under the following circumstances:
  - The suspended ceiling wire or support shall not be utilised to fasten SCS cables.
  - The cables shall not be directly laid on the top of the removable tiles or ceiling rails.
  - A purpose built SCS Pathway is installed throughout the Ceiling Space.

The specific requirements for the project are defined in the *'Project Specifications'*.

Wall Cavities

Consideration shall be given when designing and installing Pathways & Spaces through Wall Cavities to the following:

- Pathways shall be as unobtrusive as possible All cabling shall be reticulated and hidden from view in Wall Cavities where possible

- All cabling that is installed in external Wall Cavities shall be installed in conduit

- All cabling that is installed in internal Wall Cavities shall be installed in conduit where it shall run close to Electrical cables

- Conduits used to drop cables in Wall Cavities shall be fastened before the point of entry into the wall

- Cable entry into a Wall Cavity shall be directly above or below the physical location of the TO

- The cable entry hole into the Wall Cavity shall be of an appropriate size to allow for the minimum bending radius of the cable

- The cable entry hole into the Wall Cavity shall be of an appropriate size to allow for additional cables

The specific requirements for the project are defined in the *'Project Specifications'*.

Risers

Consideration shall be given when designing and installing Pathways & Spaces through Risers in buildings to the following:

- Risers shall be established where SCS cables traverse from one building level to adjacent levels

- Risers shall be secured from unauthorised entry and accessed only by using a tool or key

- If a Riser is established in a trafficable area it shall be fully enclosed from floor to ceiling

- Risers shall not share the same space with hazardous services

- Risers shall be appropriately sized for expansion of the SCS

- Risers shall be appropriately sized for Installers to easily carry out additions, moves and changes to the SCS

- Risers shall have Cable Trays/Baskets installed from the top to the bottom of the vertical plane of the wall to facilitate SCS cable reticulation and fastening

- Risers shall have appropriately sized Penetrations through the floor and ceiling where cables are required to traverse between levels

- Where Penetrations are made in structural floors or ceilings they shall be fire sealed to the appropriate fire rating for the building

- Risers may be incorporated in the construction of a TC Refer to Section 4

- Risers may accommodate the SCS Distribution and Termination hardware

The specific requirements for the project are defined in the *'Project Specifications'*.

Workstation Furniture

Consideration shall be given when designing and installing Pathways & Spaces through Workstation Furniture to the following:

- Workstation Furniture shall be constructed with purpose built Pathways for the reticulation and termination of SCS cabling

- Enough space shall be allowed within the Workstation Furniture for cable reticulation and to terminate TOs in compliance with the minimum bending radius of the cable

- Workstation Furniture will generally share Pathways with Electrical cabling with hazardous voltages (Power Outlets). A continuous rigid barrier or a minimum separation distance shall separate the two types of cabling. It is preferable that the barrier is metallic and bonded to the building Protective Earth system

- Where the Work Station Furniture has no purpose built Pathway then PVC or metallic ducts shall be installed to the surface

The specific requirements for the project are defined in the *'Project Specifications'*.

Service Poles

Consideration shall be given when designing and installing Pathways & Spaces through Service Poles to the following:

- Service Poles shall be constructed with purpose built Pathways for the reticulation and termination of SCS cabling

- Service Poles shall be attached to and supported by the main supporting channel of the ceiling system

- Service Poles shall be attached to and perpendicular to the floor

- Service Poles will generally share Pathways with Electrical cabling with hazardous voltages (Power Outlets). A continuous rigid barrier shall separate the two types of cabling. It is preferable that the barrier is metallic and bonded to the building Protective Earth system or either the Electrical or SCS cabling is reticulated and fully enclosed through a PVC conduit for the complete length of the Service Pole

- Where Electrical cabling reticulates through Service Poles, Bonding and Earthing, requirements shall be observed. Refer to Section 3

- Cables entering and exiting service poles shall meet minimum segregation requirements

The specific requirements for the project are defined in the *'Project Specifications'*.

CATENARY SYSTEMS

Consideration shall be given when designing and installing Pathways & Spaces using Catenary Systems to the following:

- Catenary Systems are generally constructed of steel wire rope

- Catenary Systems shall be suitably anchored at both ends by means of fastening hardware to permanent building structures that has the capability of bearing the proposed weight of the SCS cabling

- Catenary Systems shall be suitably anchored along its route length at regular intervals by means of fixing hardware to permanent building structures that has the capability of bearing the proposed weight of the SCS cabling

- Catenary Systems are generally not used to reticulate Campus and/or Building Backbone Cabling unless special consideration has been given to load bearing capabilities

- Catenary Systems shall not be used to reticulate SCS vertically

The specific requirements for the project are defined in the *'Project Specifications'*.

The Catenary System shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

CABLE TRAYS/BASKETS

Consideration shall be given when designing and installing Pathways & Spaces using Cable Trays/Baskets to the following:

- Cable Trays/Baskets shall not be installed where its putting in place will be unduly detrimental to the Customer's normal operations

- Cable Trays/Baskets shall be dedicated to the purpose of SCS cabling and not be shared with hazardous services

- Cable Trays/Baskets installed within a TC that contains active telecommunication equipment shall be painted or powder coated

- Cable Trays/Baskets shall be designed to accommodate expansion of the SCS

- Cable Trays/Baskets shall be designed to bear the weight of the proposed SCS as defined by the manufacturer

- Cable Tray/Basket support and fastening hardware shall meet manufacturer's recommendations

- Cable Tray/Basket supports shall be located at intervals defined by the manufacturer's recommendations

- Cable Tray/Basket supports shall be fixed to solid and permanent Building Structures that have the capability to bear the combined weight of the proposed SCS cabling and Cable Tray/Basket Systems

- Changes of direction for Cable Trays/Baskets such as bends, tees, crossovers and reducers shall be factory manufactured or by means approved by the manufacturer

- Cable Trays/Baskets shall have visible, legible and durable SCS identification labels fastened at regular intervals along the route length

- Where installed adjacent to or on the surface of a wall or floor there shall be a minimum distance between the surfaces to allow for fastening of the SCS cables to the Cable Tray/Basket

- There shall be enough vertical clearance from the highest point of the Cable Tray/Basket surface to allow easy access for Installers to reticulate and work upon the SCS cabling

- There shall be no fastening hardware or other sharp objects protruding through the SCS cable bearing surface of the Cable Tray/Basket

- All edges of Cable Trays/Baskets that will bear the weight of SCS cables shall be adequately bushed to protect cables

- Where Earthing and Bonding is a required component of the installation, then the Earth shall be continuous for the complete route length of the Cable Tray/Basket system. Refer to the 'Project Specifications'

- Existing Cable Trays/Baskets shall not be used in the following circumstances:
  o Where the SCS cabling is exposed to physical damage
  o Where the Cable Tray/Basket is not of suitable quality as defined by the standards
  o Where the Cable Tray/Basket has insufficient segregation and separation from hazardous services
  o Where the Cable Tray/Basket does not have the spare capacity to accommodate additional SCS cabling
  o Where the Cable Tray/Basket is aesthetically unpleasing in areas that are visible to the general public unless specified

The specific requirements for the project are defined in the *'Project Specifications'.*

The Cable Tray/Basket System shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

CONDUITS/DUCTS

Consideration shall be given when designing and installing Pathways & Spaces using Internal Conduits/Ducts to the following:

- If metallic Conduits/Ducts are used then it shall be connected to the Protective Earth System of the building. Refer to the Section 3

- Conduits/Ducts shall be sized to allow for expansion of the SCS

- Where expansion has been allowed for, draw cords shall be left in the conduit

- Mechanical continuity shall be maintained through all joints of Conduits/Ducts

- Conduits/Ducts shall not be the same colour as that used by a hazardous service

- Conduits/Ducts shall be manufactured to comply with the physical and colour requirements referred to in regional Standards. Refer to Section 3

- All sharp edges shall be removed from the internal and external surfaces of Conduits/Ducts

- Extended route lengths of Conduits/Ducts shall have draw through boxes and draw cords installed at regular intervals to comply with maximum cable pulling tensions during the reticulation of cables

- Conduits/Ducts draw through boxes shall be appropriately sized to allow for the minimum bending radius of the cables

- All changes of direction in Conduits/Ducts shall be made with factory manufactured bends, elbows and tees

- Conduits/Ducts shall be fastened to surfaces with suitable hardware that is designed to bear the required load

- Conduits/Ducts shall be fastened to surfaces at regular intervals

- The original colour of the Conduits/Ducts may be painted over to suit the colour of the building surface it is fastened upon/adjacent to

The specific requirements for the project are defined in the *'Project Specifications'*.

The Internal Conduits/Ducts System shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

External

Consideration shall be given when designing and installing Pathways & Spaces using External Conduits/Ducts as defined in *Clause 5.5.1* and additionally to the following:

- The Conduits/Ducts shall be continuous and waterproof with all joints glued to retard the ingress of moisture

- Each end of the Conduits/Ducts route shall enter into an internal building environment

- Conduits/Ducts shall have expansion joints installed at regular intervals to allow for changes in the external environment such as Ultra-Violet and Temperature

- Where Conduits/Ducts are to be installed in an environment that is open to accidental or malicious damage then additional protection shall be provided to the SCS Cabling. In this situation the Conduits/Ducts shall be of metallic construction or PVC that is also covered with a metallic shroud for the complete length of the area of risk

- Where there are no Building Structures between buildings that External Conduits/Ducts can be fastened to, then other means may be adopted to provide an Aerial Pathway as follows:

o   Where the span between the buildings is minimal and the Customer approves, a wooden or steel beam may be installed between buildings on which Conduits/Ducts may be fastened to

o   Where the span between the buildings is minimal and the Customer approves, solid metallic Conduits/Ducts may be installed between buildings through which cables can reticulate

o   Where the span between the buildings is too long to adequately support a beam or solid metallic Conduits/Ducts and the Customer approves, then a Catenary System may be utilised. In this situation SCS cables shall reticulate within PVC Conduits/Ducts that are fastened to the Catenary System, or the SCS cable is moisture proof and has an integral bearer

o   All methods shall use appropriate support and fastening hardware and distances between supports that are capable of bearing the combined weight of SCS cabling and Conduits/Ducts

o   All methods shall be constructed and installed at the minimum height for Aerial SCS cabling as defined by regional regulations and to avoid unwanted access

▪   Where External Conduits/Ducts are used, the moisture retardant quality of the SCS cable sheath may be a factor to consider in some regions. Refer to Section 3.

The specific requirements for the project are defined in the *'Project Specifications'*.

The External Conduits/Ducts System shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Underground

Consideration shall be given when designing and installing Pathways & Spaces using Underground Conduits/Ducts to the following:

▪   The Conduits/Ducts shall be of a physical construction suited to the additional loads inherent with burial and compression of surrounding matter that fills excavations

▪   The Conduits/Ducts shall be continuous and waterproof with all joints glued to retard the ingress of moisture

▪   Mechanical continuity shall be maintained throughout all joints of Conduits/Ducts

▪   Conduits/Ducts shall be sized to allow for expansion by allowing a larger diameter conduit than initially required or by installing a spare conduit along the same route

▪   Where spare Conduits/Ducts are used they shall turn up to above ground surface or within pits and shall be capped to stop the ingress of moisture

▪   Draw cords capable of pulling the proposed SCS cables shall be installed in Conduits/Ducts and shall be replaced after use

▪   Conduits/Ducts shall not be the same colour as that used by hazardous services

▪   Conduits/Ducts shall be manufactured to comply with the physical and colour requirements referred to in regional Standards. Refer to Section 3

▪   Conduits/Ducts shall be buried to a depth that complies with the regional Standards. Refer to Section 3

▪   All sharp edges shall be removed from the internal and external surfaces of Conduits/Ducts

- Access Pits shall be installed at each change of direction of Conduits/Ducts. Factory manufactured bends may be used where the underground conduit turns up through the ground surface

- Extended route lengths of Conduits/Ducts shall have Access Pits installed at regular intervals to comply with maximum cable pulling tensions

- Access Pits and Conduits/Ducts shall be sized appropriately to allow for the SCS cable minimum bending radius

- Access Pit lids or covers shall be labelled to identify the SCS

- Access Pits shall be constructed and installed to bear the worst case traffic load conditions inherent with its environment

- Conduits/Ducts shall be installed in a direct line between Access Pits

- Conduits/Ducts should where possible be installed with a gradient that slopes away from the highest point and down to Access Pits such that the Conduits/Ducts do not hold any water

- Conduits/Ducts shall be installed higher than the water that collects in the bottom of the Access Pits

- Access Pits should be installed in such a way to allow collected water to dissipate into surrounding areas

- Conduits access to pits shall not be at the bottom of the pit

- Location tape that identifies the SCS shall be installed within the trench at a distance above the Conduits/Ducts for the complete route

- Ground location markers that identify SCS shall be installed at regular intervals above the location of the Conduits/Ducts route and shall be visible at ground surface level

The specific requirements for the project are defined in the *'Project Specifications'.*

The Underground Conduit System shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

PENETRATIONS

Consideration shall be given when designing and installing Penetrations through building structures to the following:

- Penetrations shall have spare capacity for future expansion of the SCS
- Penetrations through masonry floors, ceilings and walls shall be sleeved with PVC conduit that extends past the edge of the masonry on each side
- Penetrations through masonry floors, ceilings and walls do not need an additional sleeve if Cable Trays/Baskets reticulate through the penetration in a continuous length and provides adequate protection from sharp and abrasive surfaces
- Penetrations through plastic, plasterboard and metallic objects shall be fitted with appropriate bushing to provide adequate protection from sharp and abrasive surfaces
- Where Penetrations are made through Building Structures that are Fire Rated the penetration shall be fire sealed to a level that matches the designed Fire Rating of the Building Structure and additionally an independent fire sealing assessment will be carried out where there is a local regional requirement
- Where Penetrations are made through Building Structures that are exposed to the entry of moisture, the penetration shall be filled with moisture proofing material
- Where Penetrations are made through Building Structures that are exposed to the entry of rodents, the penetration shall be filled with Rodent proofing material

The specific requirements for the project are defined in the *'Project Specifications'.*

GENERAL CABLING INSTALLATION PRACTICES

The aim of this section is to provide SCS Installers with information relating to important factors that shall be considered during the installation phase of the SCS solution.

This 'Installation Standard' is documented in a format that provides the fundamental requirements before and during the installation of the SCS components on site.

After reading the first five sections of this 'Installation Standard, the Installer should have a solid understanding of the following:

- The intent of this 'Installation Standard'.
- The ability to successfully utilise this 'Installation Standard' as a reference tool for SCS Projects.
- The minimum set of responsibilities applicable to the Installer such as:
  o Compliance to regional 'Mandatory Regulations'.
  o Compliance to regional 'Design & Performance Standards'.
  o Compliance to regional 'Recommended Standards'.
  o Compliance to regional 'Manufacturer Standards'.
  o The minimum level of Licensing, Training & Experience required of the Installer.
- The international and regional industry Standards that is applicable for SCS projects.
- Widely accepted design concepts and methodology for SCS projects.

The SCS Installation Practices that are adopted by Installers are equally as important to the final solution as the SCS Design documented in the 'Project Specifications' and the quality of the Clipsal Australia's products that have been chosen for installation.

The SCS Design and Project Specification may have been meticulously researched and developed by Professional SCS Consultants, and the SCS Manufacturer products chosen for the project may be premium quality supported by high-tech Research and Development facilities, then comprehensively verified by independent laboratories. However, once the design has been accepted and the manufacturer products chosen, the success of the SCS project is ultimately in the hands of the Installer.

The hands-on Installation Practices and techniques that are adopted by the Installer and the manner and care taken when installing SCS components are a significant factor when measuring the performance of the finished product.

