



For the Government of Niue

Liolau Accommodation Upper Block

MES: 200 Building Services

Preliminary and General Services Specification





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MES: 201

PRELIMINARY AND GENERAL

1 EXTENT OF WORK

This section of the specification is the trade preliminary and general requirements for the supply, delivery, assembly, installation, and commissioning of the materials required, and the work necessary for a complete working installation, as set out in the drawings and this specification.

The following trades are applicable:

- a. Fire Protection Systems
- b. Plumbing and Drainage Systems
- c. Electrical Systems
- d. Mechanical Systems (minor systems included within the Electrical Services package)
- e. Data and Communication Systems

2 DEFINITIONS

2.1 The words - Principal and Employer

The words “Principal” or “Employer” shall have the same meaning.

2.2 The words - Engineer, Architect and Supervisor

The words, “Engineer”, “Architect” or “Supervisor” shall have the same meaning as that defined in the General Conditions of Contract for the person appointed by the Principal to act as their representative.

2.3 The word - Approval

The word, “Approval” shall mean obtaining written approval from the person appointed by the Principal to act as their representative.

3 HEALTH AND SAFETY

3.1 General

- a. Allow to carry out the responsibility required within the terms of the Health and Safety at Work Act 2015.
- b. Allow to obtain a copy of the Principal’s Health and Safety Policy upon notice of commencement of works.
- c. Take all reasonable steps on the site to ensure the safety of all concerned and to exclude all unauthorised personnel.

3.2 Submission

Within 5 working days of the award of a contract, allow to submit:

- a. The safety plan appropriate to their section of work.
- b. A statement on staff selection criteria, training standards and induction courses.
- c. A statement on how compliance with the Act and their safety performance will be monitored.
- d. A statement on their safety performance and injury record for the last 2 years.
- e. A statement of their safety rules.
- f. The operational safety guidelines for known or potential hazards.
- g. The name and contact telephone number of their Work Place Controller.

3.3 Reporting

During the duration of the contract, allow to report regularly in relation to:

- a. Review of safety performance and compliance with the Act.
- b. Action relating to breaches of safety requirements.
- c. Safety audits/reports/spot inspections carried out.
- d. Follow up on accidents.

4 MATERIALS AND WORK NOT SPECIFIED BUT REQUIRED

Materials and work not specifically mentioned shall be supplied as required by normal trade practice to enable completion of the work.

5 EQUIPMENT INSTALLATION

Install all equipment to the manufacturer's instructions.

6 ACCESS TO EQUIPMENT

All equipment requiring adjustment, cleaning, changing, or modification in its normal use shall be readily accessible and its function clearly identifiable.

7 SEISMIC RESTRAINTS

7.1 Seismic Restraint Criteria

- a. All equipment shall be provided with seismic restraints.
- b. Details of the restraints proposed shall be submitted to the Engineer and written approval obtained before construction is commenced.
- c. Unless agreed otherwise, all restraints shall be in accordance with NZS 4219.

7.2 SMACNA Guidelines

Where seismic restraint configurations found in the SMACNA guide on seismic restraints are used, the design shall comply with NZS 4219.

7.3 Acceleration Forces

The complete installation, including all fixings, shall be able to withstand normal operating loads plus acceleration forces of not less than 1.0g in a horizontal direction through the centre of gravity of the item fixed.

7.4 Equipment Requiring Restraints

Allow to provide seismic restraints for:

- a. Large mechanical plant items and solar panels.
- b. Liquid storage tanks.
- c. Pipe runs.
- d. Cable ladder and tray runs.
- e. Switchboards, distribution boards and control panels.
- f. Duct runs.

8 FIXING TO STRUCTURE

- a. Explosive charge fixing devices shall not be used without approval.
- b. Where devices are required for attaching materials or equipment to the building, expansion type devices designed for the application shall be used.
- c. Wooden plugs shall not be used.
- d. Approval shall be obtained prior to drilling to ensure that post tensioning cables or similar in the slab are not damaged.

9 SAFETY DEVICES

- a. All safety devices required by statutes, regulations or local authority bylaws, or those which are consistent with good trade practice, shall be fitted. These shall include, but not be limited to, such items as guards, cover plates, electrical-mechanical interlocks, isolators and warning notices etc.
- b. All parts of the system shall "fail-to-safety" wherever practicable.

10 UNIFORMITY

When a particular manufacturer or product range has been adopted for equipment or fittings, all such fittings and components shall be uniform throughout the project.

