

**AGENCE SPATIALE CANADIENNE
CANADIAN SPACE AGENCY**



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RCM PROJECT - ADDITIONAL SERVICES

**ELECTRICAL SPECIFICATIONS
FOR TENDER**

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Division 26 – Electrical

Section 260500	Common work results for electrical	13 pages
Section 260500.01	Specific requirements concerning the results of the work	4 pages
Section 260500.02	Restrictions concerning the works	2 pages
Section 260520	Connectors for cables and boxes 0-1000V	1 page
Section 260528	Grounding – Secondary	2 pages
Section 260529	Hangers and supports for electrical systems	2 pages
Section 260531	Splitters, junction, pull boxes and cabinets	2 pages
Section 260534	Conduits, conduit fastenings and conduit fittings	3 pages

Division 27 – Telecommunications

Section 271015	Structural cable for telecommunications network	5 pages
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Division 26

Electrical Specifications

PART 1 - GENERAL

- .1 The present section includes the common requirements to the various sections of the Division 26 and is added to the general requirements listed in the Division 1.
- .2 The present section includes the general and administrative requirements and must be read with the section 26 05 00 – Common work results for electrical.
- .3 All the systems must be complete, perfectly operational and must include all the equipment and required accessories to obtain, at the end of the works, entire functional systems and in accordance to the present specifications and to the current codes and standards.

1.2 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise stated, the terminology used in the present section and on the drawings is stated on the one defined in the IEEE SP1122 norm.
- .2 When used, the word “Owner” means Canadian Space Agency.

1.3 CODES AND STANDARDS

- .1 Applicable according to the section 26 05 00 – Common work results for electrical.

1.4 REFERENCES

- .1 Applicable according to the section 26 05 00 – Common work results for electrical.
- .2 All the documents provided by the others disciplines to the present contract must be read with the present article.

1.5 APPARATUS AND EQUIPMENT SPECIFICATIONS

- .1 In the specific case of this project, the equipment specifications in the documents are specific to the Canadian Space Agency to allow an appropriate upkeep for all systems. The contractor must single out the specified equipment and take account of the preferences formulated in the documents.

PART 2 - SCOPE OF WORK

- .1 The contractor must provide, install, carry, connect, do the test and put the equipment into service, materials and accessories following, without being limited:
 - .1 All the duct and cable network shown on plans and specifications includes, without being limited:
 - All the supports and all the structural steel elements required to support the ducts, cables, apparatus and equipment.
 - The ducts.
 - All the cable, including the tests.
 - Expect time and necessary costs based on the availability of the Canadian Space Agency offices.
 - .2 The electrical grounding to the bar in the telecommunications rooms and the duct grounding according to the standards.
 - .3 The furniture and the installation of all identification labels to identify all the components of the systems provided by the contractor and as shown on plans and specifications.
 - .4 All the specified tests.
 - .5 All the work to complete the installation.
 - .6 All the equipment, materials and accessories shown or not on the plans or specifications necessary to complete the installation according to the rules or art and according to the applicable codes and standards.
 - .7 During a refitting of an existing area, standardize the equipment with the rest of this area.

- .8 For the access control system of local 2B-202, the electrical contractor shall contract "HONEYWELL BUILDING SOLUTIONS" for the supply and installation of the necessary equipment and wiring, and for the connections and function (M. Francois Guimond Hébert 819-574-4383 estimation.montreal@honeywell.com). Plan the installation of the conduit as indicated on the plan for submission (to be coordinated with HONEYWELL). Necessary installation in the door as required by HONEYWELL.
- .9 The coordination:
 - The exact and final localisation of the ducts (endings in the offices) and of the cables has to be done in site based on the office's fitting final plans. The fitting plans will be available at the end.
 - To refer to specifications, plans and sketches for the localisation of the systems.
 - The electrical contractor should closely collaborate with the others disciplines to determine the exact features of the systems and provide the equipment's, installations and appropriate connections to make them operational, according to the current laws and regulations.
- .10 The coordination with the Owners.

PART 3 - WORK IN EXISTING BUILDING

3.1 GENERAL

- .1 The specialized electrical contractors and their sub-contractors.
- .2 Must take in consideration that the building is occupied during all the works period.
- .3 Must respect and subject to the internal rules and procedures of the establishment.
- .4 Must realise their work has too not disturb the normal functioning of the establishment, and this, during all the work execution period.
- .5 Must take all the necessary measures in order that the normal enjoyment of the building by the users is not disturbed at all during his work. These measures can concern the noise, the dust, the circulation and any other disturbance made during the work. Any additional expense to reach this objective will be at the charge of the contractor.
- .6 Must notice the Owner before the beginning of any work in a fixed area of the building, in order to allow the Owner to notice and make aware the responsible persons of this area of the work that will be realise in their immediate environment.
- .7 The contractor will be always responsible of the damages or loss could by caused to the furniture or to the occupant's personal effects, and this, for all the duration of works. However, this responsibility is limited to the immediate work site and the area around the construction site.

3.2 COORDINATION WITH THE OWNER

- .1 The contractor must take all the necessary precautions to not harm the normal operations of the building. If work, or test must be executed in occupied offices, the general contractor and the specialized contractors must obtain the Owner's authorisation and coordinate the work in consequence.
- .2 The Owner's representative can claim that the general contractor and the specialized contractors make their works outside agreed working hours, during week ends or a public holiday. The general contractor and the specialized contractors can not claim extra fees to conform to the Owner's instructions.
- .3 The contractor must notice at least 48 hours in advance the Owner for any work could beget a disturbance of the daily activities and special events or organized by the Owner.
- .4 The Owner will forward the confirmation when the request will be coordinate with the different representative (internal or external) and will get back to the contractor in a delay of five business days.
- .5 Ensure the continuity of electrical services to keep in function the existing areas not fitted out (or fitted out) during works. The interruptions of power supply must be reduced to a minimum and must be executed outside the Owner's occupation hours. They must be coordinate based on the Owner's calendar.

3.3 COORDINATION FOR INTERRUPTION OF SERVICES

- .1 No interruption of electromechanical services of the building will be done without the prior written authorization from the Owner's representative.
- .2 The written request must mention the services, sectors affected and the duration of the interruption. The application must include the name and number of a resource person always available and with the necessary qualifications, as well as the equipment to put the service (s) back into service or able to troubleshoot it at any time.
- .3 For major interruptions of service, the request must be made five (5) working days in advance. The general contractor and the specialized contractors will have to obtain a written approval from the Owner, before interrupting a given service.
- .4 In the event of non-identified additional constrain of work being discovered during the work, immediately notify the Engineer and provide a written report on the findings.
- .5 When required, general contractor and specialized contractors to ensure continuity of all existing electromechanical services. The supply, installation and connection of all the required equipment in this regard forms an integral part of their respective contract

3.4 DEMOLITION

- .1 Plan and execute demolition work to minimize inconvenience to building users. Take care to contain and reduce dust to a minimum.
- .2 Remove every day demolition material from the property and all demolition equipment.
- .3 Ensure that there is no dust in the building created by the evacuation of construction waste.
- .4 The Contractor shall evaluate the demolition work during the site visit. No plans of the existing building will be issued.

3.5 REMOVED EQUIPMENTS

- .1 Where required, specialized contractors involved shall remove all non-required conduits, pipes and accessories and plug where indicated on the drawings. These ducts will be removed to the main ducts.
- .2 Materials removed and not reused must be transported daily from the site
- .3 The equipment and accessories removed and not reused must be offered to the owner, who must decide if he wishes to keep them. The contractor must provide the owner with a list of these equipments. If the owner does not want to keep them, they stay the property of the Agency and the contractor must remove them from the site and dispose of it at will, at no additional cost. A written authorization from the owner is required.

3.6 EXISTING EQUIPMENTS TO RELOCATE

- .1 Specialized Contractors will relocate all equipment identified as such to drawings and specifications and provide, install necessary accessories and connections as required.
- .2 Each of the specialized contractors involved will be fully responsible for the removal and temporary storage of existing equipment to be relocated, so that they are not damaged or stolen. Should any part of this equipment be damaged or disappear during the work, the costs of replacing this equipment with identical equipment must be borne by the specialized contractor responsible for the relocation of this equipment.
- .3 Moreover, it is the responsibility of each of the specialized contractors concerned to advise the engineer of any existing equipment to be relocated that would be broken or defective before dismantling.

- .4 The Engineer considers that all existing equipment to be relocated is clean and in good working order. Notices of defects and poor condition of equipment that would be transmitted to the engineer after the removal of such equipment will be refused and the engineer will consider that the failures are attributable to improper handling of the equipment by the specialized contractor. The replacement (and all cost) will therefore have to be provided by the specialized contractor responsible for the equipment.

