

7703 MECHANICAL ELECTRICAL

1. GENERAL

If you have pre-customised this work section using the "questions and answers" provided as part of the downloading process, it may be necessary to amend some clauses to suit the final project-specific version.

The section must still be checked and customised to suit the project being specified, by removing any other irrelevant details and adding project-specific details and selections.

This section relates to the detail design, supply, fixing and testing of electrical work and accessories, associated with simple, air conditioning, packaged plant and mechanical systems

Modify or extend the above description to suit the project being specified. For large or complex systems the more comprehensive separate section 7707 ELECTRICAL - COMMON REQUIREMENTS and its associated sections may have to be used.

This section is intended to be combined, as appropriate, with the Common Requirements section and related work sections listed in 7600 MECHANICAL COMMON REQUIREMENTS, and they collectively comprise mechanical work:

Refer to 7600 MECHANICAL COMMON REQUIREMENTS for mechanical general and common matters, and related sections

1.1 RELATED WORK

Refer to 7600 MECHANICAL - COMMON REQUIREMENTS for general and common matters related to Mechanical

Refer to 7614 MECHANICAL PUMPS for pumps related to mechanical

Refer to 7623 FANS for fans for mechanical systems

Refer to 7631 DUCTWORK for ductwork and ancillaries

Refer to 7634 AIR GRILLES for diffusers and louvres

Refer to 7641 MECHANICAL PIPING for piping, fittings and accessories used in air-conditioning

Refer to 7695 MECHANICAL COMMISSIONING for balancing, commissioning and testing of air-conditioning and related controls

Refer to ~ for ~

Include cross references to other sections where these contain related work. Delete sections that do not apply and add further section that are required, such as:

Refer to 7611 CHILLERS for centrifugal, screw, scroll or absorption chillers

Refer to 7615 TANKS VESSELS AND HEAT EXCHANGERS

Refer to 7616 WATER HEATING BOILERS for water heating boilers, oil or gas fired

Refer to 7620 FAN COIL UNITS for air handling plant and room fan coil units for small projects

Refer to 7621 PACKAGED AIR-CONDITIONING for packaged air-conditioning plant

Refer to 7622 AIR HANDLING PLANT for air handling plant and room fan coil units for large projects

Refer to 7680 MECHANICAL CONTROLS for automatic controls for small mechanical systems

Refer to 7681 AUTOMATIC CONTROLS MECHANICAL for automatic controls for large mechanical systems

Refer to 7862 BUILDING MANAGEMENT SYSTEMS for networked building systems controllers

1.2 DOCUMENTS

Refer to the general section 1233 REFERENCED DOCUMENTS. The following documents are specifically referred to in this section:

AS 1359.101 Rotating electrical machines - General requirements - Rating and performance

AS 1359.106 Rotating electrical machines - General requirements - Methods of cooling (IC Code)

AS 1359.107 Rotating electrical machines - General requirements - Classification of types of construction and mounting arrangements (IM Code)

AS 1359.109 Rotating electrical machines - General requirements - Noise limits

AS 1359.114 Rotating electrical machines - General requirements - Vibration measurements and limits

AS1939 Degrees of protection provided by enclosures for electrical equipment (IP Code)

[AS/NZS 2053.1](#) Conduits and fittings for electrical installations - General requirements