Installers that have used poor Installation Practices shall not be deemed as compliant to this 'Installation Standard'. Acceptance of the Installation by Customers and other users of this 'Installation Standard' would be unlikely.

The Installation Practices that are described within this section are generic to most SCS solutions such as RJ45, PDS and PBE. Installation Practices that are unique to a particular SCS solution are described in more detail in *Sections 7–10* of this 'Installation Standard'.

PRELIMINARY CONSIDERATIONS

Before the Installer/s arrives at the Customer premises, the following fundamental practises shall be adopted where applicable. These practices relate to their ability to perform the installation safely, effectively and efficiently such as:

- The Installer shall be equipped with and use the correct tools (hand tools, electric tools, drill bits etc.) specific to the various tasks required to perform the installation
- The Installer shall be equipped with and use the correct equipment (ladders, cable dispensers, torches, electrical leads, push rods, etc.) specific to the various tasks that are required to perform the installation
- The Installer shall be equipped with and use the correct safety equipment and clothing (RCD power supply, steel cap boots, protective clothing, protective ear and eye wear etc.) and adopt a general Safe Work policy and procedure
- The Installer shall have copies and be conversant with the latest 'Project Specifications' and Installation Drawings
- The Installer shall know the agreed Project Schedule and completion dates
- The Installer shall procure the SCS Products to satisfy the project requirements and schedule
- The Installer shall organise and manage a suitably qualified installation team with enough resources to satisfy the project requirements and schedule
- The Installer shall have appropriate and documented safe work practices
- The Installer shall ensure an adequate number of appropriately licensed or registered cabling staff are allocated to the task

WORKPLACE CONSIDERATIONS

Before the Installer/s begins work at the Customer's premises, there are some fundamental practises that shall be adopted that relate to their capabilities to perform the installation safely, effectively and efficiently such as:

- The Installer shall adopt a Safe Work policy and procedure to ensure that the Customer's personnel are protected at all times during the installation of the SCS
- The Installer shall adopt any Safe Work policies and procedures that the Customer may have in place
- The Installer shall gain knowledge of the Customer's Security policy and procedures
- The Installer shall ensure their work is carried out in a neat and orderly fashion such that the normal operations of the Customer are not adversely effected

- The Installer shall liaise with the Customer to locate the most suitable area to store SCS products, tools, installation equipment and other objects associated with the SCS installation
- The Installer shall adopt a suitable Dress Code that is professional and inoffensive to the Customer's personnel
- The SCS Installer shall cooperate with Installers of other services that are involved in installation work associated with the same Primary project or other Customer projects
- The Installer shall liaise with the Customer to organise regular Project Meetings to discuss and document the progress and any other items associated with the successful delivery of the SCS installation
- The Installer shall ensure that all existing items (furniture, ceiling tiles etc.) that are moved or disturbed during the installation are replaced to their original position
- The Installer shall ensure that all existing items that are damaged during the installation are reported to the Customer. Damaged items shall be repaired or replaced by the Installer before the Practical Completion inspection

INSTALLATION PHASES

Once the SCS design is approved, there are seven major phases to successfully install a SCS solution:

1. Customer Liaison regarding the important site-specific requirements.
2. Installation of the SCS Pathways & Spaces.
3. Installation of the SCS Backbone & Horizontal Cabling.
4. Installation of Distribution Systems & Hardware.
5. Termination of the SCS Cabling.
6. Performance Testing & Certification of the SCS solution.
7. 'As Built' documentation of the SCS Solution for the Customer.

The information that has been included to this point of *Section 6* describes Installation Practices that are relevant for Phase 1, 2 & 3.

The remaining information within *Section 6* describes Installation Practices that are specifically applicable to Phase 3.

More information relating to Phase 4, 5, 6, & 7 that is specific to a particular SCS solution is provided in *Section 7-10*.

CABLE INSTALLATION CONSIDERATIONS

This clause includes important factors that shall be considered by the Installer when reticulating SCS cable. The information is given assuming that the Installer has determined and installed suitable Pathways & Spaces as defined in *Section 5* for the reticulation of SCS Cabling.

In this clause, the word 'SCS Cables' generally refers to cables constructed with copper conductors or fibre cores except where the word 'Fibre Optic' appears to describe factors that are specific to fibre cables only.

Segregation from Hazardous Services

Important Safety factors to consider when installing SCS Cables near Hazardous Services are as follows:

▪ Fibre Optic SCS Cables cannot be affected by hazardous Electrical Cables and may be installed adjacent to Electrical cable in the following circumstances:
  o There is no space available to separate the cables
  o The fibre optic cable is labelled regularly along its route length to be easily identifiable as the SCS and not electrical cable
  o There is no existing SCS Pathway and the installation of a new SCS Pathway is prohibitive
  o There are no metallic elements within the fibre optic cable construction
  o If there is metallic elements within the fibre optic cable then it shall be treated the same as other SCS cables for segregation and safety issues
  o If the minimum segregation cannot be obtained then Fibre Optic cable with metallic elements shall not be installed or shall be replaced with cables that have no metallic elements
  o Approval has been obtained in writing from regional authorities

▪ SCS Cable shall not be installed in close proximity with hazardous Electrical Cables without suitable protection. Methods to provide segregation are as follows:
  o The SCS or Electrical cable is fully enclosed in PVC or metallic Conduit/Duct for the entire route length where cables are adjacent and parallel to each other. Additionally the minimum mandatory separation requirements are met for this configuration. A continuous barrier made from PVC or metallic material for the entire route length where cables are adjacent and parallel to each other segregates the SCS and Electrical cable. The conduit or barrier shall be fastened into position such that it may not move in the future. Metallic barriers shall be bonded to the Protective Earth of the building. Additionally the minimum mandatory separation requirements are met for this configuration
  o The SCS and Electrical Cable are separated by a minimum distance as specified in the 'Mandatory Requirements'

    o   Where SCS and Electrical cables cross each other then one of the previous methods shall be adopted. The conduit or barrier shall be installed on either the SCS or Electrical cable and extend for the minimum distance on each side of the crossing. The conduit or barrier shall be fastened into position such that it may not move in the future. Additionally, the minimum mandatory separation requirements are met for this configuration

- SCS Cable shall not be installed in an environment that is detrimental to the minimum design capabilities of the SCS Cable construction

- The Segregation of SCS cables from Hazardous Electrical cables is an important safety issue for personnel and for the integrity of Carrier Networks. As such most regions have 'Mandatory Regulations' that cover this issue. Refer to *Section 3*.

EMI/EMC

EMI/EMC that is caused or introduced by poorly installed SCS is a factor that is known to be detrimental to the performance of Telecommunication Systems and the effective delivery of applications to users. However, most regions do not have specific regulations that relate particularly to SCS Cabling. This is due to the infrastructure being passive (until connected to systems) and services that may run over the systems will change over the life expectancy of the SCS.

This 'Installation Standard' requires the Installer to consider good installation practices that can be implemented to minimise any EMI/EMC caused or introduced by the SCS. As there is a lack of regulations and many different factors outside of the SCS installation that may be involved, this clause uses the word 'should' instead of 'shall'.

More descriptive information regarding EMI/EMC is provided in *Section 4*.

The following important factors regarding EMI/EMC should be considered when installing SCS:

- Fibre Optic SCS Cables cannot be affected by EMI/EMC and as such should be installed where high levels of EMI are unavoidable

- The separation distance between SCS and Electrical systems should be increased beyond the minimum safety requirements called for in 'Mandatory Regulations' when high EMI may be encountered

- Surge suppressors and other devices designed to limit electrical transients caused by Telecommunications and/or Electrical Systems should be used

- Where SCS and Electrical cabling cross paths they should cross at right angles

- Or, where SCS must share parallel Pathways with high voltage Electrical cabling, one or more of the following should be considered:

    o   Cabling systems should be enclosed in a grounded metallic Conduit/Duct

    o   Separate the cables from sources of EMI further than 'Mandatory Regulations'

    o   Use fibre in place of metallic cabling

    o   Separate cables by a continuous rigid barrier. The barrier should be metallic and bonded to the building Protective Earth System

- The SCS Pathways and Spaces should be designed and installed such that the SCS is not adjacent and parallel to the following potential sources of EMI/EMC:

- o High voltage Electrical Cabling and Distribution equipment
- o Radio Frequency sources
- o Inverters
- o Induction heaters
- o Arc welders
- o Large motors
- o Generators
- o Lighting that uses heavy start currents
- o Transformers
- o High voltage transmission power lines
- o Underground areas that are subject to high ground (earth potential rise-EPR zones) currents
- o Any other item that can be a potential source of EMI/EMC

- The SCS performance level should be superior to the maximum transmission requirements of the Telecommunication Systems
- The Cross-connect cords that interface between Telecommunication Systems, Users and the SCS should be factory made and of high quality to assure the minimum signal degradation when coupled together

The Designer may insert specific requirements for EMI/EMC within the *'Project Specification'*. The Installer shall check the *'Project Specification'* for any specific EMI/EMC requirements.

Reticulating Cables

The following important factors shall be considered when reticulating SCS:

- Fibre Optic SCS Cables are intrinsically more fragile than copper cables and require additional care when being reticulated throughout a building
- Fibre Optic SCS Cables shall be installed in a position where they will not be disturbed or damaged by the reticulation of other cables
- All SCS Cables shall be labelled at each end to ensure correct identification and termination later in the project
- Where SCS Cables are reticulated vertically through different levels of a building the cable shall be lowered instead of raised
- SCS Cables shall be reticulated by using constant and controlled force instead of sharp tugs that may exceed the minimum pulling tension specified for the cable
- Installers shall be placed at all changes of direction when reticulating cables to ensure that the minimum bending radius and pulling tension specified for the cable is not exceeded
- Installers shall take special care around sharp and abrasive edges to protect the SCS Cable against external sheath damage
- Installers shall avoid kinking, twisting, damaging the cable sheath and crushing of cables during reticulation of SCS Cabling

- Installers shall ensure that the SCS Cabling is always protected from the following environmental factors during the reticulation phase:
  - SCS Cables shall not be left unattended across the floor surface where any form of personnel or vehicular traffic may come into contact with it
  - SCS Cables shall not be left in wet situations
- Installers shall leave some spare capacity at each end of the SCS Cable route to allow for future moves and changes or accidental/malicious damage resulting in re-terminations etc
- Where SCS Cables are bundled and hanging in position above the final termination location for any period of time care shall be taken to ensure that the minimum bending radius and pulling tension specified for the cable is not exceeded
- Where SCS Cables have spare length, the cable shall not be fastened in close multiple loops of the same diameter.

Fastening of Cables

The following factors shall be considered when fastening SCS Cabling:

- Fibre Optic SCS Cables shall be fastened in a position where they will not be disturbed or damaged by the reticulation of other cables
- SCS Cables shall be fastened at all changes of direction at a point immediately before and after the bend to ensure that the cable retains its minimum bending radius
- Cable ties shall be purpose made for the fastening of cables. Velcro ties may be used as an alternative where additions, moves and changes are known to be frequent
- Where SCS Cables reticulate horizontally on top of cable bearing surfaces of Cable Trays they shall be fastened at regular intervals with cable ties or Velcro
- Where SCS Cables reticulate horizontally on the underside of the cable bearing surface of Cable Trays/Baskets they shall be fastened at more regular intervals with cable ties or Velcro
- Where SCS Cables reticulate vertically on the cable-bearing surface of Cable Trays/Baskets they shall be fastened at more regular intervals with cable ties or Velcro
- Where SCS Cables reticulate horizontally on Catenaries they shall be fastened at irregular intervals with cable ties or Velcro
- SCS Cables shall be tied on Catenaries in bundles that do not exceed the load carrying capacity of the catenary wire
- SCS Cables shall be tied on Catenaries in bundles that do not exceed the load bearing capacity of the SCS cable construction
- SCS Cables shall be tied, clipped or saddled with purpose made fasteners to Building Structures such as wooden or steel beams at regular intervals
- SCS Cable bundles shall not be loomed in neat parallel lines except where the cables enter the Distributor
- SCS Cables shall be fastened firmly but the outer sheath of the cable shall not be pinched, distorted or damaged
- Cable tie excess shall be cut away and left with no sharp ends protruding within the SCS Pathway

- SCS Cables shall not be fastened to any surface that is potentially trafficable

- SCS Cables may not require fastening through Pathways & Spaces where there is adequate support and the area is generally inaccessible from disturbance and possible damage

RJ45 MODULAR SCS SOLUTION

Important Features of the RJ45 Modular SCS Solution

The following information highlights the important features and benefits of the RJ45 Modular Solution:

- **Most Accepted SCS Solution (RJ45)**

  The customer has specified RJ45 as its solution, and all installation practices shall comply with Clipsal Australia's recommended practices.

- **Design Methodology**

  The RJ45 Modular SCS Solution is the most suitable option for the customer and no alternatives will be accepted.

- **IDC Termination**

  The Patch Panels and Telecommunication Outlet termination modules shall be terminated as per Clipsal Australia's instructions, utilising all cable management provided with the product. Cable retention caps shall also be utilised.

- **Support for the Cabling Loom at the rear of the Patch Panel**

  The method of support is by tying the cable looms at the back of the Patch Panel to a support brace that is integral to Clipsal Australia's design.

- **Unloaded Patch Panel Options:**

  Unloaded Patch Panels are suitable for small installations that require the capability to grow as required. Only the minimum amount of RJ45 jacks are terminated and added to, one at a time or as required. These will be accepted for this application only.

- **Labelling design:**

  Different colour Patch Panel labels can be used to distinguish between the different SCS sub-systems. This provides the SCS User with a very simple method of identifying, which Patch Panels are connected to the TOs, which Patch Panels provide Backbone Cabling to another Distributor location and which Patch Panels are connected to Telecommunication Equipment Services. Clipsal Titanium fully featured panels are accepted as an option for this purpose.

- **User Services Moves & Changes are easy**

  The RJ45 Modular patch panels shall be labelled in accordance with this specification for ease of moves and changes.

- **Documentation and Administration is made easy with a simple Record Management System:**

  Administration labelling must be carried out in accordance to Standards.

For more information regarding the termination of the RJ45 Modular IDC connector refer to the diagram in *Clause 8.1.*

RJ45 Modular Typical Schematic

The schematic design must comply with Clipsal Australia's standards, and be approved by Clipsal Australia, and the customer prior to commencement of works (insert design on this page).

HORIZONTAL CABLING

The aim of this section is to provide SCS Installers with information relating to important factors that shall be complied with during the installation phase of the RJ45 Modular SCS solution.

The Installation Practices that are described within this section are specific to the **RJ45 Modular SCS Solution** and cover the following Installation Phases:

4. Installation of Distribution Systems & Hardware
5. Termination of the SCS Cabling
6. Performance Testing & Certification of the SCS solution
7. 'As Built' documentation of the SCS Solution for the Customer

This Section includes important factors that shall be considered by the Installer when terminating SCS cable. The information is given assuming that the Installer has determined and installed suitable Pathways & Spaces as defined in *Section 5* and has reticulated SCS Cabling as defined in *Section 6*.

This Section includes information about the Horizontal Cabling and other associated sub-systems except LAN or Voice Backbone Cabling. The reason for this is that all SCS installations regardless of the size of the project will have some requirement for Horizontal Cabling to be installed. Not all installations will require LAN or Voice Backbone Cabling.

As a minimum, most Customers will require Horizontal Cabling, Telecommunication System Equipment, Carrier Services and a method to Cross-Connect services to Users. This Section describes the minimum installation practices that are required to perform and accommodate the terminations of fixed cabling and define the methods that shall be utilised to Cross-Connect between fixed cabling.

HORIZONTAL CABLING TYPICAL SCHEMATIC

Both Clipsal Australia, and the customer prior to commencement of works shall approve horizontal Link diagram.