3.7 TEMPORARY SERVICES

- .1 In all areas where work will be performed, adequate temporary lighting shall be provided and provided where required. Temporary lighting will be provided by the electrical contractor and must meet the minimum requirements of the CNESST.
- .2 The Contractor must validate with his General Contractor who will provide the temporary electrical energy and drinking water required for the execution of the work.
- .3 All other temporary services that may be required for the completion of the work of this contract, such as temporary heating and others, will be indistinctly and entirely at the expense of the general contractor and are deemed to be part of the overall lump sum contract.
- .4 The Contractor undertakes to provide visual protection of the work site throughout the duration of the work.

3.8 REPAIRS

- .1 Repair and restore, to the satisfaction of the owner, any damage caused by the drilling and work of all trades. Unless otherwise specified in the plans, finishes will be repaired such as existing finishes.

End of section

PART 1 - GENERAL

1.1 SPACE AND INSTALLATION USAGE

- .1 Perform work with minimal disturbance to normal use of premises. In this regard, make the necessary arrangements with the Canadian Space Agency Representative to facilitate the execution of the prescribed work.
- .2 Maintain existing utilities and provide site access to personnel and vehicles.
- .3 Where safety has been reduced due to the work, provide other temporary means to ensure the safety of property and persons on the premises.
- .4 The Canadian Space Agency Representative will provide sanitary facilities to the Contractor's personnel and the Contractor shall maintain them.
- .5 Protect structures by temporary means until permanent closures are installed.

1.2 MODIFICATIONS, REPAIRS OR ADDS TO THE EXISTANT BUILDING

- .1 Perform work with minimal disruption to building operation and normal use of premises. In this regard, make the necessary arrangements with the Canadian Space Agency Representative to facilitate the execution of the prescribed work.

1.3 SPECIALS REQUIREMENTS

- .1 The work must be carried out from Monday to Friday, between 6 pm and 7 am or on weekends.
- .2 Provide a schedule for all the duration of the work, including the staff of the Contractor and its subcontractors assigned to the project for each week.
- .3 Work may be stopped at any time in an area in whole or in part by the owner, the resumption (or the complete stop) of work shall be at the convenience of the owner, outside the hours of operation of this sector at the expense of Contractor
- .4 The Contractor **must** submit the daily schedule of work the week before the work.
- .5 The Contractor must submit a schedule with "Plan A" and "Plan B" for each work day. The Space Agency could at any time refuse access to a sector to the Contractor. Any loss of time, time and cost related to this item will be non-responsive.
- .6 Always obtain confirmation that access is authorized.
- .7 All employees of the Contractor will be accompanied by commissioners during the work for all their movements in the enclosure and the building of the Agency.
- .8 Ensure that Contractor personnel working on site are aware of and comply with regulations, including Agency regulations, fire safety, traffic and occupational safety.
- .9 Remain within the limits of work and access road.
- .10 The number of vehicles of the Contractor is restricted and must be authorized. Vehicle parking and storage is dictated by the Owner and must be always authorized and not restrict the proper functioning of the Agency.
- .11 Ensure materials / materials are delivered during off-peak hours between 5 pm and 7 am and between 1 pm and 3 pm unless otherwise directed by the Canadian Space Agency Representative.

1.4 SECURITY

- .1 Provide temporary means to maintain security if it has been reduced because of the work covered by this contract.

.2 Security authorizations

- .1 All personnel assigned to this work will be subject to security checks.
- .2 Obtain the required authorizations, as required, for all persons who must report to the work site.
- .3 Workers and staff will be checked daily, at the beginning of the work period, and given a daily pass for them at all times and at the end of the shift. , after the exit check.
- .4 The Contractor's personnel must meet a security check requested by the RCMP and PSEPC before being able to go to the site to do the work.

.3 Security escort

- .1 Personnel assigned to this work must be accompanied by commissioner officer when performing work in non-public areas during normal working hours. They must be accompanied always, everywhere, after normal working hours.
- .2 Submit an escort request to the Canadian Space Agency Representative at least 5 days in advance. In the case of timely requests, the cost of the escort will be paid by the Agency. In the case of late requests, the cost will be charged to the Contractor.
- .3 Any escort request may be canceled without charge if the notice is given at least four (4) hours before the scheduled time. If the cancellation notice is received too late, the cost of the escort will be charged to the Contractor.
- .4 The cost will be calculated based on the average hourly rate of a safety officer, for a period of at least eight (8) hours in the case of a late application, and at least four (4) hours in the case of a cancellation notice given too late.

1.5 NO SMOKE ENVIRONMENT

- .1 Observe the no smoking instructions. Smoking is prohibited in the Agency's compound as well as outside the doors. Refer to the directive of the security personnel.

End of section

PART 1 - GENERAL

1.1 GENERAL

- .1 The purpose of this section is to establish applicable guidelines, specifically for electrical work which are, unless otherwise indicated or modified explicitly on plans or specifications, made by the Electrical Subcontractor.
- .2 Whenever the expression “Electrical Subcontractor” is used in Division 26, it is understood that it means the person, the company, the corporate name or the corporation acting directly or through a duly authorized representative, responsible for work described in Division 26. The expression “Contractor” designates the General Contractor or the Project Manager.
- .3 The Contractor is responsible for implementation and coordination of all work mentioned and described in specifications and drawings. However, the Contractor must subcontract part of the work to qualified Subcontractors.
- .4 Responsibilities – Scope of work
 - .1 The work described on the following plans is an integral part of the Contractor responsibilities:

CSA file no.	Project title	DWG. No.
-	Additional support for project RCM	E-1 and E-4

1.2 ABBREVIATIONS

- .1 Words, sentences and abbreviations with well-known technical meaning will have the same meaning in this document, including:
 - .1 c/w: complete with, including
 - .2 c/c: centre to centre
 - .3 min.: minimum
 - .4 max.: maximum
 - .5 m: metre
 - .6 mm: millimetre
 - .7 ' or ft: feet
 - .8 " or in: inch
 - .9 m²: square metre
 - .10 mm²: square millimetre
 - .11 ft²: square foot
 - .12 in²: square inch
 - .13 Ø : diameter
 - .14 NPS: nominal pipe size
 - .15 °F: degree Fahrenheit
 - .16 °C: degree Celsius
 - .17 rpm: revolution per minute
 - .18 db: decibel
 - .19 e.g.: for example
 - .20 hr: hour
 - .21 amp. or A: ampere
 - .22 HZ (Hz): hertz
 - .23 V: volt
 - .24 kW: kilowatt
 - .25 HP: horse-power
 - .26 kVA: kilovolt-ampere
 - .27 f: connecting wire
 - .28 ph: Phase
 - .29 EMT: electrical metallic tubing, thin walled

- .30 PVC: polyvinyl chloride conduit
 - .31 C: conduit
 - .32 std: standard
 - .33 H.C.: off contract
 - .34 CSA/(ACNOR): Canadian Standard Association
 - .35 ULC: Underwriter's Laboratories of Canada
 - .36 CEC: Canadian Electrical Code
- .2 Duties and responsibilities of Electrical Subcontractor
- .1 Provide all materials, supervision, labour, handling, equipment, tools, machinery, scaffolding, hauling and transportation to build, execute and complete in a timely, substantial and satisfying manner all works required for the installation of all systems provided for in this section, as described on plans and specifications.
 - .2 Pay all permits required by authorities and respect applicable codes and regulations (latest edition in force).
 - .3 Present written proof that he and his Subcontractors have complied with work health and safety legislation requirements.
 - .4 Follow padlocking procedures of Canadian Space Agency.
- .3 Reference Plans
- .1 In preparing his bid, the Electrical Subcontractor must consult all architectural, structural, electrical, plumbing, heating, ventilation and fire protection plans and verify all elements that could affect his work.
- .4 Questions and interpretations
- .1 When there is appearance of contradiction between plans and specifications, regulations and/or codes, the Electrical Subcontractor must base his bid on the most restrictive requirements. The Space Agency Representative reserves the right to interpret his plans and specifications.
 - .2 If, upon reviewing contract documents (plans, specifications, etc.), the Electrical Subcontractor has questions about the meaning or the veracity of some points, he must immediately notify the Space Agency Representative who could, if required, send written instructions to all bidders.
 - .3 Plans and specifications are mutually explanatory and complementary. Any inaccuracy or contradiction that may be subject to interpretation must be notified to the Space Agency Representative, to obtain the only possible interpretation. Any work that does not comply with plans and/or specifications and performed without such interpretation, must, if required, be redone without compensation, at the request and to Space Agency Representative satisfaction.
 - .4 No measurement taken on scale on drawings shall be used for the interpretation of dimensions for construction.
- .5 Equivalences or substitution of materials
- .1 Specialized product – no equivalence
 - For certain products, it is desired that the specification be fully respected. Those products are identified in documents with the label “No equivalence”.
 - In such cases, no equivalence is accepted.
 - .2 Several manufacturers are identified or have the mention “Equivalent approved”
 - When more than one manufacturer is identified in documents for a given material or product, the Electrical Subcontractor remains free to choose at any time one of the manufacturers specified if the product meets specifications.
 - When, in documents, a specification is indicated for a manufacturer with the mention “or approved equivalent”, the Electrical Subcontractor remains free to choose at any time one of the manufacturers specified if the product meets specifications.
 - Any product found not equivalent by the Space Agency Representative will be rejected. His decision will be final.