11 ALTERNATIVE EQUIPMENT

11.1 Proprietary Equipment or Methods

- a. Nomination of a particular manufacture, model, reference or source of supply for materials or equipment shall be taken to indicate type and quality desired.
- b. Where alternatives are allowed to be offered, provide evidence that the proposed alternatives are 'equivalent' and to submit prices for these alternatives for evaluation without additional cost.

11.2 Assessment of Alternatives

- a. Alternative products or methods shall be subject to written approval.
- b. Factors that will be considered when assessing alternatives include, but are not limited to, the following:
 - i. Equipment dimensions and arrangement of connections are similar to the make quoted and readily fit in to the available space.
 - ii. Access for maintenance is not impaired.
- c. Quality, performance, and finish are equal to or better than that quoted. The following (where appropriate) will be considered when making comparisons:
 - i. Overall weight.
 - ii. Rigidity of components.
 - iii. Noise level.
 - iv. Efficiency.
 - v. Standard of workmanship.
 - vi. Corrosion protection.
 - vii. Surface finish.
 - viii. Floor loadings.
 - ix. kW rating.
 - x. Ease of servicing.
 - xi. Appearance.
 - xii. Quality
 - xiii. The availability of spare parts and servicing.
- d. Ensure that all variations in costs and work, especially by Others as a result of the proposed, alternative are included with the submission.

12 SAMPLES AND PROTOTYPES

12.1 General

- a. Approved samples may be retained until completion of the work. All such materials used in the work shall conform with the approved sample(s).
- b. Allow for the reasonable testing and/or analysing of samples of any materials brought on to the site and intended for use at any time.

12.2 Submissions and Approval

- a. Samples of items, materials and components shall be delivered on site at least 15 days before approval is required and 4 weeks before the equipment is expected to be installed.
- b. Two samples shall be supplied of each item required, both to be properly identified and marked with the Suppliers name and address.
- c. On acceptance the samples will be marked with:
 - i. Date approved.
 - ii. Approved by:
 - iii. Description of sample.
 - iv. Where used and installed.

12.3 Items to be Submitted

All items to be submitted will be advised in writing.

13 PROTECTION OF WORKS

- a. Take all reasonable steps to prevent damage to equipment during the contract period.
- b. Adequately protect all equipment in dust-laden areas or places exposed to the weather.
- c. Take every precaution to protect work by Others.
- d. Cap all open ducts and pipes to prevent entry of foreign materials.
- e. Upon delivery to site, all materials and equipment shall immediately be secured, properly stacked and protected from the weather, dampness and dust, with particular attention to preventing ingress to working parts, insulation and pipes. Should ingress occur, carefully remove the offending matter and thoroughly clean the conduits, pipes, ducts and equipment to approval.
- f. All equipment and materials shall be stored clear of floor slabs on timber packers.
- g. Fittings or other equipment shall not be used:
 - i. As a place for depositing tools and materials.
 - ii. As a means of supporting scaffolding.
 - iii. As a work bench.

14 WELDING

14.1 Welding Practices

- a. Metal-arc welding of mild steel structures, supports, etc. shall comply with NZS 4701.
- b. Metal-arc welding of mild steel pipe shall comply with BS 2971.
- c. Metal-arc welders shall be qualified to NZS 4711.
- d. Oxy-acetylene welding of mild steel pipe shall comply with BS 2640.

14.2 Welding Safety

Allow to take all reasonable precaution to follow the “hot-ticket” procedures or similar site practices and to prevent the initiation and spread of fire from welding.

15 CORROSION PROTECTION

- a. Make every attempt to limit corrosion.
- b. Situations not covered by this specification shall be brought to the attention of the Engineer.
- c. In moist conditions, contact between dissimilar metals, particularly copper and aluminium or copper and zinc, is not permitted. Separate such metals by an air gap of 3mm or by an insulating layer of 1.5mm thickness.
- d. Do not place metals in direct contact with concrete except where steel is cast-in for supports or hangers.
- e. Eliminate pockets that could hold water.
- f. Fastenings to have equivalent or better corrosion resistance than the materials joined.
- g. Water that drains from plant items shall drain to a visible position.
- h. Contact between copper and steel is permitted only in closed circuits.

16 IDENTIFICATION OF SERVICES

16.1 Plant and Equipment

- a. To allow its function and location to be readily identified, identify each item of plant and equipment with a designation and component number
- b. Where practicable, relate the labelling using a common theme and to the “as built” documents.

16.2 Pipework and Ventilation Systems Ducting

- a. All pipework and ducting services shall be painted or fitted with identification colour bands and direction of flow indicators in accordance with NZS 5807.
- b. Identification colour bands shall:
 - i. Be not less in width than specified in NZS 5807.
 - ii. Be located at intervals of not more than 8m and in every space that the pipe/duct appears.
 - iii. Be within 300mm of each side of every control device, change in direction, wall penetration and at such other places where identification of the service is necessary.
 - iv. Where two colours are required, have the second colour between bands of the first colour.