Both Clipsal Australia, and the customer prior to commencement of works shall approve Horizontal channel diagram

Both Clipsal Australia, and the customer prior to commencement of works shall approve the termination sequence.

PERFORMANCE CRITERIA

The Installer shall comply with the following important factors regarding the minimum Performance Criteria of the Horizontal Cabling and associated SCS sub-systems:

- Installers shall ensure that the SCS products they propose to install within a Customer premises is compliant with the technical standards described within the 'Mandatory Regulations' of their region. Refer to Section 3

- The Installer shall ensure that all SCS products have been marked or labelled with verification that an endorsed and independent Testing Laboratory has tested and approved samples of the product. Refer to Clause 4.3.12

- The Installer shall check the Manufacturer's product specifications to ensure that the products chosen are capable of the minimum transmission performance required for the intended use of the SCS sub-section

- The Installer shall ensure that Clipsal Australia, which manages the SCS Certification & Warranty Program, has officially endorsed all SCS products. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS products and associated Pathways and Spaces products are those endorsed by Clipsal Australia to support the Certification and Warranty Program. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS termination products and cables are marked with the correct colour codes. Refer to the diagrams in Clause 8.1

- The Installer shall ensure that all SCS sub-systems are installed using the correct groups of products to allow for the minimum level of transmission required from the sub-system. Refer to the Project Specifications for the minimum performance level requirement for each SCS sub-system

- All components and cabling that form part of a communications channel shall be of a performance level equal to or greater than that specified for the channel

Horizontal Unshielded Twisted Pair Cable

The Installer shall comply with the following important factors regarding Unshielded Twisted Pair (UTP) Cabling:

- Horizontal UTP Cabling shall have 4 x balanced and twisted pairs

- Horizontal UTP Cabling shall be manufactured to the minimum transmission characteristics as defined for Category 6 performance. Refer to standards listed in Section 3

- Unless specified for special application the UTP cable shall have a nominal characteristic impedance of 100ohms

- Horizontal UTP Cabling conductors shall be colour coded. Refer to the diagrams in Clause 8.1

- Horizontal UTP Cabling that is reticulated through internal building Pathways & Spaces shall be of internal grade construction

- Horizontal UTP Cabling that is reticulated through external building Pathways & Spaces shall be of external grade construction. For more information regarding definitions of an external situation, refer to the standards listed in Section 3
- Where the supply of the external grade cable with the appropriate performance level cannot be obtained, Fibre Optic Cable should be used in its place

Refer to the diagrams in *Clause 8.1* for more information regarding Horizontal UTP Cabling

Horizontal Cabling Permanent Link

The Horizontal Cabling Permanent Link is the transmission path of an installed cabling sub-system including the connecting hardware at the ends of the installed cable. In the Horizontal Cabling sub-system, the Permanent Link consists of the TO, the Horizontal Cabling and the termination of the cable at the Distributor.

The Installer shall comply with the following important factors regarding the Horizontal Cabling Permanent Link:

- All cabling and termination components that are installed in the Horizontal Cabling Permanent Link shall be manufactured to the minimum transmission characteristics as defined for Category 6 performance. Refer to standards listed in Section 3 and especially Clause 3.1.3
- The Horizontal Cabling Permanent Link shall not have a route length longer than the maximum length defined for Class E performance. Refer to standards listed in Section 3 and especially Clause 3.1.3
- The Horizontal Cabling Permanent Link does not include the Distributor, Equipment and Work Area Cross-Connect Cabling

Refer to the diagrams in *Clause 8.1* for more information regarding the Horizontal Cabling Permanent Link.

Horizontal Cabling Channel

The Horizontal Cabling Channel is the transmission path between Telecommunication System equipment such as a LAN Switch/Hub and the User equipment. A typical channel would consist of the Horizontal Cabling Permanent Link together with Cross-Connect Cabling and Work Area Cross-Connect Cabling.

It is important that the Horizontal Cabling Channel is installed to meet the required class of performance for the Telecommunication System applications that are to be used by the Customer. The performance of the channel excludes the connectors of the application-specific equipment.

The Installer shall comply with the following important factors regarding the Horizontal Cabling Channel:

- All cabling and termination components that are installed in the Horizontal Cabling Permanent Link within the Horizontal Cabling Channel shall be manufactured to the minimum transmission characteristics as defined for Category 6 performance. Refer to standards listed in Section 3 and especially Clause 3.1.3

- The Horizontal Cabling Permanent Link within the Horizontal Cabling Channel shall not have a route length longer than the maximum length defined for Class E performance. Refer to standards listed in Section 3 and especially Clause 3.1.3

- The length and performance quality of the Distributor and Work Area Cross-Connect Cabling is dependent on the performance requirements of the Telecommunication Systems that the Customer will interface with the SCS. This Installation Standard defines the minimum requirements for LAN & Voice applications that are defined in the following table:

Systems	Horizontal Cabling Channel Sub-system	Performance Class
All	Horizontal Cabling Permanent Link	Class E
Voice	Distributor, Work Area Cross-Connect Cabling	Class A, B, C, E as defined in the *Project Specifications*
LAN	Distributor, Equipment and Work Area Cross-Connect Cabling	Class E

- The minimum transmission performance requirements for Class A, B, C, & E are defined in the standards listed in Clause 3.1.3

Refer to the diagrams in *Clause 8.1* for more information regarding the Horizontal Cabling Permanent Link.

USER WORK AREA

The User Work Area is the location where the User interfaces with the SCS at the far end of the Horizontal Cabling. In an office environment this would be the workstation area that accommodates the User and their equipment such as the PC and telephone.

Telecommunication Outlets

The Installer shall comply with the following important factors regarding the Telecommunication Outlets (TOs):

- Telecommunication Outlets shall be 8 pin modular outlets, with an insulation displacement type Connection.

- Telecommunication Outlets shall be rated to perform to Category 6.

- Telecommunication Outlet terminations shall be colour coded to match the wiring sequence defined in the diagram provided in Clause 8.1

- Telecommunication Outlets shall be terminated to match the wiring sequence defined in the diagram provided in Clause 8.1

- In situations where there is existing SCS that is terminated to a different wiring sequence then the installer shall facilitate a solution via the Project Manager and Clipsal Australia for providing the Certification & Warranty for the project. All communication shall be in writing and made available to the Customer

- Telecommunication Outlets shall be terminated with the correct type of tools and method that have been approved by the manufacturer

- All 4 pairs of the Horizontal Cabling shall be terminated to the Telecommunication Outlet

- Excess cable shall be cut and removed from the Telecommunication Outlet as part of the termination technique

- The twist ratio of the cable pairs shall be maintained as close as possible to the Telecommunication Outlet terminations and shall not be untwisted further than recommended in the standards listed in Clause 3.1.3

- The cable sheath shall be maintained as close as possible to the Telecommunication Outlet terminations

- The Installer shall ensure that there are no reverse pairs, transposed pairs or split pairs when terminating the Telecommunication Outlet

- There shall be sufficient slack left behind the Telecommunication Outlet termination to maintain the minimum bend radius of the cable

- The Telecommunication Outlet shall be orientated so the latching clip of the Work Area Cross-Connect Cable is downwards when inserted

- Consideration shall be given to the Telecommunication Outlet having a built in shutter that closes to protect the internal conductors when not in use. If this is not possible then consideration should be given to a faceplate that accommodates the Telecommunication Outlet being shuttered

- The Telecommunication Outlet shall be mounted horizontally (pins to the top) unless specified otherwise, in the Project Specifications

- Where the Telecommunication Outlet is located adjacent to an electrical outlet to serve the same Work Area, the Telecommunication Outlet shall be mounted at the same height and same distance apart from electrical outlet

- Where the Telecommunication Outlet is not located adjacent to an electrical outlet then the Telecommunication Outlet shall be mounted at the height nominated in the Project Specification

- The exact quantity and locations of Telecommunication Outlets shall be determined by the Project Specifications

- The Telecommunication Outlets shall be mounted at an acceptable height to minimize contact with water and floor washing detergent that may be used in the location by cleaners

- The Telecommunication Outlet shall only be inserted with Work Area Cross-Connect cables that are terminated with a suitable 8 pin modular plug

- Any special wiring configurations that are required by the Telecommunication Systems equipment shall not be introduced at the Telecommunication Outlet and/or any part of the Horizontal Cable Permanent Link

- Any Special adapters required to split pairs match impedance change wiring sequence or deliver any other change shall be external to the Telecommunication Outlet and/or any part of the Horizontal Cable Permanent Link

Refer to the diagrams in *Clause 8.1* for more information regarding the Telecommunication Outlets.

The Telecommunication Outlet shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Faceplates

The Installer shall comply with the following important factors regarding the Face Plate:

- Where specified in the Project Specifications, the Telecommunications Outlets shall have an integral shutter to protect the conductors

- Faceplates shall match the colour of the existing faceplates, where no faceplates are present the faceplates shall be white unless otherwise specified in the Project Specifications

- Where possible, Faceplates shall be flush mounted on surfaces

- Faceplates shall be fixed to surfaces by purpose made and approved methods to assure that the Telecommunications Outlets will not become loose from the surface

- Where Faceplates cannot be flush mounted then suitable mounting apparatus that stands off from the wall shall be installed. The mounting apparatus shall be purpose made and approved by the SCS manufacturer to assure that the Telecommunication Outlet will not become loose from the surface

- Stand off mounting apparatus or suitable Modular Enclosures shall be utilised where the flush mounting of the Faceplate will not allow the minimum bend radius of the SCS cable when installed

- Where Faceplates are surface mounted to plasterboard then a suitable mounting bracket shall be used. The mounting apparatus shall be purpose made and approved by Clipsal Australia

- Where Faceplates are surface mounted to masonry then a suitable wall box/bracket shall be used. The mounting apparatus shall be purpose made and approved by Clipsal Australia

- Where the Telecommunication Outlet is not suitably protected from the ingress of dust then the Faceplate shall be fitted with a rear cover

- Where Faceplates are to be mounted on the floor the suitable enclosure shall be fastened to the floor. The mounting apparatus shall be purpose made and approved by Clipsal Australia

- Where Faceplates are to be mounted on a Service Pole the mounting apparatus shall be purpose made and approved by Clipsal Australia

- Where Faceplates are to be mounted on a Skirting Duct or Workstation Furniture the mounting apparatus shall be purpose made and approved by Clipsal Australia

- All penetrations that are prepared to provide access from any Pathways & Spaces to the Faceplate fastening location shall be free of sharp or abrasive edges that may damage the SCS

- Faceplates shall be mounted apart from the adjacent Electrical Outlet to comply with mandatory segregation rules. Refer to Section 3
- Any unused apertures of the unshuttered Faceplate shall be fitted with a blank insert to stop the ingress of dust through the front of the Faceplate
- Faceplates shall be mounted such that the minimum bend radius of the SCS cable can be maintained
- The Faceplate shall be manufactured with a purpose made identification label holder complete with a clear protective cover for the label

The Faceplates shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Modular Enclosures

The Installer shall comply with the following factors regarding the Modular Enclosures:

- Modular Enclosures may be used where specified in the Project Specifications
- Modular Enclosures shall be manufactured to maintain the minimum bend radius of the SCS cable when terminated
- Modular Enclosures or suitable Stand off mounting apparatus shall be utilised where the flush mounting of the Faceplate will not allow the minimum bend radius of the SCS cable when fastened
- Any apertures of Modular Enclosures that are unused shall be fitted with a blank insert
- Modular Enclosures shall be manufactured with a purpose made identification label holder complete with a clear protective cover for the label

The Modular Enclosures shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

19" WALL MOUNTED DISTRIBUTOR

Typically, the RJ45 Modular solution endorses the use and design of 19" Wall Mounted Distributors for the facilitation of the Cross-Connect Cabling between Horizontal Cabling Patch Panels and LAN Equipment.

For smaller SCS installations, to install a Cabinet Distributor may be overkill. This design would be suitable for SCS installations with less than 24 User Work Areas connected to LAN only applications.

Refer to the *Project Specifications* for more specific information regarding the size, termination capacity, quantity, locations and the proposed layout of Cross-Connect fields of 19" Wall Mounted Distributors.

19" Wall Mounted Distributors shall be installed to comply to the following information with the design information provided for Distributors in *Section 4*.

19" Wall Mounted Cabinets shall be of Clipsal Australia manufacture.

19" Wall Mounted Distributor Frames

As a minimum, the Installer shall comply with the following factors regarding the 19" Wall Mounted Distributor Frames:

- 19" Wall Mounted Distributor Frames shall be fastened to a solid Building Structure such as a solid masonry wall. Where the wall is made from steel or wooden framework then the frames shall be fastened to the solid steel or wooden joists. If the footprint of the frames fastening holes does not align with the joists then a suitable backplane or solid strut shall be attached to the joists. The frames shall then be attached to the backplane or struts. Whatever solution is used to mount the frames the fastening methods and hardware shall have the capacity to tolerate the weight of the frames connecting the SCS and Cross-Connect cables. The solution should also be able to tolerate the additional pressure that is applied when cables are being reticulated and/or terminated to the frames

- The top of 19" Wall Mounted Distributor Frames shall not be installed higher than specified in the standards listed in Section 3

- The bottom of 19" Wall Mounted Distributor Frames shall not be installed lower than specified in the standards listed in Section 3

- 19" Wall Mounted Distributor Frames shall be suitably sized to accommodate each sub-system of SCS and additional spare capacity as follows:
  o Horizontal Cabling + 50%

- If the aforementioned capacity cannot be provided on one 19" Wall Mounted Distributor Frames then another frame shall be supplied and installed

- Cable management shall be installed such that it can accept the system under full utilisation of permanent and Cross-Connect cables without exceeding the load bearing capacity of the cable management

- Where different sub-systems of SCS are sharing the same 19" Wall Mounted Distributor Frames the different cabling groups shall not be mixed together and shall follow the sequence detailed below:
  o Voice Equipment Cabling (white if applicable)shall be installed at the bottom of the frame with 25% space capacity for additional voice services
  o Voice and LAN (UTP) Backbone Cabling (green if applicable) shall be installed above the allocation for Voice Equipment Cabling with 25% space capacity for additional Voice and LAN backbone services
  o Horizontal Equipment Cabling (blue) shall be installed above the allocation for Voice and LAN Backbone Cabling with 50% space capacity for additional Horizontal Cabling requirements
  o LAN Equipment shall be installed with at least 300mm of segregation between the Equipment and the Cabling Patch Panels. If this cannot be achieved within the maximum space of the 19" Wall Mounted Distributor frame then the LAN Equipment shall be mounted on a shelf or such adjacent to the frame

- All 19" Wall Mounted Distributor Frames and associated cable management hardware shall be of the same manufacturer as the rest of the SCS where available.

The 19" Wall Mounted Distributor Frames and associated cable management hardware shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

19" Wall mounted distributor frames shall be of Clipsal Australia manufacture.

19" CABINET DISTRIBUTOR

Typically, the RJ45 Modular solution endorses the use and design of 19" Cabinet Distributors for the facilitation of the Cross-Connect Cabling between Horizontal Cabling Patch Panels and LAN Equipment and Voice Backbone Cabling.

19" Cabinet Distributors offer the Customer higher security as critical Equipment and the cross-connection to the Horizontal and Backbone Cabling is protected within the cabinet.

There are many sizes of 19" Cabinet Distributors to provide accommodation for small, medium or large SCS installations. Multiple 19" Cabinet Distributors can be placed side by side to expand the accommodation space available.

Refer to the *Project Specifications* for more specific information regarding the size, termination capacity, quantity, locations and the proposed layout of Cross-Connect fields and Disconnection Modules of Cabinets Distributors.

19" Cabinet distributors shall be of Clipsal Australia manufacture.