.6 Codes and standards

.1 Works must comply with the following requirements (most recent applicable editions):

- Standards of the Canadian General Standards Board (CGSB).
- Standards of the Canadian Standards Association (CSA).
- Quebec Construction Code.
- Quebec Electrical Code.
- Hydro-Québec standards.

.2 Requirements specified on plans and specifications should never be lowered under the pretext that provincial and local regulations or standards and codes mentioned above are less strict. In all cases, the most stringent standards and codes shall prevail.

.3 In “food” areas, CFIA standards must be complied with (e.g.: paint, sealant, installation).

.7 Coordination

.1 To avoid any conflict, the Contractor and his Subcontractors must coordinate the installation of their respective equipment before performing work.

.2 In addition, special attention must be given to the installation of equipment. The Contractor shall require from his Subcontractors that:

- The definitive location of luminaries (including mounting heights) is coordinated with other installations (conduits, cable racks, ventilation, plumbing, fire protection).
- The Electrical Subcontractor must notify the Space Agency Representative about any major discrepancy regarding the installation of lighting fixtures.

.3 The Contractor is responsible for any problem that may result from lack of coordination and he will apply corrective actions as required, at his own expense.

.8 Correspondence and communications

.1 Subcontractors must submit shop drawings, substitution requests, etc., to the Contractor according to the procedure established for this project. All these documents must state project names and equipment submitted, reference numbers used by the Space Agency Representative on his plans, and reference to sections of Specifications for each piece of equipment.

.9 Site meetings

.1 The Contractor must attend site meetings to which he has been invited. Time and location of meetings will be defined by responsible authorities.

.10 Work schedule

.1 Once the master schedule for the project is defined, the Electrical Subcontractor must comply with it during the project and ensure that work does not disrupt activities and the general conduct of the project.

.2 If, for reasons beyond control, a Subcontractor cannot respect the established schedule, he must notify the Contractor so that appropriate corrective actions can be taken. Each Subcontractor must comply with these new guidelines.

.3 When changes, delays or other circumstances modify the work schedule, the Contractor shall make necessary changes to the schedule and transmit the revised version to the Space Agency Representative.

.11 Cost breakdown

.1 Before applying for the first progress payment, the Electrical Subcontractor will present a detailed breakdown of costs depending on his discipline, the requirements of the responsible authorities, and the total amount of the contract. Once approved by Space Agency Representative, this cost breakdown will serve as a basis for the calculation of progress payments.

.12 Inspection of plans and specifications

.1 The Electrical Subcontractor must submit to competent authorities the necessary number of drawings and descriptive specifications so that they can study and approve them prior to start of work.

- .2 The Electrical Subcontractor shall notify the Space Agency Representative about all received requests for changes by inspection services prior to those modifications. The Electrical Subcontractor must make changes as directed by the Space Agency Representative.
- .13 Shop drawings
 - .1 The Electrical Subcontractor shall submit shop drawings of all electrical products and equipment for which such drawings are requested.
 - .2 Shop drawings must be provided 10 days after the contract is given, not prior to beginning of work, to not hamper the project.
 - .3 Drawings submitted must be prepared by the Subcontractors involved (and manufacturers) and submitted by the Contractor.
 - .4 In submitting his plans and shop drawings or assembly drawings, the Electrical Subcontractor must notify in writing to the Space Agency Representative any modifications with respect to plans and specifications of the Space Agency Representative.
 - .5 Verification of drawings by Space Agency Representative does not in any way relieve the Electrical Subcontractor and/or the Supplier from their responsibility for the accuracy of these drawings, and their conformity with regard to plans and specifications and conditions on construction site.
 - .6 Production of equipment must begin only after verification of drawings by the Space Agency Representative and required authorities.
 - .7 The Electrical Subcontractor must assume the risk associated with ordering materials or performing any work prior to the receipt of drawings verified by the required professional.
 - .8 All installed equipment must be approved by the Canadian Standards Association (CSA) for intended usage and bear the CSA seal of approval.
 - Where there is no other alternative but to provide equipment not approved by CSA, the Electrical Subcontractor must obtain specific approval from the inspection authority or CSA special inspection services and pay the fees.
 - The “ULC” certification is required instead of the “CSA” certification for fire alarm systems.
 - .9 Material subject to Space Agency Representative approval may be rejected based on poor performance with respect to energy drawn or consumed.
 - .10 Shop drawings will be accepted for review only if they contain the following information:
 - Project name and number.
 - Names of Subcontractor, Supplier and Manufacturer.
 - Identification of equipment (name, model, serial number).
 - Relevant information for the project.
 - Technical characteristics.
 - Dimensions and size of equipment.
 - Confirmation of integration on site (location in relation to adjacent structures).
 - Wiring and control diagrams.
 - Certifications (CSA, ULC, etc.);
 - Illustrated details of manufacturing and installation.
 - .11 The Electrical Subcontractor shall:
 - Verify shop drawings, product specifications and samples before submittal to the Space Agency Representative.
 - Verify measures taken on site.
 - Check catalogue numbers and related data.
 - Seal the documentation submitted stating that it has been reviewed, that the dimensions have been taken on site and that everything is in conformity with contract documents.
 - .12 The Electrical Subcontractor must match submitted documentation with requirements for work and contract documents. Drawings will not be approved piecewise. Verification will be done only when all associated drawings will have been submitted.
 - .13 Documentation must be submitted on sheets with dimensions less than 836 mm x 1143 mm.
 - .14 Unless otherwise indicated, all materials must be new and free from manufacturing defects.

- .15 Unless otherwise indicated, use products of a single manufacturer in the case of materials and equipment of same type.
- .14 Paraseismic measures
- .1 Responsibility:
- The Electrical contractor is responsible for seismic measures related to his trade.
 - The design of seismic devices and systems must be done by a company specialized in seismic protection and recognized in the province of Quebec.
 - The electrical contractor must coordinate the type of installation of his electrical equipment (recessed, surface, floor or wall mounted, etc.) with seismic measures specialist that he will retain within the project. To this effect, this specialized firm must recommend in writing to the contractor, the devices and measures to instate in order to have the installation of the electrical equipment comply with the applicable standards. A copy of the report must be remitted to the project Space Agency Representative. The specialized seismic measures firm must submit all calculation criteria used in conjunction with paraseismic measures to be used. This document must also include all technical bulletins, diagrams and installation drawings of the paraseismic anchoring methods required by the electrical equipment installed inside this project.
 - The electrical contractor must install all devices and implement all measures described in the report issued by seismic measures specialist. Once these measures and devices implemented, the electrical contractor must have his electrical installations verified by the seismic measures specialist who must certify that the electrical contractor conforms to the measures described in the specialist's report.
 - Where appropriate, the electrical contractor shall make required adjustments and take corrective actions according to the written report presented by the seismic protection specialist.
 - The seismic protection specialist has to provide a conformity certificate sealed and signed to the electrical contractor who has to give a copy to the Space Agency Representative.
- .2 Codes and standards in effect:
- SMACNA 1138, "Seismic Restraint Manual Guidelines for Mechanical Systems";
 - Addendum no.1 to Seismic Restraint Manual Guidelines for Mechanical Systems;
 - ASTM E-488;
 - Quebec building code, latest edition.
- .3 Installation:
- Seismic measures must be designed and selected to meet the requirements of the latest edition of the National Building Code of Canada and its supplement, and of the NPPA.
 - Submit shop drawings for seismic measures and calculations.
 - After installing all rigid and flexible restraints and ensuring their proper functioning for normal conditions, request an inspection by certified authorities, perform required repairs (if applicable) and prepare a report (accredited authorities).
 - All seismic measures must be fully integrated and compatible with requirements for noise reduction and anti-vibration systems on electrical material and related systems.
 - Equipment and materials must be firmly anchored to the building structure.
 - Equipment laid on floor must be firmly anchored to the floor or retained by a bearing wall with metal straps. For equipment with high centre of gravity, provide rigid supports with struts anchored to floor, ceiling or bearing wall.
 - For cabinets, use steel framing external to cabinet and anchor them to the floor or the ceiling.
 - Suspended equipment must be retained with metallic belts and appropriate bracings.
- .15 Power and services during construction
- .1 The Contractor shall provide, install and connect all required components for connection, distribution and services on site.
- .2 Services (outlets) must be made using double outlets 15A, 125V Install as needed for the project. Provide 15A circuit for each outlet.

