

V-05-04.09.2022

Document Title:

SPECIFICATION

FOR

161 kV CIRCUIT BREAKERS

According to IECo Spec SR-145
or last NOGA request

Project Name:

Yotveta - EAPC

Construction of 161/6.6 kV Substation



9/2022

1 Scope of work.

This Specification details the technical and quality assurance requirements for design, manufacture, testing, shipping and unloading at EAPC Yotveta.

2 Purchaser.



3 Scope of supply.

Will be installed 161kV circuit breakers with three/one pole operation types.

4 Warranty.

All materials and components of the circuit breaker shall be new and unused.

The function of the circuit breaker shall be warranted against defects in material and workmanship for proper, continuous operation at full capacity under the specified service and site condition including all equipment, for a period of five years.

Immediately after receipt of notice of failure, the supplier shall take action to repair/replace on site the failed equipment at no cost to the purchaser. The procedure of repair/replacement shall be approved by purchaser.

The warranty shall cover the expenses for in-out dismantling, removal, transportation to factory or repair facility, repair, test, return shipping, installation, inspection and field test.

5. general terms

The supplier will provide the Eur1 certificate upon acceptance of the item, along with the technical data sheet.

6 System Conditions.

Rated System Voltage, kV	161
Maximum System Voltage, kV	170
Minimum System Voltage, kV	152
Neutral HV side grounding	Effectively grounded
Neutral MV side grounding	Trough grounding transformer
Range of frequency variation, Hz	125 (peak)

7 Site and Environmental Conditions.

The circuit breaker will be used for energizing 20 MVA transformer at Yotveta

The weather conditions are as follows:

Atmosphere	Dust and corrosive
Altitude above the sea level	< 1000 m
Minimum ambient temperature	-5 °C
Solar radiation heating effect	1120 W/m ²
Maximum ambient temperature	65 °C
Maximum relative humidity	90%
Seismic condition acceleration	0.5g
Wind load	34 m/s
Low/high air pressure	70/106 kPa
Rain intensity	15 mm/min
Pollution Zone III	As defined by IEC 60815-2008

The circuit breakers must be designed for outdoor and sub-tropical climates. Taking in consideration environmental conditions, painting procedures of the external exposed metal parts shall be according to the requirements for such conditions.

8 Standards.

The circuit breaker shall be designed, manufactured and tested in accordance with the relevant, up to date published Recommendations of IEC standards. All aspects not covered by IEC/CEI standards shall conform to French (NF) and German (VDE or DIN) standards.

In case the requirements in this Specification differ from those in any standard, the circuit breaker shall conform to the requirements in this Specification.

The main IEC recommendations considered are:

- IEC 60028 International standard for resistance for copper
- IEC 60034 Rotating Electrical Machinery
- IEC 60050 International Electro technical Vocabulary
- IEC 60056 High voltage AC circuit breakers
- IEC 62271-100 "High-voltage switchgear and control gear – Part 100: Alternating-current circuit-breakers"
- IEC 59 Normal IEC currents
- IEC 60060 High voltage testing techniques
- IEC 60071 Insulation coordination
- IEC 60072 Dimensions and power ranges of rotating electrical machines
- IEC 60137 Insulated bushings for AC voltages greater than 1000 V
- IEC 233 Tests on Hollow Insulators for Use In Electrical Equipment
- IEC 267 Guide for testing circuit breakers with regard to switching on and off during a phase discrepancy
- IEC 269 Low voltage fuses
- IEC 445 Identification of equipment terminals and the ends of certain designated leads and general rules for an alphanumeric system
- IEC 60617 Graphical symbols for diagrams
- IEC 60947 Low-voltage switchgear and control gear
- NEMA 107 Methods for measuring radio disturbance voltages in high voltage equipment

In case some of listed standards will be replaced at the moment of manufacturing, the new standard requirements prevail.

9 Circuit Breakers Data – Minimal Technical features Requirements.

Parameter	Info
Nominal voltage	161kV
Highest rated equipment voltage	170kV
Frequency	50 Hz
Number of poles	3
Number of trip coils	2
Control gears	Three polar/one polar
Earth fault factor	1.4
Line surge impedance	375 Ω
Current Characteristics	
Rated current for continuous service	3150 A
Cut-off current for short circuits (1 second)	50kA
Current to be carried by breaker when closed for 1 second	50 kA rms
Rated peak short-circuit current	125 kA
Maximum permissible percentage of the DC component	$\leq 45\%$
Insulation levels:	
Rated insulation levels (kV peak/kV rms)	750/325
Rated lightning impulse withstand voltage to earth	750 kV peak
Rated lightning impulse withstand voltage across breaking unit	860 kV peak
Switching Cycle:	
Operating sequence	O-3min-FO
Break time	< 50 msec
Auxiliary Power Supply	
Supply voltage for closing and tripping circuits	48 VDC
Motor recoil spring	230 VDC/AC
Heating resistor	230VAC

10 General Information.

Three-pole circuit breakers with separate poles switching in SF6, with common spring-type mechanism, designed for outdoor use.

11 Operation.

Line circuit breakers shall permit fast reclosing during single phase or three phase short circuit, after an adjustable delay that allows the extinction of the arc, a rated operating cycle 0- (t) -FO-3 min-FO with adjustable (t) between 0.3 and 15 seconds.