19" Cabinet Requirements

The Installer shall comply with the following important factors regarding 19" Cabinets:

- The Cabinets locations, size and proposed layout shall be provided in the Project Specifications
- Cabinets shall be sized for 30% expansion
- Cabinets shall be supplied with front and rear equipment mounting rails
- The front rails for the equipment mounting rails shall be set back to allow enough space for all Equipment, Patch Panels and Cross-Connect Cabling
- Cable entry into the Cabinet shall be via the bottom plate (plinth) or through a penetration in the cabinet top. Side access in a Cabinet adjacent to a cavity wall is acceptable
- Cable entry into the Cabinet shall have grommets or be sealed to prevent the ingress of dust
- An additional 30% capacity in the cable entry shall be provided and sealed to stop the ingress of dust
- Cable entry into the Cabinet shall not be via penetrations in the side, front or back panels
- Cable runs within Cabinets shall use the cable tray provided, where appropriate
- Cables within Cabinets shall be loomed in such a way as not to reduce useable cabinet space designed for Equipment mounting
- Cables within Cabinets shall be loomed in a position that is inaccessible once all terminations and Equipment has been installed
- Cabinets shall be fastened to the floor with suitable anchors
- Cabinet doors must be capable of opening past 90 degrees
- The Installer shall check the Project Specifications for any special requirements for the installation of a Protective Earth to Cabinets
- Communications Cabinets that are intended to house LAN/WAN equipment shall be supplied with a power rail and extraction fans. The size shall be provided in the Project Specifications
- SCS and Equipment shall be accessible from the front and back of the Cabinet.

The Cabinets and associated hardware shall be included in the list of materials that is incorporated within the Clipsal Australia Certification & Warranty Agreements for the project.

Patch Panels

The Installer shall comply with the following important factors regarding Patch Panels:

- Patch Panels may be manufactured with intrinsic 16,or24 IDC ports
- Patch Panels shall be fastened to the side rails of the 19" Cabinet
- The top of the Patch Panels shall not be installed higher than specified in the standards listed in Section 3
- The bottom of the Patch Panels shall not be installed lower than specified in the standards listed in Section 3
- Each Patch Panel shall have installed below it a cable management module that has the capacity to accept the maximum amount of Patch Cables inserted into a fully terminated Patch Panel
- Cable management shall be installed such that it can accept the system under full utilisation of permanent and Cross-Connect cables without exceeding the load bearing capacity of the cable management
- Where different sub-systems of SCS is sharing the same 19" Cabinet, the different cabling groups shall not be mixed together on the same Patch Panel but installed as follows:
    - Voice Equipment Cabling Patch Panels **(white)** shall start at the bottom of the Cabinet then 25% spare capacity shall be left free
    - Voice & LAN (UTP only) Backbone Cabling Patch Panels **(green)** shall start next and additionally have 25% spare capacity left free
    - Horizontal Equipment Cabling Patch Panels **(blue)** shall start next and additionally have 50% spare capacity left free
    - There shall be at least 300mm of segregation between the Copper cabling and the LAN/WAN Equipment
    - LAN Backbone at the top(fibre optic if applicable)
- Cable management shall be installed to accommodate Cross-Connect Cables that plug into the LAN Equipment
- Horizontal cable management shall be utilised between each LAN Equipment component
- Where two Communication Cabinets are required then one shall be designated for the SCS Cabling and the other frame shall be for the LAN Equipment
    - The two cabinets shall have the adjacent sides removed and be fastened together
    - The mounting rails of the cabinets shall be moved further back from the front door to allow for Cross-Connect Cable reticulation between cabinets
- All Patch Panels and associated cable management hardware shall be of the same manufacturer as the rest of the SCS

- Patch Panels shall be 8 pin modular outlets, with an insulation displacement type Connection

- Patch Panels shall be rated to perform to Category 5e

- Patch Panels terminations shall be colour coded to match the wiring sequence defined in the diagram provided in Clause 8.1

- Patch Panels shall be terminated to match the wiring sequence defined in the diagram provided in Clause 8.1

- In situations where there is existing SCS that is terminated to a different wiring sequence then the installer shall facilitate a solution via the Project Manager and Clipsal Australia for providing the Certification & Warranty for the project. All communication shall be in writing and made available to the Customer

- Patch Panels shall be terminated with the correct type of tools and method that have been approved by the manufacturer

- All 4 pairs of the Horizontal Cabling shall be terminated to the Patch Panels

- Excess cable shall be cut and removed from the Patch Panels as part of the termination technique

- The twist ratio of the cable pairs shall be maintained as close as possible to the Patch Panels terminations and shall not be untwisted further than recommended in the standards listed in Clause 3.1.3

- The cable sheath shall be maintained as close as possible to the Patch Panel termination

- The Installer shall ensure that there are no reverse pairs, transposed pairs or split pairs when terminating Patch Panels

- There shall be sufficient slack left behind the Patch Panel termination to maintain the minimum bend radius of the cable

- The cable loom behind the Patch Panel termination shall be tied to and supported by an intrinsic bracket

- The Patch Panels shall be orientated so the latching clip of the Cross-Connect Cable is downwards when inserted. Pins at the top

- The exact quantity and locations of Patch Panels shall be determined by the Project Specifications

- The Patch Panels shall only be inserted with Cross-Connect cables that are terminated with a suitable 8 pin modular plug

- Any special wiring configurations that are required by the Telecommunication Systems equipment shall not be introduced at the Patch Panels and/or any part of the Horizontal Cable Permanent Link

- Any Special adapters required to split pairs, match impedance, change wiring sequence or deliver any other changes shall be external to the Patch Panels and/or any part of the Horizontal Cable Permanent Link

- Permanent SCS shall be reticulated through the backspaces of the Wall Mount Distributor Frames and Cabinets and shall not be reticulated through the cable management. Permanent SCS shall be reticulated through the back channel in numbers that allows enough space for the termination of cables while maintaining the minimum bend radius

- Cross-Connect cabling shall be reticulated through the cable management and not through the back spaces of the Wall Mounted Distributor Frames or Cabinets. Cross-Connect cables shall be reticulated and terminated without removing any sections of the Wall Mounted Distributor Frames, Cabinets or Patch Panels

- Patch Panels shall be designed with in-built capabilities to accept purpose made labels above each RJ45 port.

The Patch Panels shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

LAN Equipment Cabling

The RJ45 Modular Solution does not have a requirement for the LAN Equipment Cabling sub-system. The fundamental design of the RJ45 Modular SCS Solution designates the location of the LAN Equipment within or adjacent to the same Distributor that terminates the Horizontal Cabling.

Most standards based LAN Equipment products use RJ45 Modular ports for connecting to Users. Therefore, connections between LAN Equipment and the Horizontal Cabling is performed by using Cross connect Patch Cables between the LAN Equipment RJ45 port and the Patch Panel RJ45 port.

Voice Equipment Cabling

The Installer shall comply with the following important factors regarding the Voice Equipment Cabling:

- The length of Voice Equipment Cabling is dependent on the application. The Installer shall check with the Project Specifications for the maximum length of the Voice Equipment Cabling

- The minimum transmission performance criteria for Voice Equipment Cabling are dependent on the application. The Installer shall check with the Project Specifications for the performance level Category of the Voice Equipment Cabling

- The Voice Equipment end of the Voice Equipment Cabling shall be manufactured and terminated to the Voice Equipment Manufacturer's guidelines

- The Distributor end of the Voice Equipment Cabling shall be terminated to the Voice Equipment field and white Patch Panels

- Voice Equipment Cabling shall be neatly reticulated through a purpose built Pathway from the Voice Equipment to the Distributor Frames or Cabinets

- Voice Equipment Cabling shall be neatly reticulated through the backspaces of the Distributor Frames or Cabinets

- Voice Equipment Cabling shall be neatly reticulated to the Patch Panel and the sheath removed to the edge of the lowest module to be terminated in the multi-pair group

- Voice Equipment Cabling shall be separated into sequential groups of the correct color codes and loomed neatly to each Patch Panel

- Where 25 pair Voice Equipment Cabling has been specified for termination on a 24 port Patch Panel, there will be 1 x loom and the last pair shall be left un-terminated

- Where 50 pair Voice Equipment Cabling has been specified for termination on 24 port Patch Panels, there will be 2 x looms and the last 2 x pairs shall be left un-terminated

- Where 100 pair Voice Equipment Cabling has been specified for termination on 24 port Patch Panels, there will be 4 x looms and the last 4 x pairs shall be left un-terminated

- Each pair of the LAN Equipment Cabling shall be terminated to the color code and sequence recommended by the Voice Equipment manufacturer and/or the standards listed in Section 3

- Refer to Clause 8.5.2 for more information regarding the termination of cabling

The Voice Equipment Cabling shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

LABELLING

Labelling is a very important part of the SCS. This Installation Standard defines the acceptable methods of labelling for each sub-system or component of the SCS. The Installer shall comply with one of the options listed in each clause for labelling.

The labelling convention for the site shall be defined in the *Project Specifications*.

Horizontal Cable Sheath

The Installer shall comply with the following important factors regarding the Horizontal Cable Sheath Labelling:

- All Cable Sheaths shall be labelled

- # designates Letter or Number

- The labelling shall conform to the following: Distributor Location # - Distributor Frame # - Outlet #

- For example the 10th TO terminate on the B Distributor frame located within the A Distributor would read as follows: A-B-10

- Horizontal Cabling labels shall have the same number as the TO Faceplate

- Each Horizontal Cable shall be labelled with a permanent label at each end of the cable attached to the sheath just before the termination point. Acceptable types of labels are as follows:
  o Black legible ink handwritten or typed on a white background that is protected by a wrap around self-laminating clear material
  o A label that can be tied to the cable with black legible indelible ink
  o Applicator ferrules displaying the label designation
  o Adhesive wrap around labels displaying the designation
- Labels shall not be with ink marked directly to the cable sheath
- Labels shall not be with adhesive plastic or paper tape marked with ink
- All Distributors in the same building shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Faceplates

The Installer shall comply with the following important factors regarding the Face Plates:

- All Faceplates shall be labelled
- # designates Letter or Number
- The labelling shall conform to the following: Distributor Location # - Distributor Frame # - Outlet #
- For example the 10th TO terminate on the B Distributor frame located within the A Distributor would read as follows: A-B-10
- Face Plates shall be purpose made with an integral facility to accept printed paper or plastic labels above the TO apertures. The label once inserted shall be protected by a clear clip-on plastic cover that shall fit flush
- Labels shall be legible and typed using black ink on a white background
- All Distributors in the same building shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Modular Enclosures

The Installer shall comply with the following important factors regarding the Modular Enclosures:

- All Modular Enclosures shall be labelled
- # designates Letter or Number

- The labelling shall conform to the following: Distributor Location # - Distributor Frame # - Outlet #

- For example the 10th TO terminate on the B Distributor frame located within the A Distributor would read as follows: A-B-10

- Modular Enclosures shall be purpose made with an integral facility to accept printed paper or plastic labels above the TO apertures. The label once inserted shall be protected by a clear clip-on plastic cover that shall fit flush

- Labels shall be legible and typed using black ink on a white background

- All Distributors in the same building shall have a different letter or number.

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Patch Panels

The Installer shall comply with the following important factors regarding Patch Panels:

- Patch Panels shall be manufactured with special label holders and labels supplied with the Patch Panel kit

- All Patch Panels shall be labelled either above or below the RJ45 Ports such that the label describes the Telecommunication Outlet that each RJ45 port is connected to

- Labels shall be legible and typed using black ink on a colour coded background:
  - o White background for Voice Equipment Services
  - o Green background for UTP Voice/LAN Backbone
  - o Blue background for Horizontal cabling to Telecommunication Outlets

- Each RJ45 port shall be labelled as follows:
  - o Labelling numbers shall begin on the left most and highest mounted Patch Panel for each different sub-system and continue from left to right ascending by one number for each RJ45 port

- # designates Letter or Number

- The labelling shall conform to the following: Distributor Location # - **Outlet #**

  For example the **10**th TO terminated within the **A** Distributor would read as follows: **A-10**

  - o When there is more than one Patch Panel required to terminate Telecommunication Outlets from a Distributor, the next Patch Panel mounted below will carry on the numbering sequence from the first Patch Panel

  - o For example: 24 port Patch Panels are being installed. The top most Horizontal Field Patch Panel is labelled from left to right A-1 through to A-24. The next Patch Panel installed below the first will be labelled from right to left A-25 through to A-48. The labels are printed in Black ink on a light blue background to designate that the Patch Panels are Horizontal Cabling

- o   More information regarding the Labelling methods of Patch Panels that terminate Voice Equipment or UTP Voice/LAN Backbone is provided in those sections of this document
- All Distributors shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

LAN Equipment Cabling

The RJ45 Modular Solution does not have a requirement for the LAN Equipment Cabling sub-system. The fundamental design of the RJ45 Modular SCS Solution designates the location of the LAN Equipment within or adjacent to the same Distributor that terminates the Horizontal Cabling.

Most standards based LAN Equipment products use RJ45 Modular ports for connecting to Users, therefore, connections between LAN Equipment and the Horizontal Cabling is performed by using Cross connect Patch Cables between the LAN Equipment RJ45 port and the Patch Panel RJ45 port.

Voice Equipment Cabling

The Installer shall comply with the following important factors regarding the Voice Equipment Cabling:

- All Voice Equipment shall be labelled
- \# designates Letter or Number
- The labelling shall conform to the following: Voice Equipment Location \# – Voice Termination Designation \# at the Distributor Frame end of the cable. Distributor Location \# – Patch Panel Termination Pair Range at the Voice Equipment end of the cable
- For example the label attached to the cable sheath at the Distributor may read as PABX Room 1 – Chassis Slot 2. The Voice Equipment End of the cable may read as D-01/50. This would designate that the cable is terminated in Distributor location D on pair 1 through to 50 of the Patch Panels
- Each Voice Equipment Cable shall be labelled with a permanent label at each end of the cable attached to the sheath just before the termination point. Acceptable types of labels are as follows:
  - o   Black legible ink handwritten or typed on a white background that is protected by a wrap around self-laminating clear material
  - o   A label that can be tied to the cable with black legible indelible ink
  - o   Applicator ferrules displaying the label designation
  - o   Adhesive wrap around labels displaying the designation
- Labels shall not be with ink marked directly to the cable sheath

- Labels shall not be with adhesive plastic or paper tape marked with ink
- All Distributors shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

19" Wall Mounted Distributor Frames

The Installer shall comply with the following important factors regarding the 19" Wall Mounted Distributor Frames:

- All 19" Wall Mounted Distributor Frames shall be labelled with a different letter, name or number
- 19" Wall Mounted Distributor Frames shall have labels that are engraved with large legible black letters on white background
- The label shall be mounted on the front near the top and middle of the frame

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Communication Cabinets

The Installer shall comply with the following important factors regarding the Communication Cabinets:

- All Communication Cabinets shall be labelled with a different letter, name or number
- Communication Cabinets shall have labels that are engraved with large legible black letters on white background
- The label shall be mounted on the front door near the top and middle of the door
- The first cabinet shall be labelled CAB A the next cabinet shall be labelled CAB B, then CAB C, CAB D etc

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Telecommunication Closets

The Installer shall comply with the following important factors regarding the Telecommunication Closets:

- All Telecommunication Closets shall be labelled.
- Telecommunication Closets shall have labels that are engraved with large legible black letters on white background.
- The label shall be mounted on the entrance door near the top and middle of the door.

- Each closet shall be labelled with a building designation. Example the CD is in the National Tower and the BD is in another building called World Hall.
- Closets that accommodate a CD shall be labelled. NT-CD. There should only be one CD on site.
- Closets that accommodate a BD shall be labelled. WH-BD. A single building shall only have one BD. Other Buildings shall be labelled differently.
- Closets that accommodate a FD shall be labelled FD1 and any other FDs shall be labelled 2, 3, 4 etc. WH-FD1. A single building may have any number of FDs. FDs in another building shall be labelled differently.