.16 Safety measures during construction work

- .1 The Electrical Subcontractor must observe and enforce safety measures required for construction work by the latest applicable edition of the Quebec Construction Code, provincial agencies, the Commission de la Santé et de la Sécurité au Travail and municipal organisms and by-laws.
- .2 The Electrical Subcontractor must comply with requirements of the Fire Commissioner of Canada standard FC 301, "Standards for construction operations", most recent edition, published by the Fire Commissioner of Canada and any other applicable standard.
- .3 In case of conflict between the requirements of organizations mentioned above, the Electrical Subcontractor must follow the most stringent requirements.

.17 Additional precautionary measures

- .1 When work is performed in an existing building or adjacent to an existing building, the Electrical Subcontractor must take necessary measures so that normal enjoyment of building by users is in no way disrupted during work. These measures may concern noise as well as any other disturbance produced by the work. Any additional expenses incurred towards this goal will be at the expense of the Electrical Subcontractor.
- .2 During construction work and to ensure the safety of staff, the Electrical Subcontractor must protect exposed and energized equipment.
- .3 The Electrical Subcontractor must enclose and mark energized parts using the inscription "circuit sous tension 120 volts" (or appropriate voltage), in French.
- .4 The Electrical Subcontractor must provide for the installation of temporary doors to close rooms containing electrical distribution material and keep those doors locked, except when under direct supervision by an electrician.
- .5 The Electrical Subcontractor must provide warning signs with minimum dimensions of 177 mm x 250 mm in accordance with requirements and/or as required by the Space Agency Representative and the responsible inspection body.

.18 Cleaning

- .1 During construction, the Electrical Subcontractor shall:
 - Not unduly accumulate materials or equipment that could clutter the site.
 - On a daily basis, keep the premises, including rooftops, free of debris and waste.
 - Keep all construction site and public property free of debris and waste.
 - Install on site containers to receive debris and waste.
 - Remove debris and waste from construction site.
 - At the end of each work day, the Electrical Subcontractors shall block the open end of all pipes and conduits to prevent entry by any waste.
 - Evacuate from site waste material and debris at regular interval or dispose of as directed by the Space Agency Representative. Do not burn waste materials on site unless approved by the Space Agency Representative and/or the Architect and/or the Project Manager.
- .2 During final cleaning, the Electrical Subcontractor shall:
 - When the work is nearly completed, remove excess materials, tools, and machinery and construction equipment that are no longer required for performance of the work remaining to be done.
 - Remove discarded materials and debris and leave facility clean and ready to be occupied by the Space Agency Representative.
 - When the work is completely finished, remove excess materials, tools, and machinery and construction equipment. Remove waste and debris.
 - Take necessary arrangements with competent authorities for the disposal of waste materials and waste, and obtain from them the required permits.
 - Perform a general clean-up to remove dust, stains or marks on electrical equipment.
 - Inspect finish of electrical equipment, repair damaged material and retouch paint as required.

.19 Delivery and storage

- .1 Materials and equipment must be delivered and stored on site in such a way that manufacturer's seal and label are kept intact.

- .2 The Electrical Subcontractor must ensure that materials and equipment are not damaged, soiled or altered during delivery, handling and storage. Rejected materials and equipment must be transported out of site immediately.
- .3 The Electrical Subcontractor must store materials and equipment in accordance with instructions received from suppliers.
- .4 The Electrical Subcontractor must resurface to Space Agency Representative satisfaction damages caused by surfaces finished at factory. Use a primer and an enamel paint matching original finish. Do not paint nameplates.
- .5 The Electrical Subcontractor must move equipment or stored materials that hinder work of Space Agency Representative or another Subcontractor.
- .6 The Electrical Subcontractor must obtain from the Project Manager the authorization to store equipment in areas identified by him.

.20 Lifting

- .1 The Electrical Subcontractor must perform lifting of materials and equipment he provides, plan the lifting tasks and pay for rental cost of required equipment.

.21 Scaffolding

- .1 The Electrical Subcontractor must design and build scaffoldings according to CSA S269.2-M standard (latest edition).

.22 Acoustical treatment

- .1 The Contractor is responsible for acoustic sealing around conduits and other technical equipment running through walls.
- .2 The Contractor is responsible for ensuring that the electrical equipment causes no sound or vibration which may disrupt normal activities of the building. If deficiencies are noticed, the Contractor must take, at his own expense, required corrective actions so that the facility is acceptable. The Contractor must obtain Space Agency Representative approval.

.23 Furring

- .1 The Contractor shall perform all required furring to dissimulate and/or embed equipment.
- .2 The Contractor is also responsible for associated finishing and painting work.

.24 Access doors and panels

- .1 The Electrical Subcontractor shall provide access doors in ceilings, partitions, etc., to allow access and maintenance of material, fittings, equipment such as junction and pull boxes. Access doors must be installed by the Contractor in accordance with requirements of section on wall, ceiling or floor construction, or in accordance with existing conditions in case of modifications to an existing building.
- .2 Unless otherwise indicated, access doors must be surface-mounted and have dimensions of 600 mm x 600 mm in the case of an entry hole and 300 mm x 300 mm in the case of a hand hole. They must open to 180°, have rounded corners, be fitted with concealed hinges, screwdriver locks and anchor fittings. The steel must have been coated with a layer of primer and doors must come from a recognized manufacturer which publishes technical documentation.
- .3 In the case of tile, marble or terrazo surfaces, access doors must be in stainless steel.
- .4 Access doors opening on fireproof partitions must show the seal ULC two (2) hours (Underwriters Laboratory Canada).
- .5 The exact location of access doors should be determined on site with the Contractor, other Subcontractors and the Architect to minimize the number and integrate them into the work.
- .6 Unless otherwise indicated, boxes must meet the following guidelines:

	NEMA 1	NEMA 3R	NEMA 4X
Exterior			X
Dry area	X		
Wet area		X	

.25 Rated voltages

- .1 Operating voltages must comply with CAN-3-C235 standard (latest revision).
- .2 All motors, electrical heating equipment and control and distribution devices should operate satisfactorily at a frequency of 60 Hz and within normal limits established by the standards mentioned above. The equipment must be capable of operating in extreme conditions defined in this standard without being damaged.

.26 Equipment installation

- .1 Locations of outlets for electrical apparatus, equipment and fittings are indicated approximately on drawings. The exact location will be determined on site and approved, if required, by the Space Agency Representative and/or the Architect.
 - The location of outlets can be modified without additional charge or credit, provided that this displacement does not exceed 3 metres and a notice of change is given prior to installation.
- .2 Size and appearance of electrical equipment shown on drawings are approximate. Overall dimensions of electrical equipment must be approved by the Space Agency Representative. Technical specifications and overall dimensions of equipment must be included in operating and maintenance manuals upon completion of work.
- .3 The Electrical Subcontractor must install electrical outlets, apparatus, equipment and fittings as to minimize overall dimensions and to maximize peripheral clearance.
- .4 The Electrical Subcontractor should refer to the manufacturer's recommendations to perform installation in accordance with requirements and notify in writing the Space Agency Representative if discrepancies are noted between manufacturer's recommendations and requirements of contract documents. Final connections must be carried as directed by Space Agency Representative.

.27 Diagrams

- .1 Operation sequence for control of main electrical and electromechanical systems is illustrated on control diagrams shown on drawings. Detailed diagrams for wiring and connection, according to technical instructions by suppliers of system components, must be submitted to the Space Agency Representative for approval. These diagrams must be included in operating and maintenance manuals supplied upon completion of work.

.28 Identification

.1 General

- All identifications must be made in French and English in accordance the Project Manager's directives. Before doing the work, the Electrical Subcontractor must ask the Space Agency Representative to verify and approve the list of identifications.

.2 Equipment identification

- The Electrical Subcontractor must identify with nameplates (glued and screwed lamicoïd plates) all electric panels, motor control centres, starters, contactors, disconnecting switch, transformer and any other equipment to be identified in part 3 of the corresponding section.
- Prior to inscription, three (3) copies of the list of identifications must be submitted to Space Agency Representative for verification.
- Plate dimensions must correspond to dimensions given in the table below:

Format 1	9.53 mm x 50 mm	1 line	Letters of 3 mm high
Format 2	12 mm x 68 mm	1 line	Letters of 4.76 mm high
Format 3	12 mm x 68 mm	2 lines	Letters of 3 mm high
Format 4	18 mm x 87 mm	1 line	Letters of 7.94 mm high
Format 5	18 mm x 87 mm	2 lines	Letters of 4.76 mm high
Format 6	25 mm x 100 mm	1 line	Letters of 12 mm high
Format 7	25 mm x 100 mm	2 lines	Letters of 6 mm high

- Identification plates for equipment connected on the emergency and plates for the fire alarm must be of red colour.