12 Actuation.

- a) Circuit breakers shall be operated by a single-pole spring-type device for line bays and couple, three-pole control for circuit breakers for transformer bay.
- b) Each circuit breaker will be delivered with its control cabinet and electrical and SF6 connections between poles and cabinets. It is understood that all circuits to be connected to the outdoor facility will be grouped together in the cabinet.
- c) **Opening and closing shall be REMOTE only, controllable through of a set of pushbuttons with a mechanical safety interlock and a "local-remote" lockable switch, are installed in the external field control panel.**
- d) Opening must be mechanically forced in an emergency by activating a device located in the control cabinet. It must be possible for one man to carry out the action, without excessive effort.
- e) The switching devices will be equipped with two independent tripping coils per pole for circuit breakers with single-pole control, or by two independent tripping coils for circuit breakers with three pole control.
- f) Each actuator will be equipped with automatic devices blocking operation in case of an internal fault (like low SF6 pressure, etc.) with an alarm contact.
- g) Each operating unit shall be equipped with a mechanical operation counter, a counting device for the number of starts for each motor, when necessary, and a local mechanical indicator indicating an open or closed position of the device.
- h) A sufficient number of auxiliary contacts indicating circuit breaker status in closed and in open position.
- i) In addition to the contacts necessary for the operation of the circuit-breakers, the extra position indication contacts shown below must be provided and connected to terminal blocks in the motor drive box:
- j) At least 18 spare contacts closed in open position and 18 spare contacts closed in closed position of the circuit-breaker must be available wired to terminal blocks in motor drive box.
- k) A device indicating a position discrepancy between poles will be provided for single-pole operated circuit breakers.
- l) An anti-pumping device will be provided to prohibit two successive closures separated by a trip if in the meantime the close command is maintained.
- m) Each circuit-breaker will be equipped with a lock that prevents the disconnectors from being operated when the circuit-breaker is in the closed position.

The circuit breaker will be equipped with a lock and captive key when the bolt is retracted, which is when the circuit breaker is closed, meaning that the electrical contact for opening the circuit breaker will allow the key to be removed.

When the key is removed, bolt out, the control of the circuit breaker will be locked electrically and mechanically in the open position, therefore making reclosing impossible.

Each disconnecter will be equipped with a lock controlled by the same key, a disc with two notches to release the key regardless of the position of the disconnecter, whether it is open or closed and locked.

n) The insulation of auxiliary circuits and motors shall be provided for a test voltage of 2000 V eff./1 min.

o) Each cabinet will be equipped with an anti-condensation heating element powered by alternating current and controlled by an individual thermostat and lighting device powered by alternating current and controlled by opening the cabinet door.

13 Design and Construction.

14 Characteristics.

Circuit-Breakers for outdoor operation shall be of the "Live tank" type with "puffer" or "auto-puffer" under SF6 type switch equipped with a spring mechanism.

The circuit-breaker mainly consists of:

- the arcing chambers and possible dividing capacitors.
- the porcelain insulators, supporting the arcing chambers.
- the arcing chamber actuating devices, including the energy storage devices making it possible to complete the O-C-O actuating cycle.
- the galvanised steel structures supporting the pole isolators.
- a control cabinet containing the auxiliary control, resetting and monitoring systems.
- the electrical connections between the control cabinet and the arcing chamber actuating devices.

15 Insulated Bushings.

High voltage insulators will be made of porcelain, in one piece, and should be flawless and fully glazed. Stacking designs are not acceptable. The glazing must be smooth, hard, of a uniform brown color, and must cover all exposed parts of the insulator.

The outer insulation should not be sensitive to the weather, acids, alkalis, dust and rapid temperature changes that may be encountered during operation. The porcelain must not be in direct contact with hard metal parts and, when necessary, seals will be placed between the porcelain and accessories. All parts of the porcelain in contact with seals must be carefully ground and free of varnish. Hollow porcelains must complete and meet the standards of IEC tests, recommendation 233.

The creepage distance shall be at least 31 mm/kV.

16 Control Cabinet.

- a) Operating devices, auxiliary switches and associated relays, control switches, control cable terminal blocks and other auxiliary equipment for circuit breakers shall be installed in pest-proof and weatherproof metal cabinets, whereas the protection level shall be meet the standards for an IP54 category. Preferably the cabinets to be installed on the circuit breaker support structure, but if not possible they can be placed on the ground.
- b) The cabinets must be rigid and must include the metal frames as necessary for mounting on the circuit breaker support structure or on concrete foundations. Access to the cabinets will be through rigid lockable doors and will be covered by waterproofing material suitable for the specified climatic conditions. Sunshades and awnings to prevent water infiltration will have to be fitted.
- c) Cabinets must be properly ventilated with ventilation vents that are equipped with an insect screen made of a brass lattice attached to a frame inside the cabinet. The separations between cabinet cells (if any) will have to be perforated to facilitate air circulation. Also, an anti-condensation heating element must be installed. It must be controlled by a unipolar contactor mounted in the cabinet. The protection level of the cabinet will conform to the specification 1010 - General Provisions.
- d) Doors or access panels should be glazed, if necessary, to allow viewing of the instruments without having to open the cabinets. The arrangement of the equipment in the cabinet must allow access to the cabinets at any time for maintenance or disassembly with a minimum amount of disruption to the associated equipment.
- e) The circuit breaker control position switch and the specified circuit breaker operating control switches shall be installed in the cabinet. Circuit breaker control from this location will only be used for maintenance purposes or in emergency situations. Any position of this selector that inhibits electrical controls will trigger an alarm. It must only be possible to close a circuit breaker from its local position when it is disconnected.
- f) Where required, approved circuit breaker local control system schematics which are a reference to appropriate maintenance plans and instructions and identify the individual components inside the cabinet and on the circuit breaker, must be affixed to the inside of the cabinet door. These schematics must be marked in a permanent manner on an appropriate material for the specific site conditions.
- g) A 220V single-phase 16A receptacle must be installed in each cabinet. All of these cabinets must be equipped with a lamp controlled by a switch that is activated by opening the door.
- h) Removable gland plate must be provided on the bottom of cabinet, with installed not less than 20 pcs of PG21 stainless steel cable glands for external cables.
- i) Grounding bar inside the control cabinet with provision for grounding of external control cable screens.

Schematics of the control cabinet must be sent to the Purchaser for review and approval before start of their manufacturing.