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

TESTING

The Installer shall test 100% of Horizontal Cabling. This clause defines the minimum requirements for Installers to comply with, before the manufacturer will enter the SCS installation into their Certification and Warranty documentation program.

The Installer shall rectify or replace any defective Horizontal Cabling that does not pass the test, and then re-test the cable.

All testing results shall be saved in an electronic database format that can be either printed as a hard copy or provided to all interested parties as a report.
The Installer should be aware that all test reports could be audited by an independent third party verification organisation that will conduct a comprehensive quality control procedure for all tests provided.

Where the test results pass through this quality control, the third party would sign them off, as one of several steps before Clipsal Australia approve a Certification and Warranty agreement.

If the third party organisation detects any anomalies with any of the test reports then those cables will not be accepted until rectified (at the cost of the Installer) and correct test reports are provided.

UTP Field Test Unit

The Installer shall comply with the following important factors regarding the UTP Field Test Unit:

- The UTP Field Test Unit shall be of Level 2E or Level 3 quality
- The UTP Field Test Unit shall be operating with the latest manufacturer software and firmware that is applicable to the Class E Permanent Link and Class E Channel tests. Refer to the standards listed in Section 3 for more information regarding the latest testing parameters for Class E Permanent Link and Class E Channel testing
- The UTP Field Test Unit shall be regularly calibrated by an independent Test Laboratory organisation every twelve months. A copy of the verification

certificate from the laboratory shall be supplied as part of the Installer's Certification Warranty documentation to Clipsal Australia. The certificate shall include the serial number and the latest calibration date

- Clipsal Australia shall not accept test reports that are provided by the Installer that do not indicate the latest firmware and software

- The UTP Field Test Unit shall be set up to perform the correct tests as specified in this Installation Standard with evidence of this clearly stated in each test report

- All UTP tests reports shall be designated with a PASS result. Test reports designated with a PASS* will be deemed as marginal and will require some follow up investigation by Clipsal Australia and/or the third party test verification organisation. Any test report designated with a FAIL* and/or FAIL are not acceptable and the Installer shall take measures to rectify such cables

- All acceptable test reports shall be included as a section in the Customer SCS Documentation for the project

The Horizontal UTP Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Horizontal UTP Permanent Link

The Horizontal UTP Permanent Link is defined as the transmission path created by the connection of the Telecommunication Outlet, the Horizontal UTP Cabling, the Disconnection Module and Consolidation Points (when they exist).

The Installer shall comply with the following important factors regarding the Horizontal UTP Permanent Link:

- 100% of installed Horizontal UTP Links shall be tested and tests reports submitted to the manufacturer.

- The UTP Field Test Unit shall be fitted with the correct performance Test Leads to perform the latest ratified version of the Class E Permanent Link test as defined in the standards listed in Section 3 and as defined by the UTP Field Test Unit manufacturer.

- SCS Cross-Connect leads shall not be used to perform the Class E Permanent Link tests.

- All components of the Horizontal UTP Permanent Link shall be 100% terminated and mounted in the final location and shall not be altered, moved or disturbed after the testing process.

- All Horizontal UTP Permanent Links that are altered in any way shall be re-tested and the latter test included into the documentation.

Horizontal UTP Channel

The Horizontal UTP Channel is defined as the transmission path created by the connection of the Work Area Cross-Connect Cabling, Telecommunication Outlet, the Horizontal UTP Cabling, the Patch Panel and the Distributor Cross-Connect Cabling.

Where the installation of the LAN Equipment Cabling, Cross-Connect Cabling and Work Area Cabling is also the responsibility of the Installer then the following important factors regarding the Horizontal UTP Channel shall be complied with:

- The Installer shall carry out some indicative testing to provide some examples to the manufacturer that the Horizontal UTP Channels when fully connected by the Customer, will generally perform to Class E Channel as defined in the standards listed in Section 3

- The highest performance rated Horizontal UTP Channel (LAN) shall be tested as well as 100% of the Horizontal UTP Permanent Link

- The longest length Horizontal UTP Channel shall be tested to Class E Channel using the longest possible lengths of LAN Equipment Cabling, Distributor Cross-Connect Cabling, Horizontal Cabling and Work Area Cross-Connect Cabling

- The Installer shall perform this test on the longest fully connected route length on each individual Distributor included in the installation. If there are 4 Distributors there shall be 4 longest test reports

- The shortest length Horizontal UTP Channel shall be tested to Class D Channel using the shortest possible lengths of LAN Equipment Cabling, Distributor Cross-Connect Cabling, Horizontal Cabling and Work Area Cross-Connect Cabling

- The Installer shall perform this test on the shortest fully connected route length on each individual Distributor included in the installation. If there are 4 Distributors there shall be 4 shortest test reports

- All components of the Horizontal UTP Channel shall be 100% terminated and mounted in the final location and shall not be altered, moved or disturbed after the testing process

- All Horizontal UTP Channels that are altered in any way shall be re-tested and the latter test included in the documentation

The Installer shall refer to the *Project Specifications* for information regarding their responsibilities for providing and/or installing Cross-Connect Cabling and Work Area Cabling.

Where the installation of the Cross-Connect Cabling and Work Area Cabling is not the responsibility of the Installer then the Customer shall comply with the following important factors regarding the Horizontal UTP Channel if the Customer requires **Applications Assurance**:

- The Customer shall engage a suitably qualified Installer to perform the tests that were previously described in this clause
- The Customer shall provide the Installer with the longest and shortest Cross-Connect Cables and indicate which Telecommunication Outlets are the longest and shortest from each Distributor
- The Customer shall provide the test results to the manufacturer who will forward the reports to their independent test verification organisation

In both instances the test reports shall be provided to the manufacturer if the Customer requires **Applications Assurance**:

- Once Clipsal Australia has accepted the test reports, then the installation will be included in the Certification and Warranty program for the full Horizontal UTP Channel Applications Assurance Program. For example, if at the time of the test reports being submitted to the manufacturer the highest performing LAN application is Gigabit Ethernet then that would be the highest performance application that would be assured by Clipsal Australia
- If the Horizontal UTP Channel has not been designed correctly and the route lengths are over length or under length requirements defined in the standards listed in Section 3 then the Horizontal UTP Channel will not be assured by Clipsal Australia
- If for any other reason the Horizontal UTP Channel tests fail then that installation will not receive applications assurance for the Horizontal UTP Channel
- If this occurs then the Customer and/or contractor shall contact the manufacturer for advice

The Horizontal UTP Channel Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

CROSS-CONNECT CABLES

The Installer shall refer to the *Project Specification* regarding their responsibilities for the provision and/or installation of Cross-Connect Patch Cables.

Where the Installer is responsible for the provision and/or installation of Cross-Connect Patch Cables they shall comply with the following important factors:

▪ Where the Cross-Connect Cables are required for LAN applications then the cables shall match the same level of performance, Category 6 and be manufactured by Clipsal Australia as the Horizontal UTP Cabling and the LAN Equipment Cabling

▪ Where the Cross-Connect Cables are required for Voice applications then the cables shall be capable of the level of performance required for the Voice Equipment. More information shall be provided in the Project Specifications

▪ If possible, the Cross-Connect Cables for Voice shall be of the same manufacture as the rest of the SCS

▪ The Cross-Connect Cables shall always have an 8 pin modular plug to insert into the Telecommunication Outlet unless fibre

▪ The LAN Equipment Device end of the Cross-Connect Cables shall always have an 8 pin modular plug to insert into the device unless fibre

▪ The Voice Equipment Device end of the Cross-Connect Cables shall match the interface socket of the device

▪ Different lengths of Cross-Connect Cables shall be provided as specified

▪ Spare User Cross-Connect Cables shall be stored in separate labelled boxes in the location nominated by the Customer

▪ Care shall be taken to install Cross-Connect Cables such that the bend radius, pulling tension and other factors that could damage the cable or degrade the performance are avoided

▪ Care shall be taken to install Cross-Connect Cables such that OH&S issues are avoided

▪ The Horizontal UTP Channel will only perform to the highest level allowed by the lowest rated component. For example when a User Work Area Cross-Connect Cable is of Voice grade quality then the rest of the performance capability of the complete Horizontal UTP Channel is lowered to the lowest common denominator

Cross-Connect Cables shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

DISTRIBUTOR RECORD MANAGEMENT SYSTEM FOLDER

The Installer is responsible to Record all terminated SCS cables in a suitable Distributor Record Management System Folder.

The Distributor Record Management System Folder shall document the following information.

- Distributor location
- Distributor ID
- Cable terminated ID
- Patch Panel, Port, Pair ID
- Type of service connected
- Description of Service
- Location of other Distributor, module, cable where the service is patched or jumpered to

The Distributor Record Management System Folder shall be available electronically and downloaded from the WWW web.

The Distributor Record Management System Folder shall be especially formatted and colour coded for the following SCS Subsystems:

- Blue   :   For Horizontal Cabling (TOs). 4 pair sequence
- Green   :   For Voice Equipment Cabling. 1 pair sequence
- White   :   For Voice Equipment Cabling.1 pair sequence

It is the responsibility of the Installer to compile the original Distributor Record Management System Folder for each Distributor and record the installed status of the SCS terminations.

The folder pages shall be grouped into the relevant SCS sub-sections and filled out with erasable pencil.

Where the Installer is responsible for the provision and/or installation of Distributor Cross-Connect Cables they shall record the termination locations and destinations of all patch cables and jumper cables. More information is provided in the *Project Specifications*.

Where the Customer is responsible for the provision and/or installation of Distributor Cross-Connect Cables either they and/or their incumbent Installation partner shall record the termination locations and destinations of all patch cables and jumper cables.

All moves and changes shall be recorded and updated in the Distributor Record Management System Folder to describe the current status of the Telecommunication Systems as it interfaces with all sub-systems of the SCS to the User.

HORIZONTAL INSTALLATION DOCUMENTATION

The Installer shall comply with the following important factors regarding the Horizontal Installation Documentation:

Site Documentation shall be provided for all SCS installations performed by the Installer.

Site Folders and associated soft copies will be created for all new SCS installations.

When additional works are performed, the site documentation shall be updated to reflect the changes. Where no site documentation is available, a site folder shall be created to house the new information.

The details and format of the folders and associated documentation shall meet the following requirements:

- Two copies of a Master Site Folder shall be supplied and updated for all sites
- A Distributor Folder shall be supplied and updated for all Distributors
- A holder shall be supplied and installed to house the floor Distributor folder
- The folder shall be a four ring white A4 Folder with a clear protective sleeve
- An insert shall be provided for front and side detailing the site

The **Front Insert** shall be an A4 sheet and shall be labelled, as a minium, with the following:

- Customer name
- Site name
- Site address
- Folder description

Folder Identifier shall be either **MASTER SITE FOLDER** or the Distributor Type and identifier i.e. **BUILDING DISTRIBUTOR BD- 02**

The **Side Insert** shall be labelled as a minium with the following:

- Site name
- Site address
- Folder identifier

Master Folder

Dividers shall be provided for all folders. They shall be labelled and sequenced into sections as detailed in this clause. Labels on dividers shall not be handwritten.

Master Site Folder shall contain the following sections and associated documentation:

- Index
- Site Details
- SCS Overview
- Distributor Layout
- Telecommunication Outlet Floor Plans
- Test Results UTP Link and Channel - Summary (Paper & Electronic Copy)
- Test Results UTP Link and Channel - Full Page Report (Electronic Copy)
- UTP Field Test Unit Calibration Certification
- Installation Compliance Declaration
- SCS Manufacturer Product information

Distributor Folder

Distributor Folders shall contain the following sections and associated documentation.

- Index
- Distributor Layout
- Telecommunication Outlet Floor Plans

Section Description

An index shall contain the identifiers for all folder dividers in the sequence they appear.

Site Details shall contain the following information:

- Site Name
- Address
- Telephone Number
- Facsimile Number
- Site Co-ordinator Name and associated Telephone Number and e-mail Address
- Customer Name, Project Manager Name and associated Telephone Number and e-mail Address

- Installer including Site Supervisor, Contact Name, Address, Telephone Number, Facsimile Number, e-mail Address and services offering

The SCS Overview drawing shall include additional Distributors, Cabinets and LAN Backbone Cabling Routes. The Installer shall update the drawing after each addition, alteration or deletion to the SCS installation.

The Distributor Layout shall be a drawing showing the layout of services and Telecommunication Outlet locations on the Distributor frames.

The Cabinet Layout drawings shall include the termination layout of LAN Backbone Cabling within the Cabinet.

The Telecommunications Outlet Floor Plans of each Distributor shall contain location of all Telecommunication Outlets, the associated identifier and the location of the Distributor.

The Test Result Summary showing outlet identifier, date tested, length, type of test performed and pass/fail of all Telecommunications Outlets. Summary sheets are to be signed to verify the validity of all test results.

The Calibration Certification for all equipment used for testing on the site.

The Installation Compliance Declaration Forms that documents all of the SCS installation shall be included.

The SCS Manufacturer Product Information such as a complete 'Bill of Materials' and supporting documentation for all manufacturer products installed and require inclusion in the Manufacturer Certification and Warranty Agreements.

Electronic Records

Electronic records shall be provided on 3 ½ diskettes or on CD for all SCS installations.

Two copies shall be provided with one copy left on site and the other presented to the Customer or Project Manager or appointed agent on practical completion.

The electronic documentation shall come complete with the necessary licensed software to view the UTP Field Testing Reports.

The electronic documentation shall include all information contained in the Master Site Folder and all individual Telecommunications Outlet test reports for the Horizontal UTP Link and Channel.

Telecommunication Outlet Floor Plan Holder

Each Distributor shall have a Wall Mounted Perspex A3 Drawing Holder with a copy of the Telecommunication Outlet Floor Plan. It shall be installed either:

- On the wall adjacent to Distributor, or
- Within the Telecommunication Closet, or
- Within the Communications Cabinet.

An additional A3 drawing holder shall be installed at the CD/BD with a copy of the **SCS Overview**.

LAN BACKBONE CABLING

The aim of this section is to provide information relating to important Installation Practices that SCS Installers shall comply with during the installation phase of the **LAN Backbone Cabling** sub-system of the RJ45 Modular SCS solution.

The Installation Practices that are described within this section are specific to the **RJ45 Modular SCS Solution** and cover the following Installation Phases:

4.   Installation of Distribution Systems & Hardware.

5.   Termination of the SCS Cabling.

6.   Performance Testing & Certification of the SCS solution.

7.   'As Built' documentation of the SCS Solution for the Customer.

This Section includes important factors that shall be considered by the Installer when terminating SCS cable. The information is given assuming that the Installer has determined and installed suitable Pathways & Spaces as defined in *Section 5* and has reticulated SCS Cabling as defined in *Section 6*.

This Section also assumes that the **Horizontal Cabling sub-system** is the base element of the installation and the LAN Backbone Cabling sub-system is installed using common SCS infrastructure.

There are many elements of both sub-systems that are common and share the same Installation Practices and as such there are many clauses in this section that also require the Installer to review the installation factors in *Section 7* and *Section 8*.

The Installer shall comply with the installation practices defined in this section for those projects that have LAN Backbone Cabling included in the *Project Specifications*.