AS/NZS 2053.2	Conduits and fittings for electrical installations - Rigid plain conduits and fittings of insulating material
AS/NZS 2053.4	Conduits and fittings for electrical installations - Flexible plain conduits and fittings of insulating material
AS/NZS 2053.7	Conduits and fittings for electrical installations - Rigid metal conduits and fittings
AS/NZS 2053.8	Conduits and fittings for electrical installations - Flexible conduits and fittings of metal or composite material
AS/NZS 3000	Electrical installations
AS/NZS 3008.1.2	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand installation conditions
AS/NZS 3013	Electrical installations - Classification of the fire and mechanical performance of wiring system elements
AS/NZS 3100:2009	Approval and test specification - General requirements for electrical equipment
AS/NZS 3111	Approval and test specification - Miniature overcurrent circuit-breakers
AS/NZS 3439.3	Low-voltage switchgear and controlgear assemblies - Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use - Distribution boards
NZS 3947.3	Low-voltage switchgear and controlgear - Switches, disconnectors, switch-disconnectors and fuse-combination units
AS/NZS 4251.1	Electromagnetic compatibility (EMC) - Generic emission standard - Residential, commercial and light industry
AS/NZS 4296	Cable trunking systems
AS/NZS 4680	Hot-dipped galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4961	Electric cables - Polymeric insulated - For distribution and service applications
AS/NZS 5000.1	Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 (1.2) kV
AS 60269.1	Low-voltage fuses - General requirements
AS 60269.2.0	Low-voltage fuses - - Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)
AS 60269.2.1	Low-voltage fuses - - Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Sections I to VI: Examples of types of standardized fuses
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS/NZS 60898.1	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Circuit-breakers for a.c.operation
AS/NZS IEC 60947.1	Low-voltage switchgear and controlgear - General rules
AS/NZS IEC 60947.2	Low-voltage switchgear and controlgear - Circuit-breakers
AS/NZS IEC 60947.4.1	Low-voltage switchgear and controlgear - Contactors and motor-starters - Electromechanical contactors and motor-starters
AS/NZS IEC 60947.5.1	Low-voltage switchgear and controlgear - Control circuit devices and switching elements - Electromechanical control circuit devices
SAA HB 301	Electrical installations - Designing to the Wiring rules
IEC 60034-8	Rotating electrical machines - Terminal markings and direction of rotation
IEC 60034-12	Rotating electrical machines - Starting performance of single-speed three-phase cage induction motors for voltages up to and including 666V

Electricity (Safety) Regulations 2010 (Reprint as at 4 April 2016)

Delete from the DOCUMENTS clause any document not cited. List any additional cited documents. Note; AS/NZS 3100:2009 will be superseded by AS/NZS 3100:2017 from 13 January 2019.

The following are related documents and if referred to in the work section need to be added to the list of DOCUMENTS.

AS/NZS 1359.5 Rotating electrical machines - General requirements - Three-phase cage induction motors - High efficiency and minimum energy performance standards requirements

- AS 1359.30 *Rotating electrical machines - General requirements - Preferred outputs and frame sizes*
- AS 60269.4.0 *Low-voltage fuses - - Supplementary requirements for fuse-links for the protection of semiconductor devices*

1.3 MANUFACTURER'S DOCUMENTS

Manufacturer's and supplier's documents relating to work in this section are:

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Copies of the above literature are available from ~

Web: ~

Email: ~

Telephone: ~

Facsimile: ~

It is important to ensure that all personnel on site have access to accurate, up to date technical information on the many products, materials and equipment used on a project. In most cases individual products are not used in isolation, but form part of a building process. Also a particular manufacturer's and/or supplier's requirements for handling, storage, preparation, installation, finishing and protection of their product can vary from what might be considered the norm. Access to technical information can help overcome this potential problem.

Warranties

1.4 WARRANTY

Warrant the mechanical electrical installation under normal environmental and use conditions against failure of materials and execution.

1 year: Warranty period

Refer to the general section for the required form of 1237WA WARRANTY AGREEMENT and details of when completed warranty must be submitted.

Check general section 1237 WARRANTIES for the date of commencement of warranties; which is normally practical completion of the contract. Refer to the chosen conditions of contract as it may also contain information on warranties and guarantees.

Requirements

1.5 COMPLY

Comply with the Electricity (Safety) Regulations 2010, [AS/NZS 3000](#), [AS/NZS 3008.1.2](#) and [AS/NZS 4251.1](#) for listed and prescribed work and with the utility network operator's requirements. Arrange for the required inspections of listed work. Pay all fees.