.3 Identification of cables and conduits

- Cables and conduits must be identified with colour markers (plastic ribbons) at intervals of 15 m and wherever they enter in or emerge from a wall, a ceiling or a floor.
- The base colour band shall be 25 mm wide and the complementary colour band must be 19 mm wide.
- Colour for markers must be according to the table below:

	Base colour	Complementary colour
Up to 250 volts	yellow	
Up to 600 volts	yellow	green
Up to 15 kV	yellow	blue
Up to 25 kV	yellow	red
Telephone	green	
Other communication network, general call, etc.	green	blue
Fire alarm	red	
Emergency communication	red	blue
Other auxiliary and security networks	red	yellow

- An additional marker must be installed in front of the other ones when the load is connected to the "normal/emergency" or "UPS" networks.
 - a) "normal / emergency" network : orange
 - b) "UPS" network : purple

.4 Conductor identification

- All feeder, branch and control circuit conductors must be numbered at each end and within boxes, using Thomas & Betts indicators.

.5 Colour code

- Colour code used for conductors must be in accordance with C.22.10 CSA standard (latest edition). This code must be respected for the entire installation.
- Use a colour code for communication cables wires and match colours for the entire network.

.6 Junction and pull boxes

- The Electrical Subcontractor shall identify with self-adhesive "P-Touch" tape, or equivalent, circuits and their origin on each junction and pull box exceeding 150 x 150 mm. Use of "Dymo" type tape is not acceptable.
- Junction and pull boxes associated with the fire alarm system must be painted in red.

.7 Outlets and lighting switches

- The Electrical Subcontractor must identify each outlet using self-adhesive "P-Touch" tape, or equivalent.
- Circuit numbers and panel identification must appear on tapes.

.8 Nameplates

- Manufacturer nameplates and CSA labels must be clearly visible and legible after installation of equipment.

.9 Existing panels

- Redo identification of circuits for all existing panels that have been modified (new sheets and lamicoïd plates).

.29 Tests and start-up

.1 Tests – General

- The Electrical Subcontractor shall provide all materials and labour required to perform tests, including costs incurred by the independent laboratory and manufacturers.
- The Electrical Subcontractor must ensure that tests are not destructive for equipment and, if necessary, disconnect or isolate certain components.
- The Electrical Subcontractor must notify the Space Agency Representative 48 hours before testing day. The Space Agency Representative will confirm his presence to the Electrical Subcontractor if the Space Agency Representative wants to assist to tests.
- In the event that tests indicate deficiencies regarding expected results, the Electrical Subcontractor must, at his own expense, perform required verifications and take the necessary corrective actions, including replacing defective or inadequate components. A new series of tests shall be performed and results transmitted to the Space Agency Representative before start-up of equipment and systems.
- The Electrical Subcontractor must submit to the Space Agency Representative all reports indicating equipment tested, type of testing, methodology and results. All reports must be typed, dated, signed and submitted in three (3) copies.
- Some tests must be performed by a recognized independent laboratory (L), the Electrical Subcontractor (E) or the manufacturer (M). Some of those tests are as follows:

	Tests to be done	Tests bone by
Medium voltage equipment and cable test		
Low voltage equipment test	X	E
Coordination study		
Grounding test	X	E
Dielectric test (low voltage)		
Generator test		
UPS test		
Fire alarm system test		
Lighting control system test		
Camera test		
Intrusion alarm test		
Arc flash tests		

.2 Low voltage equipment test

- Check all circuits and ensure they are free of short-circuit and ground fault.
- Check all connections and make sure they are done properly.
- Check the polarity of outlets and correct as required.

.3 Start-up

- The Electrical Subcontractor must perform or have performed, before start-up of equipment and systems, tests described above as well as those described in specifications or asked for on plans and ensure that the results comply with requirements and have been verified by the Space Agency Representative.

- The start-up of all electromechanical systems must take place at least two (2) weeks prior to the date of building delivery (or building section if applicable).

.30 Spare parts and special tools

- .1 When required in Specifications, provide spare parts in original packaging, clearly indicating the content.
- .2 The Electrical Subcontractor must provide a toolkit containing all special tools required for maintenance of equipment in accordance with manufacturer's recommendations.

.31 Equipment Operation and Maintenance Manual

- .1 Upon completion of work, the Electrical Subcontractor must submit to the Space Agency Representative copies of the Operation and Maintenance Manual containing all operating and maintenance data for equipment according to quantities mentioned in contract documents. This manual must be written in French and/or the language spoken by the Project Manager as indicated by him. Unless otherwise indicated, it must be prepared in accordance with the following:
 - Write data on loose leafs of 366 mm x 280 mm sheets in a three-ring hard cover vinyl binder.
 - Write on title page "Manuel d'exploitation et d'entretien", name of installation, date and table of contents.
 - Divide the content in appropriate sections, according to subdivisions of the specifications. Identify each section with a labeled tab, covered with celluloid attached to the rigid paper division sheet.
- .2 Include on operating and maintenance sheets the following information in addition to required data:
 - Details of components, construction specifications, function and maintenance requirements for various components in order to facilitate start-up, operation, maintenance, repair, modification, extension and expansion of any part, network or feature of the installation.
 - Technical data and product specifications must be accompanied by supplementary information such as newsletters, illustrations and exploded view of parts, technical descriptions and list of parts.
 - Full description of equipment and parts. Give information about nameplates such as brand, dimensions, capacity and serial number.
 - Name, address, telephone number and fax number of Subcontractors and Suppliers.
 - Complete set of shop drawings (bound separately) with corrections and changes made during manufacturing and installation.
 - Specific purpose of warranty (project, work), effective date and duration.
 - Final reports for requested tests.
- .3 Type neatly lists and remarks. Ensure clarity of drawings, diagrams and/or manufacturers' publications. Advertisement leaflets or brochures are not accepted.

.32 As-built plans

- .1 The Electrical Subcontractor must provide two sets of drawings for the production of "as-built" plans.
- .2 A copy of these plans must be maintained on site and any change to the work will be traced in red on plans as changes are made.
- .3 The Electrical Subcontractor must update drawings and faithfully note any deviations from the requirements of the contract documents, changes imposed by the nature of the site and/or changes made by various stakeholders, and changes made on site to dimensions or construction details.
- .4 Upon completion of work and prior to temporary acceptance of work by the Space Agency Representative, the concerned Subcontractor must carefully transcribe corrections on the second set of drawings and hand over the two complete sets to the Contractor for verification and submittal to Space Agency Representative.

.33 Certificate of substantial completion

- .1 In addition to the requirements of this section, the "Certificate of completion" for all mechanical and electrical trades cannot be issued before acceptance, by concerned professionals, of all balancing reports required in the contract documents.

- .2 Upon receipt of a written request for acceptance by the Contractor that the work of his Subcontractor has been completed and that approval is required, the Space Agency Representative will conduct an initial general inspection of the work and write a report indicating defects requiring corrective actions. This verification of work will be titled "General inspection #1".
 - .3 After written confirmation from the Contractor that work of his Subcontractor have been completed in accordance with contract documents and the general inspection report #1 issued previously by the Space Agency Representative, the Space Agency Representative will perform a second inspection, this time with the Architect if the Architect deems it necessary. This second inspection will be titled "General inspection #2".
 - .4 At this stage, if mechanical and electrical work are deemed compliant with plans and specifications to the satisfaction of the Space Agency Representative and the Architect, the Contractor will prepare a list of mechanical and electrical work requiring corrective actions, taking into account comments contained in the report "General inspection #2" and will agree in writing to complete the corrective actions within five (5) days, and he will request acceptance by the Architect, with copy to the Space Agency Representative.
 - .5 The Space Agency Representative will then use the "Certificate of substantial completion of mechanical and electrical work" in accordance with the spirit of the text below.
 - Following an inspection that we made on the above mentioned date, we are hereby certifying that there has been substantial completion of work in our trades dated ... so that the Space Agency Representative can use these systems for the purpose for which they are intended.
 - a) A list of mechanical and electrical works to correct or to complete, as prepared by the Contractor and verified by the Space Agency Representative, is attached hereto, and the Contractor agrees to complete this correction or completion work within five (5) days. This list was signed by the Contractor.
 - b) It may not be exhaustive and the failure to mention particular work into it does not relieve the Contractor of his responsibility to complete all work in accordance with contract documents. In particular, everything that is mentioned in other reports or instructions given to the Contractor must be completed.
 - c) Attached to this document:
 - d) List of work to complete....
 - e) Letter of transmission of documents, warranties and manufacturers' instructions.
 - .6 If, to issue such a certificate of temporary acceptance, the Space Agency Representative must perform more than three (3) general inspections due to the negligence of the Contractor and his Subcontractor(s) to correct any defects listed on the report "General inspection #3", the Contractor must be prepared to pay all inspection costs subsequent to this third inspection, if it proves insufficient to enable the Space Agency Representative to issue his certificate of substantial completion.
 - .7 Therefore, general inspections #4, #5, etc., required for the issuance of the "Certificate of substantial completion" will be charged (on an hourly basis) to the Space Agency Representative by the Space Agency Representative and/or the Architect. In accordance with this contractual document, the Space Agency Representative will deduct the amount of this invoice from the amount indicated in the contract.
 - .8 The above procedure is not intended to penalize unduly Mechanical and Electrical Subcontractors, but rather to seek their full cooperation to complete their work and avoid that their negligence cause unnecessary cost to the Space Agency Representative.
 - .9 The Space Agency Representative will, at his discretion, inspect the site and he will make known to the Contractor the deficiencies he observes.
- .34 Required certificate with acceptance request
- .1 No acceptance request for work made by a Subcontractor to the Contractor may be considered, unless it is accompanied by delivery of all certificates pertaining to this Subcontractor.
 - .2 These documents and certificates are the following:
 - For each electrical motor of each Subcontractor, current intensity in amperes with no load and with normal load, capacity of the heating element installed in the starter and value of maximum current, indicated in amperes on the motor plate.
 - Warranty of work.
 - Warranty of manufacturer for equipment provided through this contract.
 - Operation and Maintenance Manuals.
 - All certificates and documents required by the authorities.
 - Certificates of equipment start-up.