GENERAL PRODUCTS PERFORMANCE CRITERIA

The Installer shall comply with the following important factors regarding the minimum Performance Criteria of the LAN Backbone Cabling:

▪   Installers shall ensure that the SCS products they propose to install within a Customer premises is compliant with the technical standards described within the 'Mandatory Regulations' of their region. Refer to Section 3

▪   The Installer shall ensure that all SCS products have been marked or labelled with verification that an endorsed and independent Testing Laboratory has tested and approved samples of the product. Refer to Clause 4.3.12

▪   The Installer shall check the Manufacturer's product specifications to ensure that the products chosen are capable of the minimum transmission performance required for the intended use of the SCS sub-system

- The Installer shall ensure that all SCS products have been sourced from the same manufacturer or partners that have been officially endorsed by Clipsal Australia.. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS products and associated Pathways and Spaces products are those endorsed by the manufacturer and will be included in the scope of the SCS Certification & Warranty Program. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS termination products and cables are marked with the correct colour codes. Refer to the diagrams in Clause 8.1

UTP LAN BACKBONE CABLING

SCS Designs that have short distances between Distributors may specify 4 pair, UTP Cable for those parts of the LAN Backbone Cabling. Refer to the *Project Specifications*.

The UTP LAN Backbone Cabling shall be included in the list of materials that is incorporated within the Manufacturer Certification & Warranty agreements for the project.

Refer to the diagrams in *Clause 9.1* for more information regarding UTP LAN Backbone Cabling.

Performance Criteria

- UTP LAN Backbone Cabling shall have 4 x balanced and twisted pairs of 100 ohm impedance.

- UTP LAN Backbone Cabling shall be manufactured to the minimum transmission characteristics as defined for Category 5e performance. Refer to standards listed in Section 3 and especially Clause 3.1.3.

- The route length of the UTP LAN Backbone Cabling shall include the Backbone Link and 2 x Distributor Cross-Connect Patch Cables. Refer to the diagram in Clause 9.1.

- The maximum route length shall be determined by checking the standards listed in Section 3. The introduction of any stranded conductor UTP cables will shorten the maximum allowable (Channel) route length depending on how long the stranded conductor links are.

- The complete route length (Channel) shall be tested to Class D Channel.

- UTP LAN Backbone Cabling conductors shall be colour coded. Refer to the diagrams in Clause 8.1.

- UTP LAN Backbone Cabling that is reticulated through internal building Pathways & Spaces shall be of internal grade construction.

- UTP LAN Backbone Cabling that is reticulated through external building Pathways & Spaces shall be of external grade construction. For more information regarding definitions of an external situation. Refer to the standards listed in Section 3.

Termination Methods

The information is given assuming that the Installer has determined and installed the following SCS components and/or sub-systems as part of the Horizontal Cabling installation:

- Wall Mounted Distributor and Frames
- Cabinet Mounted Distributor and Frames
- Cross-Connect Patch Cabling (Category 6)

The Installer shall comply with the following important factors regarding the Termination Methods of the UTP LAN Backbone Cabling:

- UTP LAN Backbone Cabling shall be terminated on Patch Panels
- UTP LAN Backbone Cabling shall be terminated on Patch Panels that are separate from the Horizontal Cabling
- Patch Panels may be manufactured with intrinsic 16,or 24 IDC ports
- Patch Panels shall be manufactured, mounted and equipped to comply with the installation practices defined in Section 8
- Patch Panels shall be colour coded to differentiate each different SCS sub-system that is terminated as follows:
- Green: Voice and LAN Backbone Cabling (UTP)
- UTP LAN Backbone Cabling shall be terminated to match the colour code sequence as defined in the diagram in Clause 8.1
- UTP LAN Backbone Cabling shall be terminated to comply with the installation practices defined in Section 8
- UTP LAN Backbone Cabling shall be reticulated through Distributor frames to comply with the installation practices defined in Section 8
- UTP LAN Backbone Cabling shall be Cross-Connected to the LAN Equipment using Class D Cross-Connect Patch Cables as defined in Section 8

All SCS components used to terminate and accommodate UTP LAN Backbone Cabling shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

FIBRE OPTIC CABLING

SCS Designs that have long distances between Distributors or require the transmission of high bandwidth applications between LAN Equipment locations may specify Fibre Optic Cabling for those parts of the LAN Backbone Cabling.

The requirement for Fibre Optic LAN Backbone Cable shall be specified in the *Project Specifications*.

The source and destination of each Fibre Optic LAN Backbone Cable shall be specified in the *Project Specifications*.

The minimum performance capabilities of each Fibre Optic LAN Backbone Cable shall be specified in the *Project Specifications*.

The physical construction of each Fibre Optic LAN Backbone Cable shall be specified in the *Project Specifications*.

The number of cores required in each Fibre Optic LAN Backbone Cable shall be specified in the *Project Specifications*.

The Fibre Optic LAN Backbone Cabling and all associated termination components shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty agreements for the project.

Refer to the diagrams in *Clause 9.1* for more information regarding UTP LAN Backbone Cabling.

Performance Criteria

The Installer shall comply with the following important factors regarding the minimum Performance Criteria of the Fibre Optic LAN Backbone Cabling:

SCS Fibre Optic LAN Backbone Cabling has four different Classes of minimum transmission performance. The four Classes are commonly known as:

- OM1
- OM2
- OM3
- OS1

The choice of Fibre Optic LAN Backbone Cabling is dependent on the current and future bandwidth requirements of each Customer and as such the Installer shall refer to the *Project Specifications* and/or Customer for the scope for a particular project:

The minimum performance of the Fibre Optic LAN Backbone Cabling shall comply with the parameters set out for each Class as defined in the standards listed in *Section 3*.

Safe Working Practices

The Installer shall comply with the following important factors regarding the Safe Work Practices for Fibre Optic LAN Backbone Cabling:

- A "Sharps Bin" shall be used in conjunction with Fibre optic terminations
- Excess glass shall be immediately placed in the sharps bin after each fibre cleave
- Care shall be taken to ensure that no excess fibre glass is left on site at the completion of the installation

- The Sharps Bin and the excess glass shall be removed from site after installation
- The Installer shall provide specification sheets on any chemicals used so that appropriate precautions can be taken
- It is important to maintain a clean and organised work area
- Dust covers shall be supplied and installed on all fibre connectors including patch leads
- The Installer shall not look at the end of a fibre while connected to LAN Equipment with or without a Microscope
- Fibre Termination Enclosures shall be suitably mounted at a height that is not at normal eye level and/or the enclosure shall have another means of protecting personnel
- Warning labels shall be affixed to each optical fibre connector if the laser hazard at the location is in excess of 'Hazard Level 1'. Refer to the standards listed in Section 3
- Connectors may be labelled as a bundled cable group, with a single, clearly visible hazard warning
- Where connectors are enclosed out of sight, a hazard label shall be clearly visible both before and after the access panel is removed

Termination Methods

The Installer shall comply with the following important factors regarding the Termination Methods for Fibre Optic LAN Backbone Cabling:

- All Fibre Optic LAN Backbone Cabling shall be terminated within a Communications Cabinet that also accommodates the LAN Equipment
- For those instances where the Communications Cabinet is full to capacity then another cabinet of the same size and manufacture shall be installed adjacent. The cabinets shall have the internal sides removed and cabinets joined together with a suitable joining kit
- All Fibre Optic LAN Backbone Cabling shall be reticulated and fastened to a purpose built Cable Tray located as such, that the cable cannot be damaged or impede the installation of LAN Equipment
- All Fibre Optic LAN Backbone Cabling shall be terminated within an approved 19" rack mountable Termination Enclosure
- The Termination Enclosure shall be mounted at a suitable height that is not at eye level when in the normal standing position or the connections are angled away from the front
- The Fibre Optic LAN Backbone Cabling shall be secured with a clamp or compression gland that is integral to the Termination Enclosure and shall prevent the cable from moving once in position
- All fibre cores of an installed cable shall be terminated and tested
- All connectors shall match the minimum performance required of the specified Class of the Fibre Optic LAN Backbone Cabling
- The preferred method is direct terminated SC connectors unless otherwise specified in the Project Specifications

- Connectors may be glued or crimped or by any method that is approved by the product manufacturer

- Clipsal Australia approved pre-polished connectors may also be used

- Clipsal Australia approved, factory terminated connectors with fibre tails may be fusion spliced

- All methods of terminations shall be approved by Clipsal Australia as part of the Certification and Warranty Agreements

- Each end of an outdoor type fibre cable shall be terminated with a 'break-out kit' approved by Clipsal Australia

- All fibre cores shall be encased in a protective tube for the complete length from the break out kit and/or protective outer sheath into the fibre connector

- The ends of terminated fibre cores shall be free of chips, scratches, cracks, glue and dust and shall be flush with the face of the connector

- The terminated ends of the fibre shall be kept clean from dust and moisture

- Fibre cores shall terminate in fully enclosed; telescopic 24 port Termination Enclosures with integral cable support and fibre core management unless otherwise specified in the Project Specifications

- The method of securing the fibre cables within the Termination Enclosure shall be suitable to firmly hold the cable in position as the telescopic tray is moved forward within the cabinet

- The Termination Enclosures shall be fitted with enough SC adapters to accept the terminated fibre connectors

- The Termination Enclosures shall be fitted with blank inserts where there are spare ports

- The Fibre core terminations shall be inserted into the adapters from the left to right of the Termination Enclosure to suit the colour code defined in the standards listed in Section 3

- Fibre patch cord management shall be provided at each Distributor and shall be installed to ensure that all Fibre Cross-Connect patch cables can be installed without exceeding the manufacturer's minimum bend radius

- One horizontal Fibre Management module shall be installed under each 24 port Termination Enclosure

- Where Fibre Cross-Connect patch cables will reticulate vertically then vertical cable management shall be installed at regular distances on each side of the cabinet mounting rails to protect the cable

- All connectors shall be supplied with protective caps fitted. Where the caps are removed to make a patch to the LAN Equipment the spare caps shall be saved and stored within the cabinet

- The protective caps shall be fitted to all adapters loaded with fibre connectors/cores when not in use

LABELLING

Labelling is an important part of the SCS. This Installation Standard defines the acceptable methods of labelling for each sub-system or component of the SCS. The Installer shall comply with one of the options listed in each clause for labelling.

The labelling convention for the site shall be defined in the *Project Specifications*.

Cable Sheath

The Installer shall comply with the following important factors regarding the labelling of the LAN Backbone Cable sheath:

- All Cable Sheaths shall be labelled
- # means letter or number
- The labelling shall conform to the following: Source Building # - Distributor/Cabinet Location # – Frame/Termination Enclosure # - Module/Port/Core Count #
- For example, the 10th fibre core terminated within the B Termination Enclosure located within the A Cabinet from the World Plaza Building would read as follows: WP-A-B-10
- Each LAN Backbone Cable shall be labelled with a permanent label at each end of the cable attached to the sheath just before the Disconnection Module/Termination Enclosure entry point. Acceptable types of labels are as follows:
    - o Black legible ink handwritten or typed on a white background that is protected by a wrap around self-laminating clear material
    - o Black legible permanent ink handwritten label that can be tied to the cable a
    - o Applicator ferrules displaying the label designation
    - o Adhesive wrap around labels displaying the designation
- Labels shall not be with ink marked directly to the cable sheath
- Labels shall not be with adhesive plastic or paper tape marked with ink
- All Cabinets in the same building shall have a different letter or number
- All Termination Enclosures within the same cabinet shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Patch Panels

The Installer shall comply with the following important factors regarding Patch Panels:

- Patch Panels shall be manufactured with special label holders and labels supplied with the Patch Panel kit
- All Patch Panels shall be labelled either above or below the RJ45 Ports such that the label describes the Remote Patch Panel Port that each RJ45 port is connected to
- Labels shall be legible and typed using black ink on a colour coded background:
  - Green background for UTP Voice/LAN Backbone
- Each RJ45 port shall be labelled as follows:
  - Labelling numbers shall begin on the left most and highest mounted Patch Panel for each different sub-system and continue from left to right ascending by one number for each RJ45 port
- # designates Letter or Number
- The labelling shall conform to the following: Remote Distributor Location # - Patch Panel Port #
  - For example the 10th Patch Panel Port terminated within the A Distributor would read as follows: A-10
  - When there is more than one Patch Panel required to terminate UTP LAN Backbone to a Distributor the next Patch Panel mounted below will carry on the numbering sequence from the first Patch Panel
  - For example: 24 port Patch Panels are being installed. The top most UTP LAN Backbone Field Patch Panel is labelled from left to right A-1 through to A-24. The next Patch Panel installed below the first will be labelled from right to left A-25 through to A-48. The labels are printed in Black ink on a light green background to designate that the Patch Panels are UTP Backbone Cabling
- More information regarding the Labelling methods of Patch Panels that terminate Voice Equipment or UTP Voice Backbone is provide in those sections of this document
- All Distributors shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project.

Termination Enclosures

The Installer shall comply with the following important factors regarding the labelling of the Fibre Optic LAN Backbone Cabling Termination Enclosure:

- All Termination Enclosures shall be labelled

- Termination Enclosures shall utilise the integral label or a purpose made engraved label that shall be attached horizontally above or below the fibre connectors

- Where there is more than one, the bottom most Termination Enclosure shall be A then the frame mounted above shall be B then C etc

- The Termination Enclosures that are located at the source/centre of the Fibre Optic LAN Backbone Cabling Hierarchical Star shall be labelled as follows:

  o The group of fibre cores that are common to the same cable shall be labelled with the Destination location where the other end of the cable is terminated and the number of cores. Refer to the following table:

F/O TO BUILDING # - DISTRIBUTOR # - CABINET # - ENCLOSURE #					
1	2	3	4	5	6

  o The label may be one label (as above) fastened above the associated group of fibre cores. Or may be one continuous label fastened above the complete width of the termination enclosure as long as the individual cable/core groups are clearly delineated

- The Termination Enclosures that are located at the remote end of the Fibre Optic LAN Backbone Cabling Hierarchical Star shall be labelled as follows:

  o The group of fibre cores that are common to the same cable shall be labelled with the Source location where the other end of the cable is terminated and the number of cores. Refer to the following table:

F/O FROM BUILDING # - DISTRIBUTOR # - CABINET # - ENCLOSURE #					
1	2	3	4	5	6

  o The label may be one label (as above) fastened above the associated group of fibre cores, or may be one continuous label fastened above the complete width of the termination enclosure as long as the individual cables are clearly delineated.

- The Installer shall utilise the label that is supplied with the Termination Enclosure in the first instance. This label shall comply with the aforementioned requirements

- Warning labels shall be affixed to each optical fibre connector if the laser hazard at the location is in excess of 'Hazard Level 1'. Refer to the standards listed in Section 3

- Groups of connectors may be labelled as a group with a single, clearly visible hazard warning

- Where a group of connectors is enclosed within a box, a hazard label shall be clearly visible both before and after the access panel is removed

- Warning labels shall be installed in addition to Source and Destination labels

LAN Backbone Testing

This clause defines the minimum SCS testing and certification requirements for Installers to comply with before the manufacturer will enter the SCS installation into their Certification and Warranty Program.

The Installer shall rectify or replace any defective LAN Backbone Cabling that does not pass the tests and re-test the cable.

All testing results shall be saved in an electronic database format that can be either printed as a hard copy or provided to all interested parties as a report.

The Installer shall be aware that all test reports will be audited by an independent third party verification organisation who will conduct a comprehensive quality control procedure for all tests provided.

The test results shall pass through this quality control and be signed off by the third party as one of several steps before Clipsal Australia will issue a Certification and Warranty Agreement.

If the third party organisation detects any anomalies with any of the test reports then those cables will not be accepted until rectified at the cost of the Installer and correct test reports are provided.