Modify this clause to suit project.

1.6 QUALIFICATIONS

Carry out work under the supervision of an electrical licensed supervisor.

It is the electrical licensed supervisor's responsibility to ensure that adequate supervision is provided

1.7 SAFETY OF INSTALLATION - DESIGN BY ELECTRICAL ENGINEER

Before installation work commences obtain from the electrical engineer a Certified Design. The Certified Design is to comply with the Electrical (Safety) Regulations (2010), regulation 58.

NOTE: Delete this clause if it is not required or if design by electrician.

Certified Design is not required for:

- *Low risk work to Electrical (Safety) Regulations, reg 6A (1), some maintenance, replacement and low risk work on existing installations*
- *Domestic installations, low or extra low voltage, to Electrical (Safety) Regulations, reg 59*

Certified Design is mandatory for:

- *Low or extra low voltage that can only be constructed to Part 1 AS/NZS 3000*
- *High Voltage*

The document will not become part of the Certificate of Compliance, but is to be attached to it when the installation is completed. The Declaration is to remain on site while the work is being carried out.

- 1.8 SAFETY OF INSTALLATION - DESIGN BY ELECTRICIAN
Before installation work commences provide a Certified Design. The Certified Design is to comply with the Electrical (Safety) Regulations (2010), regulations 58. It must be signed by the designer of the installation.
NOTE: Delete this clause if it is not required or if design by electrical engineer. (Check with Engineer.)
- Certified Design is not required for:*
- Low risk work to Electrical (Safety) Regulations, reg 6A (1), some maintenance, replacement and low risk work on existing installations
 - Domestic installations, low or extra low voltage, to Electrical (Safety) Regulations, reg 59
- Certified Design is mandatory for:*
- Low or extra low voltage that can only be constructed to Part 1 AS/NZS 3000
 - High Voltage
- The document will not become part of the Certificate of Compliance, but is to be attached to it when the installation is completed. The Declaration is to remain on site while the work is being carried out.*
- 1.9 ELECTRICAL CERTIFICATE OF COMPLIANCE
Supply a certificate of compliance (CoC) to the owner, and if required the NUO, as required by the Electricity (Safety) Regulations (2010), prior to connection.
- Arrange for the NUO to inspect before the meter installation, listed work inspection, polarity check and supply becoming live.
 - Arrange for an inspector to inspect as required by regulation 70.
- 1.10 ELECTRICAL SAFETY CERTIFICATE
Provide an Electrical Safety Certificate (ESC), as required by the Electrical (Safety) Regulations 2010, to the owner and when required the BCA. To be provided no later than 20 working days after connection and prior to Practical Completion.
Note: required for CCC.
- 1.11 PRODUCER STATEMENTS
Provide a 'producer statement - design' and 'producer statement - construction' to the satisfaction of the Building Consent Authority, for the complete mechanical electrical installation.
Delete 'producer statement - design' if not applicable.
- 1.12 COMPLIANCE SCHEDULES
Provide compliance schedules for the installation to the satisfaction of the territorial authority, in accordance with the [New Zealand Building Code](#) requirements for the mechanical electrical installation.
Where either of the two preceding clauses is used, cross reference to the general section 1234 DOCUMENTATION, to ensure that this requirement does not clash with any general requirements on the project.
- 2. PRODUCTS**
- 2.1 CABLES
Generally to the recommendations of SAA HB 301.
Electrical equipment to [AS/NZS 3100](#).
Fire and mechanical performance classification to [AS/NZS 3013](#).
Selection of cables to [AS/NZS 3008.1.2](#).
Distribution cables to AS/NZS 4961.
Testing to AS/NZS 3017.
- 2.2 WIRING SYSTEMS
Provide wiring systems appropriate to the installation conditions and the function of the load.
*Determine the wiring systems appropriate to the project, and list in the schedules.
If protection against fire or mechanical damage is required state classifications (e.g. WSX5, WS43) and locations.*
- 2.3 POWER CABLES
Standard:

- PVC and XLPE cables: To AS/NZS 5000.1.
- Use multi-stranded copper cable generally.
- Minimum size:
- Power sub-circuits: 2.5mm².
- Sub-mains: 6mm².