- As-built plans.
- Copy of detailed report for tests done by a recognized independent laboratory.
- Other documents requested in other sections of the specifications.

.35 Warranty

- .1 The warranty period shall begin when the Space Agency Representative will issue the Certificate of substantial or provisional completion.
- .2 If law, specifications or a section of the provincial Code Civil provides for a warranty period longer than one year, it should be applied.
- .3 Subcontractors must guarantee their work and installed equipment for a minimum period of one (1) year from the date of issuance of the Certificate of substantial completion. This warranty includes replacement and/or repair without charge (materials and labour) of any element found defective during this period, and all service calls required to maintain systems in good working order.

End of section

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
 - .2 National Electrical Manufacturers Association (NEMA)

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
 - .1 Connector body and stud clamp for copper conductors.
 - .2 Clamp for copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on copper conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

End of section

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Construction Code Quebec Edition – Chapter V -Electricity

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Grounding clamps: Size, as appropriate, to connect conductors to underground water line of good electrical conductivity.
- .2 Grounding conductors: bare copper, tinned annealed strand, size, diameter indicated.
- .3 Green insulated grounding conductors type RW.
- .4 Ground bus bars: copper, dimensions as indicated, with insulated supports, fasteners and connectors.
- .5 Anticorrosion accessories required for the earthing system, types, dimensions and materials as indicated, including:
 - .1 Grounding and bonding tips. Clamp for copper conductors.
 - .2 Protection flanges.
 - .3 Bolted connectors.
 - .4 Connectors for aluminothermic welding.
 - .5 Greenhouse connectors.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install complete, permanent and continuous grounding systems, including necessary conductors, connectors and accessories. When using metal electrical tubing (TEM type), pass a grounding conductor through the tubes.
- .2 Install connectors according to manufacturer's instructions.
- .3 Protect against grounding conductors laid open.
- .4 Use mechanical connectors to make connections to devices with earthing terminals.
- .5 Welded joints are prohibited.
- .6 Place a wire on the flexible conduits, carefully secured inside the conduit and connected at each end to a grounding terminal, a solderless terminal, a wire clamp or a screw with Belleville washer.
- .7 Install flexible link braids at joints of bus bars, where bonding is not provided by the equipment itself.
- .8 Arrange grounding conductors in radial form and route all connections directly to a single common ground point on the street side of the water line. Avoid loop connections.
- .9 Ground the secondary distribution boxes.

3.2 NETWORK AND CIRCUITS GROUNDING

- .1 Make the ground connections of the network and circuits to the neutral of the primary network of 347 / 600V, secondary 120 / 208V.

3.3 EQUIPMENT GROUDING

- .1 Make the required earthing connections for all equipment, including: service equipment, transformers, raceways, motor racks, motor control centers, starters, control panels, distribution panels and network rack, outdoor lighting etc.

3.4 OMNIBUS GROUNDING BAR

- .1 Mount copper busbars on insulated supports fixed to the wall of the electrical installation room.
- .2 Connect equipment from electrical premises to ground bus, using individual stranded bare copper conductors as indicated on the plans.

3.5 QUALITY CONTROL

- .1 Perform tests in accordance with Section 260500 Electrical - General Requirements for Work Results. Connect equipment from electrical premises to ground bus, using individual stranded bare copper conductors as indicated on the plans.
- .2 Verify continuity and resistance of the earthing system in accordance with methods appropriate to local conditions and approved by local authorities.
- .3 Perform tests before powering up the electrical installation.
- .4 During testing, disconnect the ground leakage indicator.

End of section

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Fasteners and supports: General architectural requirements General product requirements (if applicable).

1.2 TECHNICAL DRAWINGS

- .1 Submit required shop drawings and data sheets in accordance with Section 260500 General Requirements for Work Results.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Supports, U-shaped, 41 mm x 41 mm, 3 mm thick, surface-mounted or suspended. Grounding conductors: bare copper, tinned annealed strand, size, diameter indicated.
- .2 Materials: steel, galvanized steel, aluminum and / or CPV as indicated. Ground bus bars: copper, dimensions as indicated, with insulated supports, fasteners and connectors.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Unless otherwise specified, the specified materials on the drawings shall be used :
- .2 Secure equipment to solid hollow masonry, tile and plaster surfaces using lead anchors or nylon bushings.
- .3 Secure equipment to poured concrete surfaces using expandable anchors.
- .4 Fasten equipment to masonry hollow walls or suspended ceilings using rocker bolts.
- .5 Support equipment for conduits or cables consisting of staples, spring bolts and cable ties designed as accessories to the basic U-shaped supports.
- .6 Fastening to secure visible cables or ducts to building structure or building elements.
 - .1 One-hole malleable iron steel flanges for surface fixing of conduits and cables 50mm in diameter or less
 - .2 Two-hole steel flanges to secure conduits and cables larger than 50 mm in diameter.
 - .3 Clamps to secure ducts to exposed steel structural members.
- .7 Suspended support systems:
 - .1 Support each cable or conduit with 6 mm diameter threaded rods and spring clips.
 - .2 Support at least two cables or conduits on U-shaped bars suspended from 6 mm diameter threaded suspension rods where it is impractical to attach directly to the frame of the building.
- .8 Surface mount brackets to support two or more conduits on U-profile bars.
- .9 Provide metal brackets, brackets, hooks, clamps and other types of support where indicated or where conduit and cable are required.
- .10 Provide suitable support for piping and cables laid vertically to the equipment when there is no wall support.
- .11 Do not use lanyard wire or perforated strapping to support or secure piping or cables.
- .12 Do not use supports or equipment installed for other trades, such as conduit or cable support; except with the permission of people from these other trades and the approval of the Canadian Space Agency Representative

- .13 Install fasteners and brackets as required for each type of equipment, conduit and cable and according to manufacturer's recommendations for installation.

End of section

PART 1 - GENERAL

1.1 TECHNICAL DRAWINGS

- .1 Submit required shop drawings and data sheets in accordance with Section 260500 General Requirements for Work Results.

PART 2 - PRODUCTS

2.1 SPLITTERS

- .1 Metal sheet boxes, welded corners, with hinged lid formed and lockable in closed position.
- .2 The lugs of the mains and branches and the connecting bars must correspond to the size and the number of input and output conductors connected to them, as indicated.
- .3 Provide at least three spare terminals for each series of lugs of distribution boxes with a rated current of less than 400A.

2.2 JUNCTION AND PULL BOXES

- .1 Boxes with screwed flat covers for surface mounting.
- .2 Covers with a rim of 13 mm or more, suitable for flush mounted junction boxes.

2.3 CABINETS

- .1 Type E surface mounted cabinet with hinged door with folded edges over sides, handle, lock and latch.
- .2 T-type cabinet for surface or recess mounting, with hinged door, latch, two-key lock, and rear sheet steel support panel.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Unless otherwise specified, all box are in aluminium or the same materials of the specified conduit on the drawings shall be used :
- .2 Outside, in wet areas and in the food industry, all connections must be watertight.

3.2 INSTALLATION OF SPLITTER BOX.

- .1 Install distribution boxes as indicated and install plumb, align and square to building lines.
- .2 Unless otherwise indicated, the distribution boxes shall be of the length required to receive secondary equipment.
- .3 When work is done in a "food" area, all boxes must be wall mounted and sealed with HACCP approved seal to prevent seepage behind boxes.