17 Auxiliary Circuits.

All auxiliary circuits in the control cabinet must have the following rating values:

- 48 volts direct current + 10% - 20%: Relays, contactors, closing and tripping coils as well as signaling circuits are connected to this power source.
- 400 V AC three-phase current, 230 V single-phase current - 50 Hz with a voltage variation of 80 to 110% of the nominal value: AC motors, lighting fixtures and the heating resistors are connected to this power source.

18 Earthing.

At least the following grounding provisions shall be made:

- The circuit breaker base frame,
- All exposed metal parts of the circuit breaker must be grounded via its base frame,
- Control cabinet.

19 Corrosion Protection.

The paint system chosen for the control cabinet and for exposed metal parts should provide excellent corrosion protection. After fabrication all metal parts must be cleaned and sanded both internally and externally according to BS 4232 standard or equivalent, and they shall immediately receive a zinc phosphate rustproofing application on the external surfaces.

This application will be followed by at least two coats of paint that is both temperature and atmospheric agent resistant. Repairs of any damage to the paint on-site will be subject to approval by the Employer.

20 Painting.

All metal parts that are not galvanized, stainless steel or of corrosion resistant material and are exposed to oil or water shall be thoroughly cleaned and painted according to.

Painting requirements for all metallic parts exposed to the atmosphere as follows:

Zinc spraying	(μm) 150
Painting coat	(μm) 70
Topcoat color gray RAL 7038	(μm) 50
Anticorrosive protection for onshore and offshore transformer sites, providing anticorrosive levels to meet standards of C5 - C5M - C5H - ISO 20340. CX	

21 Nameplates

Nameplates will be made of anodized aluminum or stainless steel. As a minimum, they will indicate information specified in IEC Recommendation IEC 62271-100 "High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers".

A nameplate mounted externally on the circuit breaker shall identify the manufacturer, type, serial number and main technical data of the breaker. This nameplate must be visible from ground level.

22 Factory Tests.

The tests shall be performed by the supplier in the manufacturer test facilities. The test shall be performed according to this specification and IEC Standard requirements, on the circuit breaker completely assembled. Tests not covered by IEC shall be performed according to ANSI/IEEE standards. The supplier shall send, as a bid document, a list of the equipment and instruments intended to be used for testing the specified breaker. The test equipment shall be calibrated in a test laboratory accredited to ISO/IEC 17025 or similar. Each individual instrument shall be 0.1 accuracy class or better.

Circuit breaker must be from type which had successfully passed type tests on independent laboratory, accredited to standard ISO/IEC 17025 or similar.

Each circuit breaker subject of delivery must have passed routine tests in accordance with IEC 62271-100 "High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers" must be provided.

The purpose of routine tests is for revealing faults in material or construction. They do not impair the properties and reliability of a test object. The routine tests shall be made at the manufacturer's works, to ensure that the product is in accordance with the equipment on which the type tests have been passed.

The routine tests should include as a minimum:

- Dielectric test on the main circuit in accordance with sub clause 7.1;
- Tests on auxiliary and control circuits in accordance with sub clause 7.2;
- Measurement of the resistance of the main circuit in accordance with sub clause 7.3;
- Tightness test in accordance with sub clause 7.4;
- Design and visual checks in accordance with sub clause 7.5.

Daily test results shall be reported to the purchaser at the end of tests day.

23 Packing and shipment.

The supplier shall pack up the complete circuit breakers to be shipped in such manner to avoid any damage during shipment. It is allowed control cabinet to be shipped separately packed from the circuit breaker.

All packages shall be marked for careful handling and shall have their lifting and handling marks. All items shall have identification tags and designation. It must be clearly indicated which control cabinet to which circuit breaker must be installed.

The supplier shall provide a packing list including bill of materials shipped.

The supplier will deliver all packing in one deliver to EAPC Yotveta substation.

One set of SF6 gas bottles must be included in the shipment in amount sufficient for final filling-up of the circuit breakers in the scope of delivery, and one spare full bottle. A set of all necessary accessories necessary for filling-up and future maintenance of the circuit breakers must also be included.

The supplier is responsible for any damage of the circuit breaker or it's components during shipping on truck, rail and overseas caused by packing failure.

24 Installation.

Circuit breakers must be delivered ready for installation on the support structure, excluding only coupling of control cabinet and topping-in with SF6 gas to be done on site. No any special adjustments of pole operation or other specific works to be needed.

The supplier will not include supervision in his offer.

25 Quality Assurance.

The supplier shall authenticate his ability to design and manufacture HV circuit breakers to purchaser specification, IEC standards and other requirements and also establishes evidence of the proven engineering, design and manufacture of the relevant equipment. The purpose is to ensure that the final product will fulfill its service function.

The supplier shall maintain a Quality Management System certified to ISO 9001 that shall specifically cover the transformer activity in engineering, design, manufacture and testing.

A complete quality assurance manual, describing the execution of all the elements of the quality assurance system, shall be available from the supplier as a reference for the purchaser or his representative.

The documents submitted with the bid shall include a description of the quality assurance and quality inspection plans that will be used to ensure that the equipment design, materials, workmanship, tests, service capability, maintenance and documentation, will fulfill the requirements stated in contract documents, standards and specifications.

The supplier is responsible for any sub-suppliers setting up and executing their own QA system.

The purchaser or his representative shall have the right at any time, without advance notice, to witness any inspection, manufacturing procedure or test at the manufacturers plant and to be informed of the results.

Inspections and tests performed in the presence of the purchaser or his representative will not imply any limitation of the supplier's responsibility.

26 Maintenance.

Circuit breakers shall be designed so that they do not require maintenance or adjustment of the mechanism before 1000 cycles of opening and closing during operation.