2.4 CABLE SUPPORTS AND DUCTS

Cable trunking systems to AS/NZS 4296.

Conduits and fittings for electrical installations to [AS/NZS 2053.1](#) and the appropriate other parts of the Standard.

AS/NZS 4296 clause 6 identifies various options for trunking which should be selected by the specifier. These include the following in the Wiring enclosures and cable support systems schedule:

- *Material e.g. metal, insulating, composite.*
- *Construction e.g. solid, open slotted, closed slotted.*
- *Mechanical properties e.g. light mechanical stresses.*
- *Electrical characteristics e.g. continuity and insulation.*
- *Protection against external influences e.g. water, foreign objects, pollution, solar radiation.*
- *Acid-gas emission e.g. halogen-free, or not halogen-free.*
- *Method of cover retention e.g. tools necessary*

2.5 STEEL CONDUIT

To [AS/NZS 2053.7](#), hot-dip galvanized to [AS/NZS 4680](#), for damp or exterior situations and complete with fittings and accessories brand matched as required by the conduit manufacturer.

2.6 HEAVY DUTY RIGID PVC CONDUIT

To [AS/NZS 2053.2](#) for underground wiring, jointed together and to fittings with solvent cement to the conduit manufacturers requirements. Fittings and accessories brand matched as recommended by the conduit manufacturer.

2.7 RIGID PVC CONDUIT

To [AS/NZS 2053.2](#), high impact, cold setting light or medium duty complying with, jointed together, to fittings with solvent cement to the conduit manufacturer's requirements. Fittings and accessories brand matched, as recommended by the conduit manufacturer.

2.8 FLEXIBLE CONDUIT

To [AS/NZS 2053.1](#) and [AS/NZS 2053.4](#) for PVC, also [AS/NZS 2053.8](#) for rust proofed steel sheathed with PVC. Securely terminated in purpose made fittings when connected to equipment enclosures and maintaining the degree of protection of the enclosure. Minimum degree of protection IP54 to AS1939.

Modify the clause to suit the project. Steel types are normally used in hostile environments.

2.9 DUCTED WIRING ENCLOSURES

Provide purpose-made ducts. Provide rigid supports. Round off sharp edges and provide bushed or proprietary cable entries into metallic ducting.

Provide purpose-made accessories and covers to match the duct system. Provide screw-fixed covers or clip-on covers removable only with the use of tools.

Except for horizontal runs where the covers are on top, support wiring with retaining clips at intervals of not more than 1000mm.

Switchboards

2.10 SWITCHBOARDS

To [AS/NZS 3439.3](#).

Incorporate proprietary busbar systems for the interconnection of isolators, circuit breakers and other circuit protection devices.

Provide lockable doors with a circuit card holder unless enclosed in cupboards or in an area which is not readily accessible to the public.

IP rating IP51 minimum.

Weatherproof IP56 minimum.

Wall mounted for proprietary switchboards or floor mounted if assemblies > 2 m².

Ventilation to maintain design operating temperatures at full load.