General Testing Requirements

All LAN Backbone Cabling shall be tested to the following minimum requirements:

- 100% of the LAN Backbone Cabling shall be tested
- All components of the LAN Backbone Cabling shall be terminated and mounted as specified in this document in the final location before testing
- The test equipment utilised for testing LAN Backbone Cabling shall be regularly calibrated by an independent Test Laboratory organisation every twelve months
- A copy of the verification certificate from the laboratory shall be supplied as part of the Customer's SCS Documentation and Installer's Certification documentation to the manufacturer. The certificate shall include the serial number and the latest calibration date
- The test equipment utilised for testing LAN Backbone Cabling shall be regularly updated with the latest manufacturer software and firmware that reflect the latest ratified changes in industry standards. Refer to Section 3
- Clipsal Australia shall not accept LAN Backbone Cabling test reports that are provided by the Installer that indicates obsolete firmware and software

- The test equipment utilised for testing LAN Backbone Cabling shall be set up to perform the correct tests for each different LAN Backbone Cabling type as specified in this Installation Standard and/or the Project Specifications with evidence of this clearly stated in each test report

- LAN Backbone Cabling tests reports that are provided in the test manufacturer's database format shall be designated with a PASS result

- Test reports designated with a PASS* will be deemed as marginal and will require some follow up investigation by Clipsal Australia and/or the third party test verification organisation

- Any test report designated with a FAIL* and/or FAIL are not acceptable and the Installer shall take measures to rectify such cables

- All acceptable test reports shall be included as a section in the Customer SCS Documentation and Certification Documentation for the project

- LAN Backbone Cabling that is altered in any way shall be re-tested and the latter test included in the documentation with the old test report removed from the documentation

UTP Field Test Unit Testing

The UTP Field Test Unit and test certification methodologies shall comply with the minimum requirements as defined in *Clause 8.9.1.*

The Installer shall refer to the *Project Specifications* for information regarding their responsibilities for providing and/or installing Cross-Connect Cabling.

Where the installation of the Cross-Connect Cabling is the total responsibility of the Installer then the following important factors regarding the UTP LAN Backbone Channel shall be complied:

- The Installer shall test 100% of the UTP LAN Backbone Channels when all components are fully Cross-Connected to perform to the Class D Channel as defined in the standards listed in Section 3

- All components of the UTP LAN Backbone Channel shall be 100% terminated, Cross-connected and mounted in the final location and shall not be altered, moved or disturbed after the testing process

Where the installation of the Cross-Connect Cabling is not the responsibility of the Installer then the Customer shall comply with the following important factors regarding the UTP LAN Backbone Channel, if the Customer requires **Applications Assurance**:

- The Customer shall engage a suitably qualified Installer to perform the tests that were previously described in this clause to 100% of the UTP LAN Backbone Cabling

- The Customer shall provide the test results to the manufacturer who will forward the reports to their independent test verification organisation

In both instances the test reports shall be provided to the manufacturer if the Customer requires **Applications Assurance**. Clipsal Australia shall provide Applications Assurance under the following conditions:

▪ Once Clipsal Australia as fully compliant has accepted the test reports then the installation will be included in the Certification and Warranty Program for the full UTP LAN Backbone Channel Applications Assurance Program. For example, if at the time of the test reports being submitted to the manufacturer the highest performing LAN application is Gigabit Ethernet then that would be the highest performance application that would be assured by Clipsal Australia

▪ If the UTP LAN Backbone Channel has not been designed correctly and the route lengths are over length or under length requirements as defined in the standards listed in Section 3 then the UTP LAN Backbone Channel will not be assured by Clipsal Australia

▪ If for any other reason the UTP LAN Backbone Channel tests are marginal or fail, then that installation will not receive applications assurance for the UTP LAN Backbone Channel

▪ If this occurs then the Customer and/or contractor shall contact the manufacturer for advice

The UTP LAN Backbone Channel Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreement for the project.

Fibre Optic Light Source & Power Meter Testing

The Installer shall comply with the following important factors regarding the testing of the Fibre Optic LAN Backbone Cabling:

▪ The Light Source & Power Meter shall be stand-alone units especially designed for the testing of fibre optic cables. Or they shall be additional components that are designed to adapt to the UTP Field Test Unit.

▪ The Light Source & Power Meter shall be operating with the latest manufacturer software and firmware that is applicable to the class of the installed fibre. Refer to the standards listed in Section 3 for more information regarding the latest testing parameters for OM1, OM2, OM3 and OS1 testing

▪ All terminated fibre cores shall be tested from each end of the cable. The **source/centre** end of the Fibre Optic LAN Backbone cable at two wavelengths shall be designated as '**A**' the remote end shall be designated '**B**'

▪ The test leads and adapters that are used to perform the test shall be part of the test unit materials list

▪ The test leads and adapters that are used to perform the test shall be of the same performance level and quality or better of the installed Fibre Optic LAN Backbone to be tested

- The test leads and adapters that are used to perform the test shall be zero referenced by the appropriate method as defined in local standards before the tests are undertaken

- Where no clear test method is defined by local Standards, refer to the diagram provided in Clause 9.1 for information regarding the test lead configuration.

- The test units shall be zero referenced each time the units are powered on and/or the test lead configuration has been altered in any way

- When testing Fibre Optic LAN Backbone it is essential that the correct transmission mode and wavelength be used for measurements

- The Installer shall refer to the minimum testing parameters and values provided in the standards listed in Section 3

- In the instance that the stand alone Light and Source test sets are used then the Installer shall calculate the minimum attenuation loss budget for each Fibre Optic LAN Backbone Cable and use the budget as the reference for indicating PASS and FAIL results

- The Installer shall use the following method to calculate the maximum attenuation loss allowable for the type and length of cable:

Maximum Link Attenuation = Cable Attn + Connector Attn + Splice Attn.

Cable Attn (dB) = Attenuation Coefficient (dB/km) x Length (km).

Type of Optical Fibre	Wavelength (nm)	Attenuation Coefficient (dB/km)
Multimode 62.5/125 µm OM1 & OM2	850	Refer to *Section 3*
	1300	Refer to *Section 3*
Multimode 50/125 µm OM2 & OM3	850	Refer to *Section 3*
	1300	Refer to *Section 3*
Single mode 8.3/125 µm OS1	1310	Refer to *Section 3*
	1550	Refer to *Section 3*

Connector Attn (dB) = number of connector pairs x connector loss (dB)
Maximum allowable connector loss (dB) = Refer to *Section 3*
Splice Attn (dB) = number of splices (S) x splice loss (dB)
Maximum allowable splice loss (dB) = Refer to *Section 3*

- The Installer shall include the test calculation result within the Test Report documentation that shall be included in the Certification and Warranty Agreements

- All fibre test reports derived with a stand alone Light Source & Power Meter shall have the test results recorded in a suitably informative format of an electronic spreadsheet

The Fibre Optic LAN Backbone Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty agreements for the project.

Fibre Optic OTDR Testing

OTDR Testing is not a requirement of this Installation Standard, however this type of testing may be required by some *Project Specifications* and some Installers prefer to use the OTDR as their normal method of testing.

The following information defines some important factors that the Installer shall consider if/when OTDR Testing is either required or a preferred methodology:

- The OTDR Test Unit shall be operating with the latest manufacturer software and firmware that is applicable to the class of the installed fibre. Refer to the standards listed in Section 3 for more information regarding the latest testing parameters for OM1, OM2, OM3 and OS1 testing
- A 500 Metre or greater launch cable shall be used in conjunction with all OTDR Testing
- The configuration of the OTDR Test Unit for testing of Fibre Optic Cabling shall be as follows:

	Wavelength	Pulse Width	Launch Cable
Multi-mode	850 nm	<51 ns	>500
Multi-Mode	1300 nm	<51 ns	>500
Single Mode	1310 nm	<51 ns	>500
Single Mode	1550 nm	<51 ns	>500

- OTDR Test Units that have automatic fibre optic core analysis capabilities are acceptable, if the automatic test carried out; included parameters detailed in the previous table.

The contractor shall perform and record the following tests and calculations using an OTDR Test Unit:

- Length
- Multi-mode modal bandwidth at 850nm for multi-mode cables
- Single mode modal bandwidth at 1310nm for single mode cables
- Optical attenuation (Link loss)
- Return loss

The Installer shall refer to the *Project Specification* regarding their responsibilities for the provision of OTDR testing.

The Fibre Optic LAN Backbone Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty agreements for the project.

CROSS-CONNECT CABLING

The Installer shall refer to the *Project Specification* regarding their responsibilities for the provision and/or installation of Cross-Connect Cables.

UTP

Where the Installer is responsible for the provision and/or installation of UTP Cross-Connect Patch Cables they shall comply with the following important factors:

- All UTP Cross-Connections from the UTP LAN Backbone Cabling Patch Panels to the LAN Equipment shall be made with Patch Cables

- The UTP Patch Cables shall match the same level of performance (Category 5E) and be manufactured by the same manufacturer as the UTP LAN Backbone Cabling

- The UTP Patch Cables shall be manufactured with four pair configurations only and shall be the same Class and manufacture of cable as that used for the UTP Backbone Cabling

- All 4 x pairs of UTP Patch Cables shall be terminated at each end with RJ45 Modular plugs

- UTP Patch Cables shall be neatly reticulated through the cable management of the Distributors not the backspaces of the Distributors

- A number of different lengths of UTP Patch Cables shall be used to facilitate neatness in cable management areas

- Care shall be taken to install UTP Patch Cables such that the bend radius, pulling tension and other factors that could damage the cable or degrade the performance are avoided

- Spare UTP Patch Cables shall be stored in separate labelled boxes in the location nominated by the Customer

- Care shall be taken to install UTP Patch Cables such that OH&S issues are avoided.

All UTP Patch Cables shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty agreements for the project.

Fibre Optic Patch Cables

The Installer shall comply with the following important factors regarding the supply and/or installation of the Fibre Optic Patch Cables:

- Fibre Optic Patch Cables shall be approved for use in the SCS by the manufacturer

- Fibre Optic Patch Cables shall be manufactured in a duplex configuration with SC connectors unless otherwise specified in the Project Specifications

- Fibre Optic Patch Cables shall be manufactured to the minimum transmission performance requirements for the Class of the Fibre Optic LAN Backbone Cabling specified and as defined in the standards listed in Section 3

- For that instance where there are multiple Classes of Fibre Optic LAN Backbone Cabling, the installer shall ensure that the correct Class of Fibre Optic Patch Cable is connected to the correct Class of Fibre Optic LAN Backbone Cabling

- Fibre Optic Patch Cables shall be supplied in lengths that are suitable to neatly patch between the permanently installed cable and the Equipment

- Fibre Optic Patch Cables shall be installed through integral cable management that is integral to the Cabinet Distributor such that the cable is protected and minimum bend radius are maintained

- Spare Fibre Optic Patch Cables shall be stored in a location designated by the Customer

Fibre Optic Cross-connect Cables shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty agreements for the project.

LAN BACKBONE INSTALLATION DOCUMENTATION

This Clause assumes that the **Horizontal Cabling sub-system** is the base element of the installation and the LAN Backbone Cabling is a layer that is installed in addition.

There are many elements of the **Horizontal Documentation** that are common and share the same methodology and as such there are many clauses in this section that also require the Installer to review the important documentation factors in *Section 8*.

The Installer shall compile the LAN Backbone Cabling information as required in this clause for inclusion into to the associated Sections of the SCS.

Site Documentation shall be provided for all SCS installations performed by the Installer.

Site Folders and associated soft copies will be created for all new SCS installations.

When additional works are performed, the site documentation shall be updated to reflect the changes. Where no site documentation is available, a site folder shall be created to house the new information.

The details and format of the folders and associated documentation shall meet the following requirements:

- Two copies of a Master Site Folder shall be supplied and updated for all sites
- A Distributor Folder shall be supplied and updated for all Distributors including Campus, Building and Floor Distributors

- A holder shall be supplied and installed to accommodate the Distributor folders
- The folder shall be a four ring white A4 Folder with a clear protective sleave face and side
- An insert shall be provided for front and side detailing the site

The **Front Insert** shall be an A4 sheet and shall be labelled, as a minium, with the following:

- Customer name
- Site name
- Site address
- Folder description

Folder Identifier shall be either **MASTER SITE FOLDER** or the Distributor Type and identifier i.e. **BUILDING DISTRIBUTOR BD- 02**

The **Side Insert** shall be labelled as a minium with the following:

- Site name
- Site address
- Folder identifier

Master Folder

The Master Site Folder shall include the relevant LAN Backbone Cabling information within the following SCS Documentation sections and associated documentation:

- Index
- Site Details
- SCS Overview
- Distributor Layout
- Cabinet Layout
- Test Results UTP Link and Channel - Summary (Paper & Electronic Copy)
- Test Results UTP Link and Channel - Full Page Report (Electronic Copy)
- UTP Test Equipment Calibration Certification
- Installation Compliance Declaration
- SCS Manufacturer Product information

The following new Sections shall be added to the Master Site Folder that includes additional LAN Backbone Cabling information:

- Test Results LAN Backbone Cabling - Full Page Report (Paper & Electronic Copy)
- Fibre Test Equipment Calibration Certification

Distributor Folder

The Distributor Folder shall include the relevant LAN Backbone Cabling information within the following SCS Documentation sections and associated documentation:

- Distributor Layout
- Cabinet Layout

Section Description

An index shall contain the identifiers for all folder dividers in the sequence they appear

Site Details shall contain the following information:

- Site Name
- Address
- Telephone Number
- Facsimile Number
- Site Co-ordinator Name and associated Telephone Number and e-mail Address
- Customer Name, Project Manager Name and associated Telephone Number and e-mail Address
- Installer including Site Supervisor, Contact Name, Address, Telephone Number, Facsimile Number, e-mail Address and services offering

The SCS Overview drawing shall include additional Distributors, Cabinets, Equipment Cabling and LAN Backbone Cabling Routes. The Installer shall update the drawing after each addition, alteration or deletion to the SCS installation

The Distributor Layout drawings shall include the termination layout of LAN Backbone Cabling and any additional LAN Equipment Cabling on the Distributor frames

The Cabinet Layout drawings shall include the termination layout of LAN Backbone Cabling within the Cabinet

The Test Result Summary showing LAN Backbone Cable/core identifier, date tested, length, type of test performed and pass/fail of all LAN Backbone Cabling. Summary sheets are to be signed to verify the validity of all test results

The Calibration Certification for all equipment used for testing of the LAN Backbone Cabling

The Installation Compliance Declaration Forms that document all of the SCS installation shall be included

The SCS Manufacturer Product Information such as a complete 'Bill of Materials' and supporting documentation for all manufacturer products installed and require inclusion in Clipsal Australia's Certification and Warranty agreements

Electronic Records

Electronic records shall be provided on 3 ½ diskettes or on CD for all SCS installations

Two copies shall be provided with one copy left on site and the other presented to the Customer or Project Manager or appointed agent on practical completion

The electronic documentation shall come complete with the necessary licensed software to view the LAN Backbone Cabling Testing Reports

The electronic documentation shall include all information contained in the Master Site Folder and all individual LAN Backbone Cabling test reports for Fibre Optic and/or UTP LAN Backbone Cabling

10 VOICE BACKBONE CABLING

The aim of this section is to provide information relating to important Installation Practices that SCS Installers shall comply with during the installation phase of the **Voice Backbone Cabling** sub-system of the RJ45 Modular SCS solution

The Installation Practices that are described within this section are specific to the **Patch by Exception/Voice SCS Solution** and cover the following Installation Phases:

4.   Installation of Distribution Systems & Hardware

5.   Termination of the SCS Cabling

6.   Performance Testing & Certification of the SCS solution

7.   'As Built' documentation of the SCS Solution for the Customer

This Section includes important factors that shall be considered by the Installer when terminating SCS cable. The information is given assuming that the Installer has determined and installed suitable Pathways & Spaces as defined in *Section 5* and has reticulated SCS Cabling as defined in *Section 6*

This Section also assumes that the **Horizontal Cabling sub-system** is the base element of the installation and the Voice Backbone Cabling sub-system is installed using common SCS infrastructure

There are many elements of both sub-systems that are common and share the same Installation Practices and as such there are many clauses in this section that also require the Installer to review the installation factors in *Section 7*, *Section 8* and *Section 9*