27 Documents.

28 Bid documents.

As minimum requirements the bid documents shall include:

- All documents required in the specification.
- Technical data sheets filled in and guaranteed values.
- Manufacturers' catalogues and brochures,
- Reference lists,
- Type test certificates.
- Outline drawing including dimensions and mass of the circuit breaker,
- Drawing of the base with connection points to the support structure,
- Drawing of the name plate.
- List and details of non-compliance and deviations from the specification.

29 After contract documents.


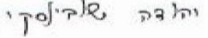

The following documents shall be revised and approved by the purchaser:

- Nameplate drawing.
- General dimension drawing including all details of dimensions, mass and external connections.
- Drawings of the connectors (to be sent to the purchaser for approval).
- Schematics of the control cabinet.
- Test reports of final tests of each circuit breaker in the scope of delivery.
- Instruction book containing all equipment installation, operation and maintenance instructions.
- All test reports and drawing required shall be included.
- Layout of transport packages.
- Identification plates.

	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT			
	TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
	SUB TITLE	QUALITY REQUIREMENTS	Rev. Status Volume	3 03/ 2005 PAGE 1 FROM 7

1. GENERAL

- 1.1** In addition to the provisions of the General Conditions – Annexure "A" and without derogating from the generality there, the Quality Requirements as specified in this document constitute an integral part of the Contract between the Purchaser and the Contractor. Implementing these requirements shall not constitute any base/reason, for the Contractor to change the Contract schedule and/or price.
- 1.2** The Contractor shall make all the necessary arrangements and prepare all the required and necessary means to enable IEC's Quality Control Unit Representative (see clause 2) to review, observe, audit, inspect, test and survey the Work - at any facilities where Work or any part thereof is performed, including those of Contractor and Sub- Contractors, without any additional cost to the Purchaser or any change in the Contract schedule.
- 1.3** The Contractor shall nominate, as part of the execution of the Contract a quality engineer or a quality specialist to control and manage the quality requirements of the Contract. This person shall have the authority and responsibility with respect to all quality requirements of the Contract (including notifying the Purchaser about inspections, tests, etc.) and shall serve as Purchaser's liaison for quality matters.
- 1.4** The Contractor shall be responsible that all of the Contract's quality requirements are known, accepted and performed by its Sub- Contractors. Special attention should be given to Contractor's procurement control and its Sub- Contractor's design control, process and manufacturing control, purchasing control, nonconforming material/events control and inspection notification. Upon Purchaser's request Contractor shall submit un-priced copies of purchase orders pertaining to the Work/Contract.

PREPARED BY A. Givony Q.C. UNIT QUALITY ENGINEERING	CHECKED BY Y. Shubinsky Q.C. Dept. - North MANAGER	APPROVED BY R. Bandel Q.C. UNIT MANAGER
DATE AND SIGNATURE: 01/03/2005 	DATE AND SIGNATURE: 01/03/2005 	DATE AND SIGNATURE: 01/03/2005 

	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev. Status Volume	3 03/ 2005 PAGE 2 FROM 7

2. DEFINITIONS, CLASSIFICATIONS AND ABBREVIATIONS.

- 2.1 CORRECTIVE ACTION (CA)** – As defined in ISO 9000:2000.
- 2.2 HOLD POINT (HP)** – the same as WP but with the distinction that the Contractor is not permitted to proceed with its planned activities without having received Purchaser's written approval.
- 2.3 INSPECTION AND TEST PLAN (ITP)** – a plan, specifying all the inspections and tests for the Work throughout all Contract stages (from its initialing through design, in process inspection, type tests, product qualification, first article inspection, final inspection/s and test/s, packing, transportation and supply to the Purchaser, erection - including Site Acceptance Test and commissioning). ITP shall also specify Witness and Hold Points.
- 2.4 NON CONFORMANCE (NC)** - deviation from any specified Contract requirement/s and/or from any quality characteristic of the Work.
- 2.5 NON CONFORMANCE REPORT (NCR)** - a report, on Contractor's numbered serial form, describing the details of a Non conformance, from its detection through disposition and corrective action(s).
- 2.6 QUALITY CHARACTERISTIC** – Any identifiable property of the Work (i.e. physical ,chemical, functional, visual, technical, environmental, economical, statistical, legal etc.)
- 2.7 QUALITY PLAN (QP)** - Plan, prepared by the Contractor especially for the Contract, in accordance with ISO 10005 which covers all Contract stages.
- 2.8 WITNESS POINT (WP)** - a planned visit of the QCUR for purposes indicated in clause 1.2 for specific point of the ITP or Quality Plan.
- 2.9 WORK** - Scope of the Contract and the means to execute it.
- 2.10 QCUR** - the Purchaser's Quality Control Unit Representative and/or any authorized representative of it.
- 2.11 SPECIAL PROCESS** - Irreversible manufacturing processes or processes which require special or specific tools.

	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev.	3
		Status	03/ 2005
		Volume	PAGE 3 FROM 7

3. QUALITY PLAN AND INSPECTION AND TEST PLAN

3.1 The Contractor shall prepare QP (see 2.7) and ITP (see 2.3) for all stages of the Contract. These plans shall be submitted to the Purchaser for approval within fourteen (14) days of initialing of the Contract by the parties. Contractor shall not amend, change or alter any part of the QP and/or ITP without the prior written approval of the Purchaser.

Note: ITP shall conform to Exhibit 'A' attached hereto or any other form approved by the Purchaser.

3.2 Contractor shall not commence work prior to receiving Purchaser's written approval to the QP and I&T Plan.

4. DOCUMENTATION

4.1 The Contractor shall submit to the Purchaser for review, along with the QP and ITP, its quality and manufacturing/operations procedures that pertain to the Work execution. The Purchaser has the right to receive explanations with respect thereto. Contractor shall provide Purchaser with all amendments and/or updates of documentation.

4.2 Special documents such as process procedures and inspection/test procedures written specifically for the Contract shall be submitted to the Purchaser, for review, comment and approval in accordance with Contract until the date agreed in there, but not less than twenty-one (21) days prior to its use.