- 2.11 SWITCHBOARD COMPONENTS
 Rated duty, uninterrupted in non-ventilated enclosure.
 Rated making capacity (peak), $\geq 2.1 \times$ fault level (RMS) at assembly incoming terminals.
 Utilisation category to AS/NZS IEC 60947.1 clause 4.4.
 Circuits consisting of motors or other highly inductive loads at least AC-23.
 Select and adjust protective devices to discriminate under over-current and earth faults.
- 2.12 SWITCH-ISOLATOR UNITS
 To AS/NZS IEC 60947.1 and AS/NZS 3947.3.
- 2.13 MOULDED CASE AND MINIATURE CIRCUIT BREAKERS
 Moulded case breakers to AS/NZS IEC 60947.1 and AS/NZS IEC 60947.2.
 Miniature circuit breakers to AS/NZS 60898.1 or AS/NZS 3111, minimum 6 kA rated.
 Independent manual operation including positive ON/OFF indicator.
 Trip type, moulded case breakers.
 Miniature circuit breakers, fixed thermal, fixed magnetic.
 Isolation facility required.
 Current limiting, moulded case breakers.
 Selectivity category, moulded case breakers:
 - Final subcircuits category: Category A.
 - Mains and submains: Category B.
 Trip settings as required, seal, and label.
 Connect interchangeable and integrally fused trip units so that trip units are not live when circuit breaker contacts are open.
Miniature overcurrent circuit breakers may be used where the short-circuit capacity < 10 kA (AS/NZS 3111), for current rating ≤ 125 A, where the breaker is not adjustable and may be operated by non qualified personnel. The interrupting capacity is classified as type B, C, or D. Delete Miniature overcurrent circuit breakers if not required. AS/NZS IEC 60947.2 Table 4 defines selectivity categories. Selectivity category A circuit breakers are not intended for selectivity under short circuit conditions with other short circuit protective devices on the load side. Selectivity category B circuit breakers are intended for selectivity under short circuit conditions with other short circuit protective devices on the load side.
- 2.14 FUSES WITH ENCLOSED FUSE LINKS
 To AS 60269.1, AS 60269.2.0 and AS 60269.2.1.
 Fuse links, enclosed, high rupturing capacity type mounted in a fuse carrier.
 Breaking range and utilisation category:
 - Distribution/general purpose: gG.
 - Motors: gM.
See AS 60269.1 clause 5.7.1. The first letter is the breaking range, the second is the utilisation category.
 Mount fuse-holders so that fuse carriers may be withdrawn directly towards the operator and away from live parts. Provide fixed insulation which shrouds live metal when the fuse carrier is withdrawn.
 Provide barriers on both sides of each fuse link, preventing inadvertent electrical contact between phases by the insertion of screwdriver.
State if extraction handles are required.
 Provide 3 spare fuse links for each rating of fuse link on each assembly. Mount spares on clips within the spares cabinet.
 Provide 3 spare fuse holder carriers for each size of fuse holder carriers on each assembly. Mount spares on clips within the spares cabinet.
 Busbar mounted fuse holders, fuse carriers with retaining clips, minimum fuse holder 32 A.
*Consult manufacturer if ambient temperature, altitude and humidity are outside the ranges in AS 60269.1 clauses 3.1, 3.2, 3.3. See AS 60269.1, Annex D, for the effect of change of ambient temperature or surrounding, on the performance of fuse links.
 Fuses with fuse-links for the protection of semiconductor devices: To AS 60269.4.0.*
- 2.15 CONTACTORS
 To AS/NZS IEC 60947.4.1.
 Enclosed, block type, air break, electro-magnetic.
 Poles: 3.

4 pole units are available for specific uses, e.g. generator changeover circuits etc.

Rated operational current: The greater of:

- Full load current of the load controlled.
- ≥ 16 A.

Provide auxiliary contacts with at least one normally-open and one normally-closed separate contacts with rating of 6 A at 230 V a.c., utilisation category: AC-1.

Consider the following:

- *Type and number e.g. 2 normally-open, 1 normally-closed, 1 make-before-break.*
- *A control voltage separate to that of the application is preferable, state the value*

2.16 CONTROL DEVICES AND SWITCHING ELEMENTS

To AS/NZS IEC 60947.1 and AS/NZS IEC 60947.5.1.

Rotary switches, cam operated type with switch positions arranged with displacement of 60° .