The Installer shall comply with the installation practices defined in this section for those projects that have Voice Backbone Cabling included in the *Project Specifications*

10.10.2   PERFORMANCE CRITERIA

The Installer shall comply with the following important factors regarding the minimum Performance Criteria of the Voice Backbone Cabling:

▪   The requirements for Voice Backbone Cable shall be specified in the Project Specifications

▪   The source and destination of each Voice Backbone Cable shall be specified in the Project Specifications

▪   The minimum performance capabilities of each Voice Backbone Cable shall be specified in the Project Specifications

▪   The physical construction type of the Voice Backbone Cable shall be specified in the Project Specifications

- The number of pairs required in each Voice Backbone Cable shall be specified in the Project Specifications

- Installers shall ensure that the SCS products they propose to install within a Customer premises is compliant with the technical standards described within the 'Mandatory Regulations' of their region. Refer to Section 3

- The Installer shall ensure that all SCS products have been marked or labelled with verification that an endorsed and independent Testing Laboratory has tested and approved samples of the product. Refer to Clause 4.3.12

- The Installer shall check the Manufacturer's product specifications to ensure that the products chosen are capable of the minimum transmission performance required for the intended use of the SCS sub-system

- The Installer shall ensure that all SCS products have been sourced from the same manufacturer or partners that have been officially endorsed by Clipsal Australia. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS products and associated Pathways and Spaces products are those endorsed by the manufacturer and will be included in the scope of the SCS Certification & Warranty Program. Refer to Clause 2.3.2

- The Installer shall ensure that all SCS termination products and cables are marked with the correct colour codes. Refer to the standards listed in Section 3

- Voice Backbone Cabling shall be copper conductor and unshielded

- Voice Backbone Cabling shall have balanced and twisted pairs

- The route length of the Voice Backbone Cabling shall include the Backbone Link and two Cross-Connect Cables. Refer to the diagram in Clause 10.1

- The maximum route length shall be determined by checking the standards listed in Section 3

- The complete route length (Channel) shall be tested to the Class specified in the Project Specifications

- Voice Backbone Cabling that is reticulated through internal building Pathways & Spaces shall be of internal grade construction

- Voice Backbone Cabling that is reticulated through external building Pathways & Spaces shall be of external grade construction. For more information regarding definitions of an external situation, refer to the standards listed in Section 3

Refer to the diagrams in *Clause 10.1* for more information regarding Voice Backbone Cabling

The Voice Backbone Cabling and all associated termination components shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project

10.2.1   Termination Methods

The information is given assuming that the Installer has determined and installed the following SCS components and/or sub-systems as part of the Horizontal Cabling installation:

- Wall Mounted Distributor and Frames
- Cabinet Mounted Distributor and Frames

The Installer shall comply with the following important factors regarding the Termination Methods of the UTP Voice Backbone Cabling:

- UTP Voice Backbone Cabling shall be terminated on Patch Panels
- UTP Voice Backbone Cabling shall be terminated on Patch Panels that are separate from the Horizontal Cabling
- Patch Panels may be manufactured with intrinsic 16,or 24 IDC ports
- Patch Panels shall be manufactured, mounted and equipped to comply with the installation practices defined in Section 8
- Patch Panels shall be colour coded to differentiate each different SCS sub-system that is terminated as follows:
  - o Green: Voice and LAN Backbone Cabling (UTP)
- UTP Voice Backbone Cabling shall be terminated to comply with the installation practices defined in Section 8
- UTP Voice Backbone Cabling shall be reticulated through Distributor frames to comply with the installation practices defined in Section 8
- Voice Backbone Cabling shall be neatly reticulated to the Patch Panel and the sheath removed to the edge of the lowest module to be terminated in the multi-pair group
- Voice Backbone Cabling shall be separated into sequential groups of the correct color codes and loomed neatly to each Patch Panel
- Where 25 pair Voice Backbone Cabling has been specified for termination on a 24 port Patch Panel their will be 1 x loom and the last pair shall be left un-terminated
- Where 50 pair Voice Backbone Cabling has been specified for termination on 24 port Patch Panels their will be 2 x looms and the last 2 x pairs shall be left un-terminated
- Where 100 pair Voice Backbone Cabling has been specified for termination on 24 port Patch Panels their will be 4 x looms and the last 4 x pairs shall be left un-terminated
- Each pair of the LAN Backbone Cabling shall be terminated to the color code and sequence recommended by the standards listed in Section 3
- Refer to Clause 8.5.2 for more information regarding the termination of cabling onto Patch Panels
- Voice Backbone Cabling shall be Cross-Connected to the Voice Equipment and Telecommunication Outlets, using the specified performance level Cross-Connect Cabling as defined in the Project Specifications

All SCS components used to terminate and accommodate Voice Backbone Cabling shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project

10.4 Labelling

Labelling is an important part of the SCS. This Installation Standard defines the acceptable methods of labelling for each sub-system or component of the SCS. The Installer shall comply with one of the options listed in each clause for labelling

The labelling convention for the site shall be defined in the *Project Specifications*

10.4.1   Cable Sheath

The Installer shall comply with the following important factors regarding the labelling of the Voice Backbone Cable sheath:

- All Cable Sheaths shall be labelled
- # means letter or number
- The labelling shall conform to the following: Source Building # - Distributor/Cabinet Location # –- Port/Pair Count #. For example, the 50 pair cable terminated within the B Termination Enclosure located within the A Cabinet from the World Plaza Building would read as follows: WP-A-B-50
- Each Voice Backbone Cable shall be labelled with a permanent label at each end of the cable attached to the sheath just before the Disconnection Module entry point. Acceptable types of labels are as follows:
  - o Black legible ink handwritten or typed on a white background that is protected by a wrap around self-laminating clear material
  - o A label that can be tied to the cable with black legible permanent ink
  - o Applicator ferrules displaying the label designation
  - o Adhesive wrap around labels displaying the designation
- Labels shall not be with ink marked directly to the cable sheath
- Labels shall not be with adhesive plastic or paper tape marked with ink
- All Distributors in the same building shall have a different letter or number
- All Distribution Frames within the same Distributor location shall have a different letter or number

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project

Patch Panels

The Installer shall comply with the following important factors regarding Patch Panels:

- Patch Panels shall be manufactured with special label holders and labels supplied with the Patch Panel kit

- All Patch Panels shall be labelled either above or below the RJ45 Ports such that the label describes the Remote Patch Panel Port that each RJ45 port is connected to
- Labels shall be legible and typed using black ink on a colour coded background:
  - Green background for UTP Voice/LAN Backbone
- Each RJ45 port shall be labelled as follows:
  - Labelling numbers shall begin on the left most and highest mounted Patch Panel for each different sub-system and continue from left to right ascending by one number for each RJ45 port
- # designates Letter or Number
- The labelling shall conform to the following: **Remote Distributor Location # - Patch Panel Port #**

  For example the **10**th Patch Panel Port terminated within the **A** Distributor would read as follows: **A-10**
  - When there is more than one Patch Panel required to terminate UTP Voice Backbone to a Distributor the next Patch Panel mounted below will carry on the numbering sequence from the first Patch Panel
  - For example: 24 port Patch Panels are being installed. The top most UTP Voice Backbone Field Patch Panel is labelled from left to right A-1 through to A-24. The next Patch Panel installed below the first will be labelled from right to left A-25 through to A-48. The labels are printed in Black ink on a light green background to designate that the Patch Panels are UTP Backbone Cabling

The Labeling systems shall be included in the list of materials that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project

10.5 VOICE BACKBONE TESTING

This clause defines the minimum SCS testing and certification requirements for Installers to comply with before the manufacturer will enter the SCS installation into their Certification and Warranty Program

The Installer shall rectify or replace any defective Voice Backbone Cabling that does not pass the tests and re-test the cable

All testing results shall be saved in an electronic database format that can be either printed as a hard copy or provided to all interested parties as a report

The Installer shall be aware that all test reports will be audited by an independent third party verification organisation who will conduct a comprehensive quality control procedure for all tests provided

The test results shall pass through this quality control and be signed off by the third party as one of several steps before Clipsal Australia for inclusion in their Certification and Warranty Agreement can accept the SCS installation

If the third party organisation detects any anomalies with any of the test reports then those cables will not be accepted until rectified at the cost of the Installer and correct test reports are provided

10.5.1   UTP Field Test Unit Testing

All Voice Backbone Cabling shall be tested to the following minimum requirements:

- The UTP Field Test Unit and test certification methodologies shall comply with the minimum requirements as defined in Clause 8.9.1

- 100% of terminated VOICE Backbone Cabling shall be tested. All components of the Voice Backbone Cabling shall be terminated and mounted as specified in this document in the final location before testing

- The test equipment utilised for testing Voice Backbone Cabling shall be regularly calibrated by an independent Test Laboratory organisation every twelve months

- A copy of the verification certificate from the laboratory shall be supplied as part of the Customer's SCS Documentation and Installer's Certification documentation to the manufacturer. The certificate shall include the serial number and the latest calibration date

- The test equipment utilised for testing Voice Backbone Cabling shall be regularly updated with the latest manufacturer software and firmware that reflect the latest ratified changes in industry standards. Refer to Section 3

- Voice Backbone Cabling test reports that are provided by the Installer that indicates obsolete firmware and software shall not be accepted by the manufacturer as correct

- The test equipment utilised for testing Voice Backbone Cabling shall be set up to perform the correct tests for each different Voice Backbone Cabling type as specified in this Installation Standard and/or the Project Specifications with evidence of this clearly stated in each test report

- Voice Backbone Cabling shall be tested with four pair RJ45 Modular – RJ45 Modular test leads

- The UTP Field Test Unit shall be set to test for Channel and for the performance Class of the Voice Channel that is required

- Voice Backbone Cabling test reports that are provided in the test manufacturer's database format shall be designated with a PASS result

- Test reports designated with a PASS* will be deemed as marginal and will require some follow up investigation by Clipsal Australia and/or the third party test verification organisation

- Any test report designated with a FAIL* and/or FAIL are not acceptable and the Installer shall take measures to rectify such cable faults

- All acceptable test reports shall be included as a section in the Customer's SCS Documentation and Certification Documentation for the project

- Voice Backbone Cabling that is altered in any way shall be re-tested and the latter test included in the documentation with the old test report removed from the documentation

The UTP Voice Backbone Channel Test Reports shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreement for the project

10.6 CROSS-CONNECT CABLING

The Installer shall refer to the *Project Specification* regarding their responsibilities for the provision and/or installation of Cross-Connect Cables

Where the Installer is responsible for the provision and/or installation of UTP Cross-Connect Cables they shall comply with the following important factors:

- All Cross-Connections from the Voice Backbone Cabling to the Voice Equipment Cabling and Telecommunication Outlets shall be made with Patch Cables

- The Patch Cables may match the same level of performance and be manufactured by the same manufacturer as the Voice Backbone

- Patch Cables shall be neatly reticulated through the cable management of the Distributors not the backspaces of the Distributors

- A number of different lengths of Patch Cables shall be used to facilitate neatness in cable management areas

- Care shall be taken to install Patch Cables such that the bend radius, pulling tension and other factors that could damage the cable or degrade the performance are avoided

- Spare Patch Cables shall be stored in separate labelled boxes in the location nominated by the Customer

- Care shall be taken to install Patch Cables such that OH&S issues are avoided

All Patch Cables shall be included in the documentation that is incorporated within Clipsal Australia's Certification & Warranty Agreements for the project

10.7 VOICE BACKBONE INSTALLATION DOCUMENTATION

This Clause assumes that the **Horizontal Cabling sub-system** is the base element of the installation and the Voice Backbone Cabling is a layer that is installed in addition

There are many elements of the **Horizontal Documentation** that are common and share the same methodology and as such there are many clauses in this section that also require the Installer to review the important documentation factors in *Section 8*

The Installer shall compile the Voice Backbone Cabling information as required in this clause for inclusion into to the associated Sections of the SCS Documentation

Site Documentation shall be provided for all SCS installations performed by the Installer

Site Folders and associated soft copies will be created for all new SCS installations

When additional works are performed, the site documentation shall be updated to reflect the changes. Where no site documentation is available, a site folder shall be created to house the new information

The details and format of the folders and associated documentation shall meet the following requirements:

- Two copies of a Master Site Folder shall be supplied and updated for all sites
- A Distributor Folder shall be supplied and updated for all Distributors including Campus, Building and Floor Distributors
- A holder shall be supplied and installed to accommodate the Distributor folders
- The folder shall be a four ring white A4 Folder with a clear protective sleeve face and side
- An insert shall be provided for front and side detailing the site

The **Front Insert** shall be an A4 sheet and shall be labelled, as a minium, with the following:

- Customer name
- Site name
- Site address
- Folder description

Folder Identifier shall be either **MASTER SITE FOLDER** or the Distributor Type and identifier i.e. **BUILDING DISTRIBUTOR BD- 02**

The **Side Insert** shall be labelled as a minium with the following:

- Site name
- Site address
- Folder identifier

10.7.1   Master Folder

Dividers shall be provided for all folders. They shall be labelled and sequenced into sections as detailed in this clause. Labels on dividers shall not be handwritten

The Master Site Folder shall include the relevant Voice Backbone Cabling information within the following SCS Documentation sections and associated documentation:

- Index
- Site Details
- SCS Overview
- Distributor Layout
- Cabinet Layout
- UTP Test Equipment Calibration Certification
- Installation Compliance Declaration
- SCS Manufacturer Product information

The following new Sections shall be added to the Master Site Folder that includes additional Voice Backbone Cabling information:

- Test Results Voice Backbone Cabling - Full Page Report (Paper & Electronic Copy)

10.7.2   Distributor Folder

The Distributor Folder shall include the relevant Voice Backbone Cabling information within the following SCS Documentation sections and associated documentation:

- Distributor Layout
- Cabinet Layout

10.7.3   Section Description

An index shall contain the identifiers for all folder dividers in the sequence they appear

Site Details shall contain the following information:

- Site Name
- Address
- Telephone Number
- Facsimile Number
- Site Co-ordinator Name and associated Telephone Number and e-mail Address
- Customer Name, Project Manager Name and associated Telephone Number and e-mail Address
- Installer including Site Supervisor, Contact Name, Address, Telephone Number, Facsimile Number, e-mail Address and services offering

The SCS Overview drawing shall include additional Distributors, Cabinets, Equipment Cabling and Voice Backbone Cabling Routes. The Installer shall update the drawing after each addition, alteration or deletion to the SCS installation

The Distributor Layout drawings shall include the termination layout of Voice Backbone Cabling and any additional Voice Equipment Cabling on the Distributor frames

The Cabinet Layout drawings shall include the termination layout of Voice Backbone Cabling within the Cabinet

The Test Result Summary showing Voice Backbone Cable/Core identifier, date tested, length, type of test performed and pass/fail of all Voice Backbone Cabling. Summary sheets are to be signed to verify the validity of all test results

The Calibration Certification for all equipment used for testing of the Voice Backbone Cabling

The Installation Compliance Declaration Forms that document all of the SCS installation shall be included

The SCS Manufacturer Product Information such as a complete 'Bill of Materials' and supporting documentation for all manufacturer products installed shall be included along with Clipsal Australia's Certification and Warranty Agreements

10.7.4   Electronic Records

Electronic records shall be provided on 3 ½ diskettes or on CD for all SCS installations

Two copies shall be provided with one copy left on site and the other presented to the Customer or Project Manager or appointed agent on practical completion

The electronic documentation shall come complete with the necessary licensed software to view the Voice Backbone Cabling Testing Reports

The electronic documentation shall include all information contained in the Master Site Folder and all individual Voice Backbone Cabling test reports for Fibre Optic and/or UTP Voice Backbone Cabling