4.3 The Contractor shall submit to the Purchaser, for review, comment and approval (as required by the Contract) all the process qualifications and the employees certifications for special processes which pertain to the Work and are relevant to the Contract execution.

4.4 Supplying Work which is not manufactured by the Contractor (under Contract terms) and which he has no control over the manufacturing process, shall not derogate from Contractors responsibility to supply the Purchaser with the documentation and quality records as indicated in Articles 4 and 7.


	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
	TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No. Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev. 3	3
		Status 03/ 2005	03/ 2005
		Volume	PAGE 4 FROM 7

5. INSPECTIONS AND TESTS

- 5.1** The Contractor shall have available all test and inspection equipment and/or any other means, required in Purchaser's opinion, for the execution of Work and ITP.
- 5.2** If Contractor uses the services of a Sub - Contractor to carry out any test/inspection required by the Work, only inspection companies certified to EN 45004 (level A or C) are acceptable.
- 5.2.1** Type test, Routine Test and Sample test shall be carried out according to Contract requirements.
- 5.3** Any other qualification test (for mechanical equipment) shall be carried out in the presence of the QCUR, followed by all quality records. The serial manufacturing shall commence only after 1st Article/piece test have successfully carried out witnessed by the Purchaser's QCUR.

6. INSPECTION NOTIFICATION

- 6.1** The Contractor shall indicate each inspection/test and notify the Purchaser of it in advance. An I&T schedule (on a GANT form) shall be prepared by the Contractor, within six (6) weeks after initialing of the Contract.
 Indications of inspection/test dates may in any event not be less than six (6) weeks in advance. Both inspection/test notification and I & T schedule shall be reported to the Purchaser's Project Management. In addition to the above I&T schedule, Contractor shall submit to Purchaser a final notice of planned tests/inspections not less than twenty-two (22) Israeli working days in advance.
- 6.2** Should Contractor fails to notify the Purchaser of a planned inspection/test, as required, or in the event Contractor carries out a test/inspection without the required presence of the QCUR, Purchaser shall have the option of demanding that Contractor re-perform the test/inspection in the presence of QCUR at a time convenient to Purchaser and at no additional cost..


	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev. Status Volume	3 03/ 2005 PAGE 4 FROM 7

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TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev.	3
		Status	03/ 2005
		Volume	PAGE 5 FROM 7

7. QUALITY RECORDS

- 7.1** The Quality Records stipulated in this clause shall be, either in Hebrew, in dual/multi-language form with English, in English only, or if not available translated to English by Contractor.
- 7.2** Contractor shall submit to the Purchaser copy of the quality records documenting the inspections, tests or other quality operations of the Work, as indicated in the ITP, QP and the Contract. All quality records of skipped or missed WP and/or HP shall be submitted to Purchaser immediately after their generation.
- 7.3** All Test and Inspection Certificates/ Reports of materials, operations and or inspection/test, purchased or carried out for the Work and/or required by the applicable Standards, shall be submitted to the Purchaser immediately following their generation. These Certificates/Reports shall be original, in accordance with EN 10204-3.1B, containing actual measured values, signed and attested by Contractor.
- 7.4** Contractor shall make available to Purchaser upon its request, for review and comment, at Purchaser's premises or other mutually agreed place (in Israel), the quality records of any - Type test, Routine test, Qualification test, First Article Inspection/Test, Process qualification, Special process and/or any other inspection/test/examination required by Purchaser, after initialing of the Contract, to evaluate the Work (at all stages) regardless of the QP and the ITP.
- 7.5** Submission of the documents and quality records, regarding the Equipment to which the documents relate, to Purchaser, as specified in Articles 4 and 7, shall be a condition, precedent to shipment by Contractor and payment by Purchaser.
- 7.6** Quality records of inspections/tests and/or of process control and process evaluation pertaining to a Work such as shelf item, standard Equipment and/ or already completed Equipment to be supplied to Purchaser between 30 to 120 days after execution of the Contract, shall be immediately submitted to the Purchaser or at least 60 days prior to packing for shipment, respectively.

	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev. Status Volume	3 03/ 2005 PAGE 6 FROM 7

8. HANDLING OF NONCONFORMANCES AND CORRECTIVE ACTIONS

- 8.1** It is Purchaser's policy to reject Work and/or Goods that do not conform to all contractual requirements, unless acceptance is in the best interests of Purchaser. Acceptance of nonconforming Work or Goods is the sole prerogative of Purchaser.
- 8.2** It is the Contractor's obligation to report to Purchaser about any nonconforming item/event which pertain to the Work and are relevant to Contract execution.
- 8.3** If the Contractor fails to report about a non conformance on time, Purchaser may request Contractor to dismantle the nonconforming Work (to witness the NC) with no additional cost. The documentation and quality records concerning this NC shall be immediately submitted to the Purchaser.
- 8.4** Each NC should be followed by corrective action/s (CA). A NC which is not followed by CA shall be rejected.
- 8.5** Deviating from 8.4 can cause stoppage of the Work and its rejection till the proper CA is taken by the Contractor.
- 8.5.1** A request for a CA (Corrective Action Request-CAR) presented by the QCUR to the Contractor can also cause stoppage of the Work and its rejection till the proper CA is taken.