Consider the following:

- *Control switches. Specify the required operating function e.g. OFF - At 12 o'clock, START - Turn to and maintain at 3 o'clock, STOP - Push operator with auto return to 12 o'clock, and LOCK OFF*
- *Turn to and maintain at 9 o'clock with provision for locking.*
- *Selector switches. Specify the required operating function e.g. manual/off/auto or test/off/auto with spring action from TEST to OFF.*
- *Contacts for d.c. Specify applicable d.c. ratings.*
- *Special applications e.g. excessive mechanical (or electrical) endurance.*

Off position at the 12 o'clock position. Test positions must spring return to off position.

Control relays:

Standard control relays:

- Type: ~
- *If switching d.c., specify d.c. voltage and current to be switched.*
- Coil voltage: ~

Fire alarm relays:

- Type: ~
- ELV supply: ~
- *Specify details of the ELV supply connection and voltage, to the assembly.*
- Fire alarm mode: ~
- *Specify load to be switched by the fire alarm relay.*
- To AS/NZS IEC 60947.5.1.

2.17 INDICATOR LIGHTS

To AS/NZS IEC 60947.5.1.

Consider the following:

- *Voltage*
- *Indicator type. Specify size and connection e.g. direct or transformer type.*
- *Lens material e.g. glass, plastic.*
- *Lens colours.*
- *Back-lit indicators. Specify shape, size and designation to be back-lit.*
- *Lamp test facility. Specify indicators to be connected to a lamp test facility.*
- *Spares: State the number of spare indicators and lamps required*

Motors

2.18 MOTORS

Provide motors selected in conformance with AS 1359.101, the application load characteristics, motor manufacturers' recommendations and the following:

- Motors ≥ 0.75 kW: Three phase.

This is an arbitrary limit but generally aligns with AS 1359.30 which lists 0.75 kW as the smallest preferred size for 4 pole (1500 r/min) cage rotor induction motors.

2.19 MOTOR RATING

To AS 1359.101.

Maximum power rating, the greater of the documented minimum motor size and next preferred standard frame size above the maximum load of the driven equipment.

Duty: \geq S1.

Class: \geq 'continuous running'.

Speed: ≤ 1500 r/min.

Specify a minimum kW rating in the respective section.

Certain motors, e.g. chillers and close coupled pumps, may run at other speeds. If this is required the speed requirement should be modified/over-ridden in the relevant application section.

- 2.20 **STARTING PERFORMANCE**
Designation: \geq Design N to IEC 60034-12.
Speed and torque to suit the driven equipment. Ensure each motor develops torque relative to the starting load of the driven machine such that it runs up to full speed steadily and within a time period compatible with motor winding temperatures, class of insulation and rating of the starting equipment.
Design N is normal torque. Other ratings e.g. Design H (high torque) are available.
- 2.21 **MOTOR EFFICIENCY**
Motors documented as high efficiency to AS/NZS 1359.5 Table A3 or Table B3.
All other motors to AS/NZS 1359.5 Section 2.
*AS/NZS 1359.5 sets out two minimum levels of motor efficiency (at 100% and 75% of rated load) designated as 'All motors' in Section 2 and 'High efficiency' in Section 3.
Motors should be specified as high efficiency in the relevant section Selections, or alternatively, the following sentence should be included as a default and the 'All other motors' clause deleted.
If high efficiency motors are not identified the 'All other motors' clause will apply.
All three-phase electric motors between 0.73 kW and 185 kW must meet Minimum Energy Performance Standards (MEPS) to AS/NZS 1359.5. AS/NZS 1359.5 does not cover motors (185 kW or certain classes of motors, notably multi-speed motors and those in hermetic or semi-hermetic compressors and submersible pumps.
For VSDs the efficiency of the motor at the expected operating speeds should be analysed to assess compliance with the standard under all conditions.
Power factor
Generally the specification of high efficiency motors implies a certain motor construction standard and this consequentially implies reasonable power factors.*
- 2.22 **MOTOR ENVIRONMENT**
Site operating conditions to AS 1359.101 Section 5.
Electrical operating conditions to AS 1359.101 Section 6.
- 2.23 **MOTOR ENCLOSURE**
Provide enclosures appropriate to the environment in which the motor operates.
Motor enclosure classification \geq IP44 to AS 60529.
Some sections include motor enclosure requirements e.g. the 7623 FANS section specifies IP54 motors for centrifugal fans. Include IP rating in the section for specific items of equipment.
- 2.24 **MOTOR COOLING**
To AS 1359.106.
Classification \geq IC01.
*IC01 is equivalent to totally enclosed fan cooled (TEFC).
Specify in the appropriate section if another cooling method is required.*
- 2.25 **MOTOR MARKING**
Terminals to IEC 60034-8.
- 2.26 **MOTOR MOUNTING**
IM classification to AS 1359.107.
- 2.27 **MOTOR NOISE**
To AS 1359.109.
- 2.28 **MOTOR VIBRATION**
To AS 1359.114.
Grade \geq N (normal).
- Starters**
- 2.29 **STARTERS**
To AS/NZS IEC 60947.1.
Electromechanical motor starters to AS/NZS IEC 60947.4.1.
- 2.30 **STARTERS SELECTION**
Provide motor starters selected according to the following:
- Electricity distribution network limitations for starting currents and voltage flicker.