16.3 Labels

Labels for plant and equipment shall:

- a. Be black lettering on a white background unless indicated otherwise.
- b. Have lettering a minimum of 5mm high unless indicated otherwise.
- c. Be permanent and rigid.
- d. Be attached by screws, chains or some other permanent method that shall be subject to approval.

17 NOISE LEVELS

- a. Noise or vibration from operating equipment shall not exceed noise levels normally acceptable from that type and class of equipment.

- b. Ensure that all installed equipment operates at a noise level suitable for its immediate surroundings and as specified.

18 EXISTING SERVICES

18.1 Disruption or Disconnection

Obtain written approval before disconnecting or disrupting any existing services. Keep all necessary disruptions to a minimum and at such times as will avoid unnecessary inconvenience to others.

18.2 Underground Services

- a. Allow to take all reasonable precautions to locate all underground services prior to commencement of excavations.
- b. Allow to search on site, and on any drawings which maybe available, for evidence of an existing underground service or factor which might affect the installation or the progress of work.
- c. Any damage to underground services during excavations shall be repaired at no cost to the Contract.
- d. Take note that “as-built” drawings, where provided, are for general information only and no guarantee is given as to their accuracy. Allow to confirm, where appropriate, all such details on site.
- e. Services found during excavation which have not been previously located shall be reported.
- f. Report immediately any services that are damaged.
- g. No excavating machine shall be used closer than 200mm to any buried services.
- h. Any power cable or service that is found to be redundant shall first be proved safe to cut before removal.
- i. Show exact locations of all underground ducts and services on as-built drawings giving exact depths and dimensions from readily identifiable buildings or landmarks. These shall include any underground services found during excavation not previously located.

19 DEMOLITION AND SALVAGE

19.1 Items to be salvaged.

- a. Salvage all such items, and any others that may be considered of value or suitable for re-use, removing same to safe storage.
- b. Allow for any salvaged items where nominated, or otherwise considered suitable for re-use, to be repaired, cleaned or replaced as necessary to obtain equivalence in quality and performance as new items.
- c. Examine at commencement of the contract all salvaged items and determine all necessary remedial actions required to obtain confirmation for re-use.
- d. Salvaged material may be used to provide temporary services during the course of the contract.
- e. Remove from site all demolition material or salvaged items rejected for re-use.

20 BUILDER'S WORK

- a. Confirm in conjunction with all relevant trades, the suitability and compatibility of all items being supplied or installed, such as excavation, structural penetrations, ducting, plant and equipment location and mounting.
- b. Identify the need for builders work associated with this trade and co-ordinate the execution of this work. This includes structural penetrations, floor or wall chases, cast bases for machinery, framing, drawings and timber work necessary for the support or enclosure of equipment and pipework, roof and wall flashing .
- c. Ensure that all building work is carried out in accordance with the relevant sections of the specification.
- d. Fire, noise rating and waterproofing must be maintained after making good.
- e. This trade is responsible for notifying other trades of requirements of filling and sealing around pipes and ducts.
- f. Where sealing of penetrations is not stated allow for making good to equal performance for fire, sound, etc., and seek final details from the Contractor.

21 CO-ORDINATION AND LIAISON

21.1 Co-ordination and Liaison

- a. Allow to co-ordinate and liaise with other Trades to determine the most practical method of installation and connection to equipment supplied by them.
- b. Allow to liaise with specialist equipment suppliers to:
 - i. determine suitable connection methods
 - ii. confirm actual ratings and connection requirements before delivery to site

21.2 Work by Other Trades

- a. Provide holding down bolts, hangers and sleeves for casting into concrete unless alternative methods have been agreed.
- b. Examine work carried out by other Trades affecting services work such as finish and air tightness of builders' work, air ducts, etc., and if unsatisfactory, notify the Contractor in writing.
- c. All chases, ducts, recesses and penetrations in structural elements not shown on the building and structural drawings shall be subject to approval before commencing work.

21.3 Setting Out of Work

- a. Each Trade shall be responsible for setting out and completing in good time to suit building progress, for the accuracy of all such work and for any costs arising from their own errors or omissions.
- b. Check construction on site at regular intervals to ascertain that the working dimensions and tolerances shown on shop drawings are being adhered to by the Contractor and to assure that such like will fit in with the contract works as specified. Should any discrepancy arise it shall be immediately reported to the Contractor.
- c. Note that the supplied drawings are diagrammatic and indicative of requirements only and, unless otherwise stated, shall not be used for determining the precise positions of equipment,

outlets and like components. The exact location of these shall be determined on site or from shop drawings.