3.3 INSTALLATION JUNCTION AND PULL BOXES.

- .1 Place pull boxes in concealed but easily accessible areas.
- .2 Install cabinets so that the top is not more than 2,000 mm above the finished floor.
- .3 Place terminal board in type T cabinets as indicated.
- .4 Only the main junction and pull boxes are indicated. Install enough draw boxes so that the length of the ducts between each box does not exceed 30 m or three elbows of 90 °.

3.4 IDENTIFICATIONS.

- .1 Provide and install identification tags for equipment in accordance with Section 26 05 00 General Requirements for Work Results. Install cabinets so that the top is not more than 2,000 mm above the finished floor.
- .2 Install labels indicating network name, current, voltage and number of phases.

End of section

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel hot dipped galvanized steel aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, steel aluminum liquid tight flexible metal.
- .6 Flexible PVC conduit: to CAN/CSA C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

- .1 One hole malleable iron steel straps to secure surface conduits NPS 50 mm and smaller. Two hole steel straps for conduits larger than NPS 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm dia., to support suspended channels.
- .5 PVC spacers with stainless steel fastenings.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory made elbows where 90° bends are required for NPS 1 and larger conduits.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 - EXECUTION

3.1 GENERAL

.1 Unless otherwise indicated, use following conduits:

- | | |
|--------------------------------|--|
| .1 Outside: | <input type="checkbox"/> galvanized steel |
| | <input type="checkbox"/> aluminum |
| | <input checked="" type="checkbox"/> PVC |
| | <input type="checkbox"/> |
| .2 Encased in slab (concrete): | <input type="checkbox"/> galvanized steel |
| | <input checked="" type="checkbox"/> PVC |
| .3 Dry area: | <input checked="" type="checkbox"/> EMT |
| | <input type="checkbox"/> galvanized steel |
| | <input type="checkbox"/> |
| .4 Damp and wet areas: | <input type="checkbox"/> galvanized steel |
| | <input type="checkbox"/> aluminum |
| | <input checked="" type="checkbox"/> PVC |
| .5 Damage prone area: | <input checked="" type="checkbox"/> galvanized steel |

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.
- .3 Surface mount conduits except as indicated.
- .4 Use flexible metal conduit for connection to transformers, motors, and vibrating equipment.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm dia.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .9 Install fish cord in empty conduits.
- .10 For each flush mounting panel board, run 2-25 mm spare conduits up to ceiling space. Terminate these conduits in 300 x 300 x 150 mm junction boxes in ceiling space.
- .11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.
- .13 For PVC conduits, install dilatation fittings in accordance with manufacture's instructions.
- .14 Install green wire of required rating in all conduits.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on suspended surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .7 In food areas, install conduits on spacers for clearance from walls and ceilings.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

End of section

Division 27

Telecommunications

PART 1 - GENERAL

1.1 CONTENTS OF THIS SECTION

- .1 The cabling specification covers the supply and delivery of the following items in accordance with the state of the art and the most recent TIA / EIA standards:
 - .1 Materials and certifications Hubbell Premise Wiring;
 - .2 Horizontal copper wiring (between computer rooms) and vertical;
 - .3 Wiring of optical fiber between computer rooms;
 - .4 CAT6A and LC-Duplex fiber patch panels;
 - .5 Wall plates, modular furniture plates and connectors;
 - .6 Velcro and color connector;
 - .7 Appropriate cable supports (J hooks and others...);
 - .8 Labeling according to the CSA standard;
 - .9 Sealing of ducts against fire.
- .2 Exclusions:
 - .1 Cabinet, rack, power bar and cable managers.

1.2 REFERENCES

- .1 Canadian standards association (CSA)/CSA International
 - .1 CSA-C22.2 num. 214, Telecommunication cables (binational standard with UL 444).
 - .2 CSA-C22.2 num. 232, Fiber optic cables.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-2017, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568- 2017, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-2017, Optical Fiber Cabling Components Standard. (including TIA-568.3-D)
 - .4 TIA/EIA-606, Administration Standard for the Commercial Telecommunications Infrastructure.
 - .5 TIA TSB-140, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
 - .6 TIA-598, Optical Fiber Cable Color Coding.
 - .7 TIA/EIA, Generic Telecommunications Bonding and Grounding (Earthing for Customer Premises)

PART 2 - PRODUCTS

- .1 Materials
 - .1 Supply and install Hubbell Premise Wiring, 12-core, OM3 50uM, Multimode, indoor tight-buffer, Plenum, FT6 fiber optic cables with LC HUBBELL PROCLICK LC OM3 connector.
 - .2 For copper (horizontal and vertical) wiring, supply and install Hubbell copper CAT6A, UTP, 26 AWG, solid core, 100 Ohm, 500 Mhz, FT6, CMP (Plenum), unshielded, 4 pairs colored according to TIA / EIA 568A, all wires must have the 2 colors, outer diameter 0.330. The color of the sheath must be white.
 - .3 At the request of the CSA, the 650 MHz best-in-class Hubbell cable against interference and has a smaller diameter of 10% (outer diameter 0.290) and certified to supply electrical components (4PPoE) up to 90watt may be required.
 - .4 Hubbell label systems for fiber optic board and copper wire panel must be used.
 - .5 Supply and install Velcro, CAT6A connectors and colored OM3-LC-Duplex connectors according to the mission category of the cable or fiber.
 - Blue => RCM Classified;
 - White => RCM Non Classified;
 - Yellow => Voice (Clearcom System);
 - Green => Multi-missions;

- Gray => Telephones;
- Orange => interconnexion;
- Black => interconnexion;
- Red => DND.

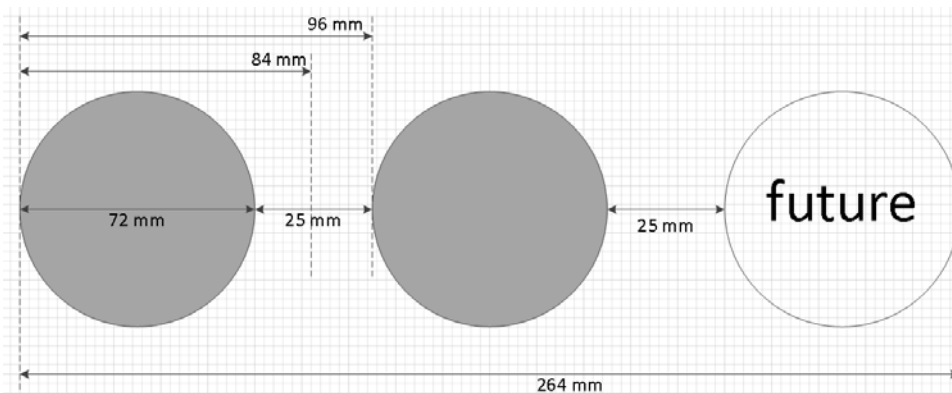
- .6 Hubbell NetSelect Patch Panel, 48 Port Modular, Rack Mount NSPJ48.
- .7 Hubbell FSP 6-Position LC-duplex Fiber Optic Patch Connectors for Hubbell Brand 2U Optical Fiber Enclosure of appropriate Color.
- .8 FT-6 grade flexible orange conduits to protect optical fibers between the metal conduit outlet and the fiber optic splice box; in the cableways and in the cabinets.
- .9 Hubbell iStation wall plates with 4 connector positions.
- .10 4 position modular Inserts for monuments and wall plates.
- .11 As provider needs to adapt quantities to reality and possible changes, unit prices are required for all equipment.

.2 Division of cable categories

- .1 CSA, requires the separation of all cables and optical fibers according to 8 mission categories: RCM Classified; RCM Unclassified; Voice (Clearcom System); Multi-missions (MDA corpo, MDA ops, CSA corpo, CSA ops, SED corpo); Voice-Clearcom, 2 categories Interconnection and DND.
- .2 The mission category corresponds to different cabinets. Each category of cables is grouped by a velcro of appropriate color and ended with a CAT6A or OM3 connector of appropriate color:
- .3 One cableway is dedicated to the "CLASSIFIED" category and another cableway serves all other categories.

.3 CAT6A cable tray

- .1 In cable trays limit CAT6A cable clusters to 61 cables to meet 802.3bt. Clusters of cables attached to the cable tray to ensure parallelism of the clusters must be 25mm apart to avoid reheating. Excess space on the raceway must be left free on one side of the path for future additions.
- .2 Sizing to be done with Hubbell branded cables.



- .3 LAN cable racks must not contain power distribution cables.
- .4 New racks must be grounded according to EIA / TIA 569D.