- Torque requirements for the motor load.
- Heating effects on the motor.
- Voltage drop during start due to starting currents.
- Time required to accelerate from rest to full speed.
- Number of starts per hour.

2.31 STARTERS PERFORMANCE

See AS/NZS IEC 60947.4.1 Annex D for items subject to agreement between manufacturer and user.

Rated operational current, at least the full load current of the load controlled.

Rated duty, Intermittent class 12.

Utilisation category, AC-3.

Mechanical durability \geq 3 million cycles to AS/NZS IEC 60947.4.1.

Electric durability \geq 1 million operations at AC-3 to AS/NZS IEC 60947.4.1.

Mount with sufficient clearance to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment.

Provide separate auxiliary contacts with at least one normally-open and one normally-closed contacts with rating of 6 A at 230 V a.c., utilisation category: AC-1.

If the number of auxiliary contacts exceeds the number which can be accommodated, provide separate slave relays.

Consider the following:

- *Type and number e.g. 2 normally-open, 1 normally-closed, 1 make-before-break.*
- *A control voltage separate to that of the application is preferable, state the value.*

2.32 DIRECT-ON-LINE STARTERS

Direct-switching electromagnetic contactor type.

Motor protection

Consider the following:

Overload protection

- *Thermal e.g. integral with contact, or special motor protective relay.*
- *Thermistor e.g. positive or negative temperature coefficient (PTC or NTC) and reference temperatures*
- *Thermostat e.g. direct connection (for operation of a control relay).*
- *Electromagnetic. Specify the range of current settings and time delay.*

Reset. If automatic reset is required on a drive, specify AUTO.

- *Other protection: Specify other types of protection for particular drives e.g. stall protection, excessive starting time.*

- *Number of poles: For single phase circuits, in the case of thermal overload devices, and for electromagnetic overload devices, specify the number of poles required.*

- *Features subject to approval. If any particular features of motor protection are subject to approval, specify those items.*

Where the contractor is required to submit recommendations, list requirements.

2.33 MOTOR PROTECTION

Provide over-current protection with manual reset giving overload protection in each phase of supply as part of the equipment assembly for each motor starter.

Provide at least one normally-open and one normally-closed set of contacts rated at the starter control circuit voltage and minimum 4 A. Connect contacts to open the starter at the setting temperature.

Utilisation category AC-11.

Ensure relays are not affected by the shock of mechanical contactor operation. Provide sufficient clear space for the disconnection, removal and replacement of heaters, without disconnecting other equipment and wiring.

State what other motor protection is required, if any.

2.34 SINGLE PHASE MOTOR PROTECTION

Provide overload units matching the motor heating curve characteristics.