- d. Confirm on the site before installation the exact location and mounting heights, etc. of all outlets, fittings, equipment, penetrations, etc. and of exposed wiring.

22 HOLES IN STRUCTURE

22.1 Beam penetrations

Major beam penetrations for services shall not be made without prior approval.

22.2 Holes to be sealed

- a. All penetrations provided shall be sealed water or air tight, acoustically and fire rated as appropriate.
- b. All penetrations through chambers subject to suction or pressurisation shall be sealed with an approved sealant and flanges.

23 DUCTS AND PENETRATIONS

23.1 Provide Sleeves

Where pipes, ducts, conduits and other parts of the installation penetrate the building structure or masonry walls and floors, sleeves shall be supplied and located as specified.

23.2 Entry Penetrations

- a. Provide all sleeves, pipe ducts, conduits etc., required for underground entry into buildings, or through or under floors, walls and ceilings, concrete or sealed areas etc.
- b. Terminate underground entry points at least 300 mm beyond the foundation line or sealed area.
- c. Terminate pipe ducts vertically at switchboards directly under the main switch or centre of the appropriate cable entry.

23.3 Ducts

- a. Provide underground cable ducts of Class D rigid PVC to NZS 7648 or (BS 3505), or reinforced fibre cement pipes with sleeved or socket joints.
- b. Bends in ducts to have internal radius greater than 15 times the diameter of the duct, or 400 mm, or as detailed.
- c. Clean out all ducts and penetrations etc. before the installation of cables, remove all sharp edges. Fit draw wires.
- d. Ducts shall be sealed to prevent the ingress of water into buildings (Refer NZBC Clause E2 (External moisture)).

24 PROGRAMME OF WORK

- a. Provide a detailed construction programme showing all activities.

- b. The works programme shall show the start, completion dates, man-days and the critical path associated with the sectors of work:
 - i. Submission of shop drawings.
 - ii. Submission of samples for approval.
 - iii. Shop fabrication.
 - iv. Ordering of plant and materials.
 - v. Delivery of plant and materials.
 - vi. Installation of plant and materials.
 - vii. Acceptance testing and commissioning.
- c. Supply two copies of the construction programme of award of contract.

25 PRACTICAL COMPLETION

25.1 Procedures to be Completed

The following procedures shall be completed prior to obtaining practical completion for the installation:

- a. All preliminary testing, pre-commissioning and commissioning of the installation shall be carried out.
- b. Draft manuals of operating and maintenance instructions incorporating completed commissioning results together with updated as-built drawings shall be provided and approved.
- c. Provide notification in writing that the installation is considered to have reached practical completion. The right is reserved to refuse any application should this condition not be fulfilled.
- d. Practical completion will be certified only after the plant has been inspected and approved and all acceptance testing satisfactorily completed.

26 GUARANTEES

All faulty parts shall be replaced and the labour required shall be free of charge.

Guarantees for all plant and equipment shall be included in the Operating and Maintenance Manual.

26.1 Warranties (all trades)

Warranty periods shall commence at practical completion or, if not concurrent with practical completion, at acceptance of installation.

The project will not be considered completed until all warranty documentation has been received by the Engineer and the Government of Niue.

26.2 Electrical installation warranties

Three types of warranties apply to electrical installations:

- i. Installation warranty (Defect Liability Period)

- ii. Electrical systems and components product Warranty (where applicable)
- iii. Electrical appliance product warranty (where applicable).

26.2.1 Installation warranty

The electrician shall provide a Defect Liability Period warranty on their own work and workmanship for a minimum period of **two (2) years**. This includes any remedial work done to bring existing electrical infrastructure up to the required Standard.

26.2.2 Systems and components warranty

The electrician shall provide product warranty for replacement or repair of systems or components, including labour, which fail to meet the specified performance standards with a minimum period of **two (2) years**.

26.2.3 Product warranty

An electrical appliance product warranty for replacement or repair of electrical appliances supplied by the electrician, including labour, which fail to meet the specified performance standards with a minimum of a **five (5) year** validity period, is a mandatory requirement.

In the event that the product warranties contradict those within this document, the electrician is to bring those contradictions to the attention of the Engineer immediately.

26.3 Data and communications cabling installation warranties

Two types of warranties apply to Data and Communication Cabling Installations:

- iv. Installation Warranty
- v. Manufacturer's Warranty

26.3.1 Installation warranty

The cabling system Contractor shall warranty its own work and workmanship for a minimum period of 24 months.