PART 3 - EXECUTION

3.1 GENERAL

- .1 All delivered equipment must be brand Hubbell Premise Wiring
- .2 After each draw, smooth a nylon pull cable in each conduit.
- .3 The pull tension applied to the cables must not exceed the manufacturer's standards. The installation must comply with the TIA / EIA 568D standard with the following details: The "de-twisted" portion must not exceed 13mm; hooks must be installed every 1.5m (5 feet) to support cables outside cable trays; all RJ45 connectors must be wired in accordance with TIA / EIA 568A; the cables must be fastened with Velcro straps on the "J" hooks, on the cable trays, the telecommunications room ladders and in the cabinets to ensure perfect parallelism of the duvets.
- .4 The installation of optical fibers must respect the radius of curvature prescribed by the manufacturer.
- .5 The installation of CAT6A cables must meet the standard and the specifications of the manufacturer.
- .6 Provide technical specifications for CAT6A cabling and optical fiber prior to delivery of equipment.
- .7 All fiber optic connectors must remain plugged at all times to avoid contamination.
- .8 Supplier must provide 25-year Certified Hubbell Mission Critical Warranty Certificate. The guarantee must take effect after the certificate has been issued. The supplier must notify the customer 3 days before each visit where tests are performed. The supplier must provide a test slip that details the results of each cable with the cable number as labeled. In the event of non-compliance, the Supplier must make the corrections at its expense or at Hubbell's expense for the duration of the certificate.
- .9 CAT6A cable tests must be Level IV and ANSI / TIA-568-C.2 compliant.
- .10 OM3 fiber optic tests must meet TIA-568.3 Annex C TIA-526-14-B. The results of each segment must be provided. The tests must be performed for both 850nm and 1300nm bands. Tests with 3 connection cords must be made. Each fiber must be tested with the protocol that will be provided by the client (example 10G-Base-SX).
- .11 When the Supplier has been authorized, the cable ducts must be sealed with FT4 silicone product against the spread of fire.
- .12 Hubbell certificate certification that the installer is authorized to issue a Hubbell Premise Wiring warranty certificate.
- .13 Technical specifications for proposed CAT6A and OM3 Optical Fiber cables, patch panels, CAT6A connectors, wall plates and modular furniture plates.
- .14 Provide a split unit price for all materials.

3.2 INSTALLATION

- .1 Horizontal wiring:
 - .1 For each cable, provide a 10m excess length wound on the J hook closest to the position designated by the customer during installation. Make hoops with a diameter of 40 cm attached with the velcro of the right color.
 - .2 Cables must be labeled at each end (not simply marked with felt) in addition to the label affixed to the caps and panels. The BPA labeling standard NO E-32 Rev1 prescribes the WW-WWW.WW-XYZZZ format: WW-WWW-WW = part of the patch panel; X = Cabinet letter; Y = Letter of the panel (in some cabinets, this letter is omitted); ZZZ = number of the port in the connection panel. Example: 2B-205.A2-DC23 means port 23 in panel C in cabinet D in the room: 2B-205.A2.
 - .3 Supplier must print cable numbers on customer-approved vinyl labels and affixed to each end of cable. Hubbell adhesive labels specifically designed for patch panels must be used on all patch panels. On wall plates and surface blocks, Hubbell adhesive labels or black-on-white vinyl p-touch printed label shall be affixed to all RJ45 connectors.

- .4 Room 2B-203 (fibre): optical fibre OM3 multi-mode 12 strands already installed needs to be properly terminated on FSP LC-duplex modules directly in a new Dasco cabinet. Provide a Hubbell 1U fiber enclosure and all other material to comply with CSA quality standards.
- .5 Room 2B-203 (copper): 2 CAT6A “classified” cables needs to run directly from floor to the table monument into a dedicated conduit.
- .6 Room 2B-202: cables are terminated in floor box and pigtails runs from floor monument to table box.
- .7 Room 2B-205.B: RJ-45connectors are added to existing iStation wall jacks.
- .8 Room 2B-205.C: install 3 cables onto two additional iStation wall jacks. Install 3 cables onto existing iStation wall jacks.
- .9 Room 2B-204.A: install three modular inserts into floor box and reorganise existing table box.
- .10 Room 2B-204.B: reorganise connectors in floor box to make room for new connectors.
- .11 Room 2B-209: Run 3 additional cables into floor box. Run 4 pigtails from floor boxes existing connector to table boxes and 4 pigtails from new connectors to table boxes.
- .12 Room 2C-201: (quote separately as an option) install connectors in existing wall jacks.
- .13 A multi-mode (12-strand) OM3 optical fiber already installed in room 2B-203 must be terminated with LC-Duplex connectors in a dedicated cabinet. In this cabinet, supply and install an optical fiber connection box. All required materials must be included.
- .14 List of cables and fiber to stations (new connectors required for all cables and fibers).

Drawing reference	Number of strands (f) or cable (c)	Category / color	Cabinet	Cabinet termination	Station	Outlet or monument modification
16	5 (c)	Multi-Mission / green	2B-207.A.D	Existing panel	2B-205.B	Existing cover plate
14	5 (c)	Multi-Mission / green	2B-207.A.D	Existing panel	2B-205.C	Add 2 new cover plates
15	3 (c)	Multi-Mission / green	2B-207.A.D	Existing panel	2B-204.B	Existing cover plates
5	4 (c)	Voice / yellow	2B-207.A.D	Existing panel	2A-204.A	From floor monument to modular wall.
5	9 (c)	Multi-Mission / green	2B-207.A.D	Existing panel	2A-204.A	Add 3 new modular inserts for existing surface plates
9	4 (c)	Multi-Mission / green	2B-207.A.D	Existing floor monument	2B-209 table	Use spare connectors in table (non-hubbell)
7	4 (c)	RCM-Class / blue	2B-207.A.A	Existing panel	2B-202	2 new double outlets on table
7	4 (c)	RCM-UnClass / white	2B-207.A.B	Existing panel	2B-202	2 new double outlets on table
8	4 (c)	Multi-Mission / green	2B-209 floor	Existing floor monument	2B-209 table	Use spare connectors in table (non-hubbell)
10	1 (c)	DND-Class / red	2B-203		2B-204.B2	Existing monument
11	12 (f)	DND-Class / red	2B-203	Existing fiber to terminate in cabinet	2A-311	Existing fiber to end in new cabinet

- .2 List of cables and fibers between rooms to be offered separately as an option:

Drawing reference	Number of strands (f) or cable (c)	Category / color	Cabinet	Cabinet termination	Station	Station termination
13	16 (c)	RCM-UnClass / blanc	2C-200	Existing panel	2C-201	Existing cover plates

.3 Vertical wiring:

- .1 Between computer rooms, copper and fiber optic cables must be installed in conduits. The supplier must close the ducts when authorized by the client at the end of the work and tests. For each 12 strands fiber, add an SFP module into Hubbell 2U fiber enclosure.

Drawing reference	Number of strands (f) or cable (c)	Category / color	Cabinet	Cabinet termination	Station	Station termination
3	12 (f)	RCM-Class / blue	2B.207.A.A	FSP blue	2A-310.Class	FSP blue
3	12 (f)	RCM-Unclass / white	2B-207.A.B	FSP beige	2A-310.Unclass	FSP beige
3	12 (f)	Multi-Mission / green	2B-207.A.D	FSP green	2A-310.MM.	FSP green
3	6 (c)	Multi-Mission / green	2B-207.A.D	FSP green	2A-310.MM	FSP green
6	12 (f)	Multi-Mission / green	2B-207.A.D	FSP blue to indicate destination class	2E-102.class	FSP green to indicate destination cabinet class

- .4 List of cables and fibers between rooms to be offered separately as an option. For each 12-core fiber, add an SFP module for Hubbell 2U fiber enclosure.

Drawing reference	Number of strands (f) or cable (c)	Category / color	Cabinet	Cabinet termination	Station	Station termination
12	12 (f)	RCM-class / blue	2B-207.A.A	FSP blue	2A-201.Class	FSP blue
12	12 (f)	RCM-UnClass / white	2B.207.A.B	FSP beige	2A-201.Unclass	FSP beige

.5 Certification « Hubbell Mission Critical Certification Program »

- .1 Supplier must be accredited for testing, certification and 25 years warranty of all Hubbell Hardware under the Hubbell Mission Critical Certification Program.
- .2 The supplier "shall produce a test report with the cable number according to the nomenclature defined in this specification; random tests will be repeated in the presence of auditors to validate the reports.
- .3 Certification must be performed in accordance with EIA TSB-67. A certification device that produces a report with the number of each cable with the results at the 10 parameters listed in the TIA / EIA-568.B.1 standard shall be used. The supplier must produce a test report with the cable number according to the nomenclature defined in this specification; random tests will be repeated in the presence of auditors to validate the reports.

End of section