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1. Introduction

- 1.1 This document has been produced by the Pakistan National Accreditation Council (PNAC) in conjunction with the PNAC Sectoral Committee for Inspection Bodies. It provides guidance to those requirements in ISO/IEC 17020 and Agreement between PNAC & IBs (F-01/13) that need interpretation when applied by Inspection Bodies carrying out inspection of Non-public High Voltage Electrical Systems. It does not cover all of the requirements of ISO/IEC 17020-General criteria for the operation of various types of bodies performing inspection and Agreement between PNAC & IBs (F-01/13). Inspection Bodies are reminded of the need to comply with all of the requirements in these documents. Appeals concerning interpretation will be considered in accordance with the PNAC Appeals Procedure. Other PNAC documents may be referred to where relevant.
- 1.2 The selection of an inspection body accredited against the requirements of ISO/IEC 17020 and this publication is intended to give the owner or user of an electrical installation the assurance of the level of competence concerning the provision of an inspection service.
- 1.3 For the purposes of this publication the term *Inspection Body* shall be taken to mean an accredited inspection body.


2 Inspection services covered by ISO/IEC 17020 Clause 3.3:

2.1 Scope

- 2.2.1 This publication details the requirements for inspection bodies undertaking the inspection of electrical systems, in the field identified in Sub-clause 2.1.2 of this document. The inspection is to ensure, as far as reasonably practicable, the detection of potential and actual defects, particularly those which may be a cause of danger or injury to persons or damage to property. It is also to ascertain if the electrical system meets relevant statutory requirements, national or international standards, approved codes of practice or guidance and similar documents.
- 2.1.2 (a) For this publication the field of inspection is electrical equipment forming part of, and connected to, a high voltage (HV) system operating above 1000V ac or 1500V dc. HV traction systems are excluded as they warrant separate consideration.
- (b) This publication embraces non-public HV electrical plant (e.g. switchgear, capacitors, reactors, transformers, motors and generators) including the associated HV cables, joints and terminations, where these are accessible for inspection. Where a substation incorporates transformation to Low Voltage (LV), the HV/LV transformer, associated LV cables and busbars to the disconnect points of the outgoing LV circuits are also included, i.e. the equipment and busbars contained within the HV zone of protection.
- Also included are items of ancillary equipment that are necessary for the safe and proper functioning of the system, eg tripping and closing batteries, battery chargers, protection/control systems and earthing systems.

3 Independence, impartiality and integrity (ISO/IEC 17020 Clause 4)

- 3.1 Inspection Bodies operating as Type A, B or C bodies as defined in ISO/IEC 17020 may be accredited for inspecting electrical systems provided that they meet the requirements of ISO/IEC 17020 and this publication.

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3.2 *Independence*

- 3.2.1 To ensure the independence of inspection work, the reporting chain for inspection shall be separable from that of any other work undertaken.
- 3.2.2 A Type C inspection body which undertakes installation, maintenance or remedial work in conjunction with inspections shall have clearly documented procedures for each activity and shall establish adequate safeguards to ensure the integrity of the inspections. Such safeguards may include the use of alternative inspection and maintenance staff and the independent auditing of inspection work.

4 Organization, management and supervision (ISO/IEC 17020 Sub-clause 6.4)

- 4.1 The following requirements shall apply:

For the inspection of electrical systems covered by this publication the requirements for supervision shown in Table 1 shall apply.

- 4.2 The technical manager in charge of, and having overall responsibility for, an inspection body seeking accreditation is to be of Category 1 status and be directly employed by the inspection body.
- 4.3 For effective supervision, the technical manager may delegate supervisory responsibilities to locally appointed managers.
- 4.4 In addition to management personnel there will be requirements for personnel working on site who are qualified at lower levels but who have the ability to undertake inspection tasks and duties at the level assigned to them.
- 4.5 Where sub-contracted service providers are required they shall be able to demonstrate their technical competence and ability to undertake the required tasks to the satisfaction of the technical manager.

5 Personnel qualifications and competence (ISO/IEC 17020 Clause 8)

- 5.1 The requirements for qualifications, experience and training relevant to the inspections covered by this document are shown in Table 1.