26.3.2 Manufacturer's warranty

The Structured Cabling System (SCS) Contractor shall provide the client with a minimum 20-year manufacturer's performance warranty and a minimum 20-year applications assurance warranty on the complete cabling installation. The application warranty shall apply to any protocol sanctioned for use with the cable plant together with the connecting hardware. The cabling contractor shall provide a clear statement of the warranty.

Any additional cabling at the warranted premises must not compromise the existing warranty. Additional cabling shall be installed and tested by a certified and accredited supplier. An updated warranty and system certification shall be provided at the completion of any additions.

26.3.3 System certification

The installed SCS must be certified and carry a minimum 20 year installation warranty by the equipment manufacturer to guarantee that it will meet the Product and Application requirements

of this document. One system certification shall cover all components of the structured cabling system.

Where the SCS is in addition to existing data communication cabling, the extent of the warranty and any exclusions shall be documented and agreed upon by the site representative.

27 MAINTENANCE

- a. Maintain and service the installation, free of charge for a Maintenance Period of 12 months from the date of Practical Completion.
- b. Include regular monthly visits during normal working hours to inspect the installation to ensure all systems and parts are operating effectively and efficiently.
- c. Make any adjustments required to maintain the installation in correct working order.
- d. Replace any defective part, and carry out any other maintenance procedures recommended in the Maintenance Manual. Include all materials required.
- e. Report any deficiencies noted which are not the responsibility of this contract but have affected, or could affect the operation of the systems covered by the contract.
- f. Provide an "on call" service at no additional charge during normal working hours for the maintenance period.

28 OPERATOR INSTRUCTION

- a. Prior to handing over the completed installation, instruct the Operating Staff in the correct use of all equipment and systems
- b. To assist with the instruction, supply a copy of the Operating Instructions as part of the Operations and Maintenance Manual.
- c. Prior to the end of the Maintenance Period, Instruct the Maintenance Staff in the correct maintenance procedures of all equipment and systems.

29 DRAWING INFORMATION REQUIRED

Where drawings, certificates or similar documentation showing the intent of work are requested, then these documents will be subject to a review and approval process before any further construction is undertaken.

Supply clear information on the following:

29.1 Equipment details.

- a. Prepare a schedule of plant giving the proposed make, model, and size of equipment and expected delivery time and apply for review in time to meet the programme. Allow two weeks for the review.
- b. Provide details of construction, capacity, weights and performance characteristics of key equipment items.
- c. These details may take the form of manufacturer's trade literature provided that the information particular to this application is clearly marked and is complete.

29.2 Construction drawings

- a. Provide construction drawings of the relevant work to facilitate the satisfactory completion of the project.
- b. Construction drawings include, but are not limited to, builders information drawings, manufacturing and installation details and circuit diagrams.
- c. Submit the required constructions drawings before work detailed on the drawings is commenced.
- d. Provide three copies of each drawing submitted for review. Allow a minimum of two weeks for the review.
- e. Rejected drawings shall be revised and resubmitted until such time as the agreement on the work to be done has been reached. No extension of time will be granted for delays that can be attributed to the need to resubmit construction drawings.
- f. The review of construction drawings shall not in any way relieve the Sub-contractor/ Contractor of the responsibility for any errors and omissions, nor from the necessity to furnish such workmanship and materials as may be required for the completion of the work.
- g. Sheet size and scale shall be not less than that used on the contract drawings for similar details.
- h. Drawings shall comply with the requirements of AS 1100.

29.3 As-built drawings.

- a. As-built drawings shall be defined as a set of the drawings that have been updated to record every instance where the work, as built, varies from that shown on the original documents and shall incorporate any additional information required by the contract.
- b. As-Built drawings shall be based on and generally compatible with the contract drawings. They shall not rely on colour for differentiation.
- c. Submit two sets of drawings for approval. Make any modifications requested and resubmit the drawings. Repeat the procedure until agreement is reached that the drawings are a true representation of the final installation.
- d. As-built drawings shall be prepared in accordance with the latest edition and amendments of NZS 5902 (all parts) but using the notations indicated on the contract drawings. Drawings not complying with the standard will not be accepted.
- e. As-built drawings shall:-
 - i. be the same size and scale as the Contract drawings
 - ii. have the Sub-contractors/Contractor's name clearly indicated on each drawing
 - iii. have the "as-built" date
 - iv. be certified by the Sub-contractor/Contractor as 'as-built'.
 - v. Location of transformer (if applicable)
 - vi. Location of mains and sub-mains cables
 - vii. Location of mains and sub-mains distribution boards
 - viii. Locations and circuit identification of all power socket outlets
 - ix. Locations of all protective devices (RCDs, MCBs, and so on)
 - x. Physical layout drawings of power outlet positions and identification numbers
 - xi. Description of the labelling system used
 - xii. Record of maximum demand calculation.
- f. When the drawings have been prepared to an acceptable and approved standard of accuracy and presentation the following copies shall be provided:

- i. Two complete sets of prints (full size) bound as sets between rigid and durable covers to approval.
 - ii. One set of prints reduced to A3 size to be included in each copy of the Maintenance Manual.
 - iii. One set of microfilm (35 mm) of all as-built drawings mounted in aperture cards.
 - iv. One set of drawings on CD-ROM in AutoCAD or Revit drawing programme plus PDF format.
- g. A base set of clean contract drawings can be provided in AutoCAD or Revit format.
- h. Switchboard and Control Panel Requirements
- i. Schematic drawings, suitably laminated shall be provided and installed adjacent to each switchboard or control panel.
 - ii. Distribution board or similar multi-point protection chassis shall have sub-circuit way charts filled out and incorporated in each door envelope.

29.4 Maintenance Drawings

- a. Maintenance drawings provide information on the location, function and operation aspects of items of the installation, subject to maintenance. Such drawings shall also be used to record information on the setting of components and adjustments made during the commissioning of the installation.
- b. Maintenance drawings shall be produced in accordance with NZS 5902 Part 5.
- c. Preliminary copies of proposed diagrams and schedules shall be submitted for review and comment before final copies are processed for inclusion in the Maintenance and Operational Manual.
- d. Modified contract or as-built drawings or parts thereof may be adapted for use as maintenance drawings. Drawings may be presented in a similar format to that required for the as-built documentation.

29.5 Time Information is required.

The above documents must be supplied before completion of the contract.

30 MAINTENANCE AND OPERATIONAL MANUAL

30.1 General

- a. Prior to the issue of the Certificate of Practical Completion, submit two draft copies of Maintenance and Operational Manuals
- b. The Maintenance and Operational Manuals and drawings incorporating comments will be returned within two months of the receipt of the draft copies.
- c. Supply four copies of the approved draft Maintenance and Operational Manual within four weeks of their provisional acceptance and prior to the issue of the Certificate of Final Completion.
- d. One bound copy and one electronic copy on CD Rom shall be provided to the Government of Niue at the completion of the work.
- e. If there is failure to meet the above requirements, then the cost of producing the Maintenance and Operational Manuals, by other parties, shall be deducted from the Contract Sum.

30.2 Presentation

- a. Maintenance and Operational Manuals shall be bound in hard backed plastic ring binders A4 size with embossed titles on the front and spine.
- b. The project identification and names of the Services Consultant, Sub-Contractor/Contractor and Principal shall be shown on the cover.
- c. A table of contents that schedules the contents of the manual. Include in the table, section headings, sub-sections and the page number for each entry.
- d. An introduction that identifies:
 - i. The Main Contractor.
 - ii. The Sub-contractors for the various systems that form part of this contract.
 - iii. The approving authorities.
 - iv. Name of the Inspector. (if relevant).
 - v. A schedule of other relevant documents that have not been included as part of the manual.

30.3 Information to be included

The Maintenance and Operational Manual shall cover the following major aspects and be arranged in the indicated sequence:

30.3.1 Index

Index of all sections and sub-divisions including lists of drawings, components and equipment.

30.3.2 Description

General description of the installation divided into sub-sections for each individual system as appropriate.

30.3.3 Plant Operations

Full operating instructions for each system and for groups of inter-related systems with details of emergency procedures.

Operating conditions fluid flows, pressures, electrical data and other characteristics as applicable for checking and adjustment of all systems and components.

30.3.4 Equipment

Equipment specification, including all technical data, names of suppliers and manufacturers, serial numbers, trade literature.

30.3.5 Maintenance

The maintenance manual shall provide a full description of the systems that have been provided as part of the contract. Where relevant information is included in another manual provide a reference that will enable the reader to locate the relevant material.

Routine maintenance requirements including detailed schedules of all periodic routine maintenance (schedules to be approved).

Manufacturer's detailed instructions for disassembly, overhaul, assembly and fault correction.

30.3.6 Commissioning Records

A full copy of all final test results

30.3.7 Drawings

One set of bound-in reduced size prints to A3 size of the final as built and maintenance drawings protected by a plastic lamination.