	THE ISRAEL ELECTRIC CORPORATION LTD. ORGANIZATION, QUALITY AND SAFETY DIVISION QUALITY CONTROL UNIT		
TITLE	APPENDICES FOR CONTRACTS / ORDERS	Spec. No.	Q - APP - 02
SUB TITLE	QUALITY REQUIREMENTS	Rev.	3
		Status	03/ 2005
		Volume	PAGE 7 FROM 7

EXHIBIT A

I&T Plan FORM

CONTRACTOR'S: NAME, I&T PLAN TITLE, THE PRODUCT INSPECTED/TESTED, and DOCUMENT IDENTITY & APPROVAL.									
PURCHASER'S: NAME AND PROJECT'S NAME AND LOCATION.									
No	THE INSPECTION OR TEST	APPLICABLE DCUMENTS	WP/HP OR OTHER	INSPECTED / TESTED BY				THE REPORT / CERTIFICATE AND ITS REF. STD/ PROCEDURE	REMARKS
				SUB- CONT./ SUPP	CONTR- ACTOR	PURCH- ASER	OTHER		
APPROVAL BY THE CONTRACTOR'S QUALITY ASSURANCE/CONTROL				NOMENCLATURE:					

31

Attache no. 2



The Israel Electric LTD
 Engineering Project Group
 Engineering Division
 Electrical & Controls Sector



STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 1	Of: 13
<p>DOCUMENT: Electrical Standard Specification .</p> <p>SUBJECT: <u>Control Cubicles –</u> <u>Electrical Wiring Requirements.</u></p>			
Date: 09/2004	Applicable: 09/2004	Rev.: -	Cancels: EPD- 3/99 Rev.F

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פרויקט:							
נושא: CONTROL CUBICLES - ELECTRICAL WIRING REQUIREMENTS							
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				09/2004		תאריך:	
שם	חתימה	שם	חתימה	שם	חתימה		
						ה. ושלר	
						א. רוזנברג	
						ג. סנטו	
						מ. זיידמן	
						א. פיץ	
						ד"ר ל. אלציה	
						אישר	
הפצה אל ה"ה:							
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א. רוזנברג	X	ל. ברגר	X	א. כהן	X	מ. אלקלעי	X
א. פיץ	X	ז. קאופמן	X	ג. שטיינברג	X	ג. סנטו	X
מ. זיידמן	X	י. סיליקי	X	ל. וורטמן	X	ב. מאירי	X
ה. ושלר	X	י. שרשי	X	ד. אליעזר	X	ש. אופק	X
א. פינרו	X	א. רובינשטיין	X	ה. קליין	X	ה. לנדאו	X
נ. קרידרמן	X	ד. פרץ	X	ב. זוניס	X	א. שחף	X
ל. פלינר	X	י. סוסקין	X	א. פישמן	X	תיק	X
ס. הראל	X	א. לור	X	מ. דוידוב	X		
א. דימיטריי	X	א. אלכסנדרוב	X	ג. גראוס	X		
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מספר הנוהל:				The Israel Electric Corporation Ltd. Engineering Projects Group Engineering Division Electrical & Controls Sector			
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The Israel Electric LTD
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 Engineering Division
 Electrical & Controls Sector



STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 3	Of: 13																		
<table><tr><td>CONTENT:</td><td>PAGE</td></tr><tr><td>1. GENERAL</td><td>4</td></tr><tr><td>2. WIRING MATERIALS AND REQUIREMENTS</td><td>4</td></tr><tr><td>3. TERMINAL BLOCKS</td><td>6</td></tr><tr><td>4. ARRANGEMENT OF WIRING</td><td>8</td></tr><tr><td>5. TERMINATIONS</td><td>10</td></tr><tr><td>6. MISCELLANEOUS</td><td>11</td></tr><tr><td>7. WIRING TESTS</td><td>12</td></tr><tr><td>8. APPENDIX 1 – INTERNAL WIRING COLOR CODING</td><td>13</td></tr></table>				CONTENT:	PAGE	1. GENERAL	4	2. WIRING MATERIALS AND REQUIREMENTS	4	3. TERMINAL BLOCKS	6	4. ARRANGEMENT OF WIRING	8	5. TERMINATIONS	10	6. MISCELLANEOUS	11	7. WIRING TESTS	12	8. APPENDIX 1 – INTERNAL WIRING COLOR CODING	13
CONTENT:	PAGE																				
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6. MISCELLANEOUS	11																				
7. WIRING TESTS	12																				
8. APPENDIX 1 – INTERNAL WIRING COLOR CODING	13																				
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F																		

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STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 4	Of: 13
<p>1. GENERAL.</p> <p>1.1 This standard applies in the implementation of control , protection , supervisory, instrumentation and measuring circuits included in control systems, protection systems, switchgears, MCC's, control panels and other electrical cubicles of Power Stations <u>and Substations</u>. HOLD</p> <p>1.2 All Control Cubicles shall conform to this Standard Specification , except where overruled by specific requirements of the Project Specification.</p> <p>1.3 This Standard shall also be read in conjunction with Standard EPD-5/2002 Rev.F: " CONTROL CUBICLES REQUIREMENTS " (or EPD –A.05 , to be issued in the future) .</p> <p>2. WIRING MATERIALS AND REQUIREMENTS.</p> <p>2.1 WIRING MATERIALS.</p> <p>2.1.1 The Israeli or European manufacturers shall use stranded copper conductors having halogen free insulation. The wire shall be type HO7Z-K for 750V rated voltage, according to Standards CENELEC HD 22.1 and HD 22.9.</p> <p>2.1.2 The American manufacturers shall use stranded copper switchboard wire , 90°C maximum operating temperature Heat – Resistant SIS Insulation , according to National Electrical Code (NFPA 70-1996) , table 310-13 , having 600V rated insulation .</p> <p>2.1.3 Connections between fixed and hinged panels shall be made with stranded (extra-flexible) switchboard wire , having the same insulation as specified above .</p> <p>2.2 CONTROL WIRING SIZE .</p> <p>2.2.1 For control circuits having a control voltage of 220 VDC or 230 VAC , wires sized 1.5 sq.mm (No. 16 AWG) shall be used .</p> <p>2.2.2 For control and supervisory circuits in which the current is less than 0.2 A , wires sized 1.0 sq.mm (No. 18 AWG) , shall be used .</p>			
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD- 3/99 Rev.F