2.35 PHASE MOTOR PROTECTION

General: Provide thermal overload protection relays for each motor.

Provide the following:

- Triple pole relays with differential trip bar operation for single phase protection, and ambient temperature compensation.

- Thermal overloads connected directly to contactor by means of proprietary links, except where operated separately by current transformers.

Current transformers, to operate protection type thermal overloads, saturating at 10 to 15 times full load current, Class 10P.

This section does not include the facility for thermistor protection of motors. Should the project include motors of sufficient size as to warrant thermistor protection then the appropriate clauses should be included.

3. EXECUTION

Installation

3.1 POWER CABLES

Generally to AS/NZS 3000. Nominate other standards if required.

Unless unavoidable due to length or difficult installation conditions, run cables without intermediate straight-through joints.

Individual wiring of extra-low voltage circuits: Tie together at regular intervals.

Identify multicore cables and trefoil groups at each end with stamped non-ferrous tags clipped around each cable or trefoil group.

Identify the origin of all wiring by means of legible indelible marking.

If particular labelling methods (including fixing, lettering or colours) are required, provide details here.

Cable systems in:

- Accessible concealed spaces: Thermoplastic insulated and sheathed cables.
- Inaccessible concealed spaces: Cable in PVC-U conduit.
- Plant rooms: Cable in heavy duty PVC-U conduit, or on tray or in duct.
- Plastered or rendered surfaces: Cable in PVC-U conduit.
- Stud walls without bulk insulation: Thermoplastic insulated and sheathed cables.
- Walls filled with bulk thermal insulation: Cables in PVC conduit.

The requirement for cables to be installed in conduit in insulated walls is one of wiring and re-wiring convenience, not one required by AS/NZS 3000. Delete if not required.

3.2 UNSHEATHED CABLES

Provide permanently fixed enclosure systems, assembled before installing wiring.

Provide draw wires to pull in conductor groups from outlet to outlet, or provide ducts with removable covers.

3.3 CONDUIT SYSTEMS

If exposed to view, install conduits in parallel runs with right angle changes of direction.

For conduits in roof spaces locate below roof insulation and sarking. In accessible roof spaces, provide mechanical protection for light-duty conduits.

Allow for thermal expansion/contraction of conduits and fittings due to changes in ambient temperature conditions. Provide expansion couplings as required.

Solar radiation protection required for exposed conduits and fittings.

Provide flexible conduit to connect with equipment and plant subjected to vibration. If necessary, provide for adjustment or ease of maintenance. Provide the minimum possible length.

State if conduits are to be painted.

'Exposed to view' is intended to include plant rooms and exclude false ceiling spaces, for example.

3.4 SWITCHBOARD MARKING AND LABELLING

Provide labels including control and circuit equipment ratings, functional units, notices for operational and maintenance personnel, incoming and outgoing circuit rating, sizes and origin of supply and kW ratings of motor starters.

Refer to 7600 MECHANICAL - COMMON REQUIREMENTS section requirements if used for marking and labelling.

Amend to suit manufacturer's standard approved labelling systems unless specifically excluded by the project requirements.

4. SELECTIONS

4.1 SAMPLES

Provide samples of the following for review:

~

Samples may include switchboards, cable supports, brackets and fixings

4.2

SUB-MAINS

Sub-main number	Size	Type	Remarks
~			

4.3

SWITCHBOARDS

Number	Enclosure	Includes	Cable entry	Fault level	Location
~					

4.4

EXPOSED CONDUIT, PAINT COLOURS

Service	Colour	Location
~		

4.5

MOTOR SCHEDULE

Properties	Motor M1	Motor M2	Motor M3
Function			
Minimum motor (kW)			
Maximum motor (kW)			
Motor enclosure			
High efficiency motor required			

Use this schedule if not included in 7623 FANS section and where motors are not supplied as part of the equipment.

SAMPLE