31 ADDITIONAL DOCUMENTATION - PLUMBING AND DRAINAGE

Details to include, but are not limited to, the following information:

- a. Power supply and alarm details
 - i. Identify the source of power supplies for Drainage and Plumbing systems.
 - ii. Identify the location of any isolator.
 - iii. Identify the function of all alarm signals, how to identify each alarm and any action that should be taken when an alarm is activated.
- b. Isolating valve locations.
- c. Manhole locations.
- d. Roding access point locations.

32 ADDITIONAL DOCUMENTATION - MECHANICAL SYSTEMS

Details to include, but are not limited to, the following information:

- a. Fully dimensioned details of all penetrations of structural members.
- b. Full details of any plinths, foundations and fixings required.
- c. Pipework and ductwork layouts, including details of construction, supports, hangers, anchoring, anti-vibration mounts, expansion, fixing, seismic restraints and the like.
- d. Reflected ceiling plans showing all air outlets, their size and air quantities and all other ceiling mounted services.
- e. Plant layouts including full manufacturing details of built up or site constructed items of plant. Detailed drawings of proprietary items or plant are not required.
- f. Schematics of the automatic control systems. These drawings shall include, but not be limited to, the following details:
 - i. Detail all connections to each item of control equipment.
 - ii. Details on the type of connection e.g. input, output, analogue, digital etc.
 - iii. A schematic of the plant being controlled.
 - iv. Details of the type and size of wiring.
 - v. Terminal and component references for each item of plant.

- vi. Component references used in any software associated with the operation of the automatic control system.
- g. Automatic controls wiring diagrams, similar to figure 4.8 in NZS 5902 Part 4: 1976, for each control panel.
- h. The as-built drawings shall include schematic line diagrams for each system similar to those included in the contract documents. Indicate the commissioning result on all as-built drawings.
- i. Piping layout drawings shall include the actual pipe sizes and the size and locations of all of the following as applicable to the system:
 - i. The location and point of access of isolating valves, regulating valves, control valves and other valves provided in pipe circuits for the purpose of regulation or control.
 - ii. The location of air release points, air bottles, automatic air vents, air cocks and similar components and their points of access.
- j. Ducting layout drawings shall include sizes and locations of all ducts, dampers, supply outlets, return inlets, fresh air intakes, access panels, fire dampers etc.
- k. Detail the location of test points in ducts for the measuring of air volumes and pressures. Provide the figures for measured pressures and for the air volumes regulated at main and secondary branches, terminal volume control units and supply, return and extract grilles and diffusers. Provide schedules for grille and diffuser volumes.
- l. Provide a schedule of all main plant and components with full operating characteristics. Include all control valves if not scheduled elsewhere.
- m. Provide schematic flow logic and control diagrams for all systems.
- n. Provide drawings that show all motorised automatic and hand operated controls such as dampers, valves, relief valves, cut-outs, thermostats, solenoid valves, bleeds, vents, drains, strainers, gauges, sight glasses and similar items required for the correct operation of the installation.
- o. Provide full plant room and/or equipment layout drawings with identification of each and every item of equipment.
- p. Provide electrical and control wiring diagrams showing all electrical controls, relays, cut-outs, timing devices, interlocks, fuses, overloads, contractors, solenoids, starters etc. with all items clearly identified as to type and function and "as built" control panel layout drawings. Where applicable, the drawings shall also include the settings and differential bands of all controls, cut-outs and other variable or adjustable items.

33 ADDITIONAL DOCUMENTATION - ELECTRICAL SYSTEMS

33.1 General

Details to include, but are not limited to, the following information:

- a. Fully dimensioned details of all penetrations of structural members.
- b. Full details of any plinths, foundations and fixings required.
- c. Details of the mains switchboard, control panels, and distribution boards. Information to be presented on the drawings include, but are not limited to the following:

- i. Construction details.
- ii. Dimensions, overall and of individual sections.
- iii. Component details including layout, component reference, make and catalogue number.
- iv. Wiring diagrams.
- v. Drawings showing details of the proposed boards shall be provided.
- vi. Where appropriate, type test certification shall be provided.