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The Israel Electric LTD
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 Engineering Division
 Electrical & Controls Sector



STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 5	Of: 13
<p>2.2.3 For control and supervisory circuits of European manufactured Control Systems (DCS) , in which the current is less than 0.2 A , wires sized 0.5 sq.mm (No. 20 AWG) can be used.</p> <p>2.3 POWER WIRING SIZE .</p> <p>2.3.1 This standard refers to the following power circuits :</p> <ul style="list-style-type: none"> a. Primary and secondary connections of control transformers. b. Incoming power circuits . <p>2.3.2 The wiring of the above devices shall be made with similar wires as defined in paragraph 2.1 . The size of the wire shall be correlated with the control transformer primary and secondary currents , with the incoming power circuits currents and with the circuit protection .</p> <p>2.4 CURRENT TRANSFORMER WIRING SIZE.</p> <p>Current Transformer Circuits wiring shall be made with similar wires as defined in paragraph 2.1. The minimum wire size shall be 2.5 sq.mm (No. 14AWG) .</p> <p>2.5 INSTRUMENT WIRING SIZING (Low Level Signal Wiring) .</p> <p>2.5.1 Shielded instrumentation cable shall be used on all low level signal wiring . Unless otherwise specified in the Project Specification , the Contractor shall use twisted-pair No. 18 AWG , Class B stranded-tinned copper-wire , with minimum use 300V insulation over each conductor, aluminized mylar tape (with stranded-tinned copper drain wire) over both conductors , and an overall jacket .</p> <p>2.5.2 If apparatus cannot accept conductors of sizes specified above , than the maximum size of conductors accepted by these apparatus can be used .</p> <p>2.5.3 For Low Level Signal Wiring of European manufactured Control Systems (DCS) , shielded wires sized 0.5 sq.mm (No. 20 AWG) , similar to those used for control wiring can be used , according to the manufacturer standard .</p>			
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F

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STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 6	Of: 13
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3. TERMINAL BLOCKS .

3.1 REQUIREMENTS FOR ISRAELI OR EUROPEAN MANUFACTURERS .

3.1.1 The terminals shall comply with IEC 60947-7-1 , July 2002 Standard .

3.1.2 Type of terminals: screw type terminals .

3.1.3 The housing shall be made of thermosetting or thermoplastic materials having the following characteristics :

- a. Tracking resistance CTI : 600
- b. Continuous service temperature 100 °C
- c. Inflammability class UL94-VO
- d. Halogen and asbestos free
- e. Good tropical and termite resistance
- f. Contamination class 3

3.1.4 The metal parts (clamping parts and current carrying parts) shall be made of copper alloy to eliminate corrosion .
The screw clamping method shall be vibration resistant .

3.1.5 Mounting rail TS 32

3.1.6 Rated Voltage 800 V

3.1.7 Approved terminal blocks Manufacturers : Phoenix or Wiedmuller , as follows :

	<u>Phoenix</u>	Weidmuller
a. Control and Instrumentation wiring up to 1.5 sq.mm (No. 16 AWG) ...	UK 2.5 N	WDU 2.5 N
b. Control and Power wiring up to 6.0 sq.mm (No. 10 AWG)....	UK 6N	WDU 6N
c. Power wiring Up to 10 sq.mm (No. 4 AWG)	UK 16N	WDU 16N
d. Current transformer circuits *	UGSK/S	WTQ 6/1

*: Three (3) terminals shall be used for each current transformer.

Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F
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STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 7	Of: 13
<p>3.1.8 The insulation material of terminal blocks shall not be adversely affected by abnormal heat and fire . Compliance to this requirement shall be checked by the needle flame test , according to Standard IEC 60695-2-2 .</p> <p>3.1.9 Performance Requirements .</p> <p>3.1.9.1 Temperature Rise . The terminal blocks shall be tested in accordance with Standard IEC 60947-1-1 , item 8.4.5 . The temperature rise of terminals shall not exceed 45°C .</p> <p>3.1.9.2 Rated Short-time Withstand Capability . The terminal blocks shall be capable of withstanding for 1 sec. the rated short-time withstanding current which corresponds to 120A/mm² of its rated cross-section , according to Standard IEC 60947-1-1 ,item 8.4.6.</p> <p>3.1.10 For European manufactured equipment Maxi-Termi-Point terminals , according to DIN/VDE 0815 Standard can be used .</p> <p>3.2 REQUIREMENTS FOR AMERICAN MANUFACTURERS .</p> <p>3.2.1 The terminals shall comply with the NEMA Standard Publication No. ICS 4 /2000 and shall be UL approved .</p> <p>3.2.2 Molded thermoset phenolic base – rated 150°C .</p> <p>3.2.3 Suitable for connection of copper conductors .</p> <p>3.2.4 Washer head screw contacts .</p> <p>3.2.5 The metal parts (clamping parts and current carrying parts) shall be made of copper alloy to eliminate corrosion .</p> <p>3.2.6 Rated insulation voltage : -- For control and instrumentation circuits less than 120V : U_i = 300 V -- For control and instrumentation circuits above 120V : U_i = 600 V</p>			
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F

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Engineering Division
Electrical & Controls Sector



STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 8	Of: 13
<p>3.2.7 The following terminal blocks are accepted :</p> <p>a. For control circuits 120 V and above : Series 1500 or Series 1600 , Marathon Special Products Co. ,or Catalogue No. 2B112 Buchanan .</p> <p>b. For control circuits less than 120 V and instrumentation : Series 300 Marathon Special Products Co. , or Type CR151B – General Electric .</p> <p>4. <u>ARRANGEMENT OF WIRING.</u></p> <p>4.1 Wire and wire groups extending from terminal blocks to instruments or devices on cubicles , or from one cubicle to another , shall be installed in halogen free ducts or troughs and packed in neatly formed bundles securely clamped or tied together and supported from the cubicle framework. Plastic cable ties (Halogen free or EPR) shall be used to bundle wires outside of ducts or troughs . No more than 30 wires shall be bundled together in wire hinge loops.</p> <p>4.2 When wiring is installed in wire ducts or troughs , the edges of the cut-outs troughs which the wires pass shall be provided with suitable protection of the insulation from cuts or nicks .</p> <p>4.3 Shielded instrument cables carrying low level signals shall be in separate bundles or wire-ways .</p> <p>4.4 Drain wires and shield tapes shall be fully insulated and terminated at terminal blocks . Grounding of shielded wires shall be as defined in the Project Specification or drawings .</p> <p>4.5 Wire extensions from wire-ways or bundles to instruments shall be neatly formed, attached and secured to the cubicles with wire cleats . Bends in the wiring shall be carefully made in such a manner that the insulation or cover is not damaged . Care shall be used in removing insulation from the wire , so that the wire will not be cut or nicked .</p>			
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F

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STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 10	Of: 13
<p>5. TERMINATIONS.</p> <p>5.1 Compression type (solder-less) lugs or ferrules shall be applied on the ends of all stranded wires for connection to terminal blocks or to instruments . For connection to screw type terminals , isolated fork type terminal lugs should be used . The lugs should be tin plated to resist corrosion .</p> <p>5.2 The wire insulation shall be removed for the lug application without nicking the conductor . The wire shall be firmly inserted into the lug and crimped with the specified tool , recommended by the lug manufacturer . Devices having compression clamps, push-on, etc type terminals will be wired accordingly .</p> <p>5.3 All solder and push-on type connections shall have snug fittings insulated sleeves which cover the entire lug and extend 1/4 inch (6mm) over the insulation .</p> <p>5.4 Terminal blocks shall be provided for terminating all wiring entering and leaving the cubicles , except the leads from thermocouples and other temperature detecting devices , and devices connected with prefabricated cables , that may be field run directly to the terminals in the instrument cases .</p> <p>5.5 Thermocouple extension wire and other solid wire terminations shall be made without the use of lugs .</p> <p>5.6 The arrangement of terminal blocks for Purchaser's connections shall permit convenient cable installation . Cable supports shall be provided for Purchaser's wiring . Wiring troughs shall be provided in areas requiring a high density of such cables . Routing paths of all such cables shall be shown on Contractor's cubicle wiring diagrams . Adhesive-backed wire bundle grips are not accepted for supporting wire extensions .</p> <p>5.7 Terminal blocks shall be arranged with terminals in vertical or horizontal rows . Terminal blocks shall have each point identified indelibly .</p>			
Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancels: EPD-3/99 Rev.F

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STANDARD No.	Control Cubicles –	Page:	Of:
The Israel Electric LTD Engineering Project Group Engineering Division Electrical & Controls Sector			13

STANDARD No.	Control Cubicles –	Page:	Of:
EPD-A.03	Electrical Wiring Requirements.	11	13
<p>One side of the terminal blocks shall be left free for Purchaser's connections.</p> <p>All jumpers between terminals shall be made on the internal wiring side .</p> <p>Terminals associated with individual items of equipment shall be grouped together for convenient cable connections .</p> <p>5.8 The terminal blocks shall not be mounted closer than 7 inches (180 mm) from the control cubicle walls and at least 10 inches (250 mm) from the cable entrance .</p> <p>Central line distance between terminal blocks shall be a minimum of 8 inches (200 mm) .</p> <p>Where terminal blocks for Purchaser's connections are mounted on vertical wire-ways , the inside area of said wire-ways shall be reserved exclusively for Purchaser's incoming cables .</p> <p>5.9 All incoming power terminals shall be clearly identified in a manner distinctly different from all other terminations , for safety in maintenance.</p> <p>It is recommended to group the terminals as follows :</p> <p>5.9.1 Power</p> <p>5.9.2 Control AC / DC (120 V/ 220 V)</p> <p>5.9.3 Control DC circuits 24 VDC , 48 VDC , 60 VDC</p> <p>5.9.4 Instrumentation</p> <p>5.10 Where bottom cable entry is used , the vertical wire-ways shall be located over floor openings , to allow Purchaser's cable to have a clear run directly to the terminal blocks .</p> <p>6. MISCELLANEOUS.</p> <p>6.1 If any component is not available at the time of shipment , Contractor shall provide wooden templates complete with accurate terminal arrangement and all wiring terminated .</p> <p>The plate shall closely resemble the configuration of the missing component , so that the cubicle wiring can be bundled and identified for easy substitution of the missing device in field .</p>			
Date:	Applicable:	Rev.	Cancels: EPD-3/99 Rev.F
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STANDARD No. EPD-A.03	Control Cubicles – Electrical Wiring Requirements.	Page: 13	Of: 13
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8. APPENDIX 1 – INTERNAL WIRING COLOR CODING .

The following color coding is required for the internal wiring of control cubicles :

8.1 AC CIRCUITS .

- 8.1.1 Protective earth : Yellow - Green (mandatory)
- 8.1.2 Neutral : Blue

8.2 AC POWER CIRCUITS .

- 8.2.1 One (1) phase : Brown
- 8.2.2 Three (3) phase :
 - Phase L1 : Brown (preferred) , or
Brown + L1 marking / sleeve
 - Phase L2 : Brown – Orange (brown with one orange
strip on the whole wire length -preferred) ,
or
Brown + L2 marking / sleeve
 - Phase L3 : Brown – Black (brown with one black
strip on the whole wire length- preferred) ,
or
Brown + L3 marking / sleeve

8.3 DC POWER CIRCUITS .

- 8.3.1 (+) : Brown
- 8.3.2 (-) : Blue

8.4 CONTROL CIRCUITS . : Grey (preferred) , or Black .

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Date: 09/2004	Applicable: 09/2004	Rev. 01	Cancel: EPD-3/99 Rev.F
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