33.2 Manual Requirements

- a. The maintenance manual shall provide a full description of the Electrical Systems that have been provided as part of the contract. Where relevant information is included in another manual provide a reference that will enable the reader to locate the relevant material.
- b. Details to be included in the manual include, but are not limited to, the following information:
 - i. A copy of the compliance certificate.
 - ii. Power supply details:
 - iii. Identify the capacity of the main supply, the point(s) of entry, the location of any substations that may be dedicated to the site, the location of the revenue meters and details of the tariff that the installation has been placed on.
 - iv. Details of the main earthing system including the location of earth electrodes, the purpose of the various connections to the electrode system and the responsibilities of the building owner.
- c. Power distribution and control:
 - i. Identify the location of the main switchboard, the manufacture and manufacturer's references material and maintenance recommendations, including copies of type test certificates.
 - ii. Schedule fuses and recommended minimum spares.
 - iii. Schedule sub mains, their size, type and destination.
 - iv. Identify UPS's, their location, ratings, manufacture, battery details, manufacturer's references and maintenance recommendations.
 - v. Schedule distribution boards, identify sub main, location of supply protection, maximum capacity, spare capacity, manufacturer and details of components installed in each distribution board.
- d. Appliances and accessories:
 - i. Provide details of switches, socket outlets and accessories, including manufacture and catalogue numbers.
 - ii. Detail lamp type, nominal life and colour reference (for fluorescent lamps).
 - iii. Schedule of luminaires, provide technical literature relating to the luminaires. Provide details of any special provision for servicing the luminaires.
 - iv. Detail any specialist lighting systems such as emergency lighting and security lighting.
 - v. Initial set points for all equipment including, but not limited to, time clocks, timers, protection devices and alarm systems.
 - vi. Detail all other specialist systems such as MATV systems, RCD maintenance testing requirements, master clock system and telephone systems.
 - vii. Administration records for the communications system wiring.

33.3 Commissioning Results

List routine maintenance tasks to be carried out at specified times. Maintenance tasks to be documented include, but are not limited to, the following:

- a. RCD testing and record keeping.
- b. Emergency lighting testing.
- c. UPS maintenance.
- d. Lamp replacement recommendations.
- e. Terminal checks for switchboards etc.

34 ADDITIONAL DOCUMENTATION - FIRE PROTECTION SYSTEMS

34.1 General

Details to include, but are not limited to, the following information:

- a. Fully dimensioned details of all penetrations of structural members.
- b. Full details of any plinths, foundations and fixings required.
- c. Reflected ceiling plans showing all ceiling mounted services.
- d. Schematics of the alarm system control panel. These drawings shall include at least the following details:
 - i. All connections to each item of equipment.
 - ii. Type of connection e.g. input, output, analogue, digital etc.
 - iii. Terminal and component references for each item of plant.
 - iv. Component references used in any software associated with the operation of the automatic control system.
- e. Certified copies of drawings submitted to authorities having jurisdiction over the works.
- f. Scale shall be not less than 1:100 for building plan layouts and 1:50 for valve room equipment layouts.

35 ADDITIONAL DOCUMENTATION – DATA AND COMMUNICATIONS SYSTEMS

35.1 General

- a. Ensure that for every cable, the following are recorded:-
 - i. cable identity
 - ii. final destination including circuit designation and pair numbers
 - iii. any comment about the circuit
 - iv. length and type of each cable
 - v. route of each cable
 - vi. jumpering at completion of the project

- b. Telephony systems.

35.2 As –built Drawings

These drawings shall include the following information:

- i. Site and building or floor location plans showing the location and size of pathways and the cables installed, cable routes, pit locations and enclosure and distributor locations.
- ii. Schematic diagrams detailing the quantity and types of cables linking distributors.
- iii. Equipment room layouts
- iv. Physical enclosure layouts
- v. Schematics of patch panel layout and port numbering
- vi. Physical layout drawings detailing outlet positions and identification numbers. (Telecommunication outlets).
- vii. Description of the patching system and the labelling system used
- viii. Equipment lists detailing the installed equipment (type, make, model) including racks, enclosures, patch panels and outlets.
- ix. Test reports detailing the procedures, equipment configuration and test results (in the test equipment native format) for both balanced copper and optical fibre cable.

35.3 Commissioning

The minimum level of testing required is to AS/NZS 3080 Annex B - Acceptance testing.

- a. The Contractor shall provide all test equipment required for the testing, and must demonstrate its effective operation to the Engineer. The test equipment is to be removed from site at the end of the test and does not form part of the material to be supplied under the contract.
- b. The test report shall be provided in the native file format of the test equipment and shall include as a minimum the following details and tests for each link:-
 - i. cable and outlet/port identification
 - ii. test equipment and test configuration details
 - iii. wire map testing
 - iv. cable length and type
 - v. cabling performance parameters as specified in AS/NZS 3080
 - vi. date and time of testing
 - vii. name and signature of the testing engineer
- c. The testing of the wiring shall include, but not be limited to the following:-
 - i. visual inspection of all work for completeness, correctness, and compliance with the drawings and specification
 - ii. test conductor polarity, and unique identification of all pairs in all cables
 - iii. test insulation in all cable pairs, and coaxial cables using an insulation tester

The testing shall demonstrate that outlets are correctly wired and labelled and the labelling is verified.



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