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Table 1				
Experience category and supervision				
Risk Group	Highest voltage level in work area	Technical Manager & Deputy	Locally appointed manager (according to operational needs eg, remote sites)	Inspection personnel
X	Above 36kV	Category 1 5 years' experience in this risk group	Category 1 5 years' experience in this risk group Supervision Level B	Category 2 4 years' experience Supervision Level B
Y	Above 12kV up to 36kV	Category 1 5 years' experience in this risk group	Category 1 4 years' appropriate experience Supervision Level C	Category 2 3 years' experience Supervision Level C
Z	Between 1kV & 12kV	Category 1 5 years' experience in this risk group	Category 2 3 years' appropriate experience Supervision Level C	Category 2 2 years' appropriate experience Supervision Level C

Notes to Table 1

- 1 Categories, levels of supervision and constraints placed on activities are explained in Appendices 1, 2 and 3.
- 2 Category 1 personnel undertaking inspection activities shall be subject to Supervision Level A
- 3 An inspection body may be accredited to undertake inspections in one or more of the groups X, Y, or Z.


6 Training (ISO/IEC 17020 Sub-clause 8.2)

- 6.1 The inspection body shall ensure that each member of the inspection staff receives training and can demonstrate a working knowledge of:
- (a) the relevant type(s) of electrical system(s) including construction, inspection, testing, operation, maintenance, significance of defects and typical problem areas.
 - (b) where relevant, any associated areas of technology;

7 Equipment (ISO/IEC 17020 Clauses 9.7 and 9.8)

- 7.1 Inspection and test equipment used during an inspection shall be fit for purpose and suitable for the locations in which it is intended to be used.

8 Inspection methods and procedures (ISO/IEC 17020 Clause 10)

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- 8.1 (a) The inspection body shall make it clear to those seeking the inspection body's services where it may be necessary to close down or otherwise de-energise and isolate equipment in order to complete the inspection. The implications of such isolation shall be considered by the inspection body and owner/operator/user.
- (b) The inspection body shall co-operate with the equipment/installation owner/operator/user to ensure that inspections cause the minimum of disruption.
- 8.2 Inspection staff shall comply with any regulatory or local requirements relating to such procedures as Permits to Work, Sanctions to/for Test and other access control procedures appropriate to the field of activity.
- 8.3 In particular with Type C inspection bodies, where inspection duties may run concurrently with other duties, for example maintenance work, work being undertaken shall not extend beyond that covered by permits to work (or similar documents). If permit extensions are deemed necessary, authorization shall be obtained in writing prior to undertaking the work.

9.0 Records (ISO/IEC 17020 Clause 12)

- 9.1 Where integral recording facilities in inspection or test equipment are used the data shall be transferred in a readily accessible form to a permanent site at regular intervals.

10 Reporting (ISO/IEC 17020 Clause 13)


- 10.1 The following requirements shall apply:

Where inspections cannot be completed due to unavailability or non-access to any part of the installation, plant or equipment being inspected this limitation should be stated in the report.

- 10.2 Where maintenance, remedial or installation work is undertaken concurrently with inspection work, the associated inspection report shall clearly define the work associated with inspection and testing in a manner of sufficient accuracy for meaningful audit trails.

REFERENCES

- ISO/IEC 17020, General Criteria for the Operation of Various Types of Bodies Performing Inspection
- IAF/ILAC-A4: 2004, Guidance on the Application of ISO/IEC 17020

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Appendix 1

QUALIFICATION AND COMPETENCY CATEGORIES

Category 1.

Graduate Engineer holding membership of Pakistan Engineering Council (PEC) with at least 4 years experience in a relevant engineering discipline of which at least two years shall have been spent working within an engineering discipline associated with the Inspection of Non-public High Voltage Electrical Systems.

Category 2.

Bachelor of technology from respective Board of Technical Education with at least 5 years experience in a relevant engineering discipline of which at least two years shall have been spent working within an engineering discipline associated with the Inspection of Non-public High Voltage Electrical Systems.

Category 3.

Person having three years diploma of Associate Engineers as defined by PEC with at least 6 years of experience in a relevant engineering discipline of which at least three years shall have been spent working in an engineering discipline associated with the Inspection of Non-public High Voltage Electrical Systems.

Category 4.

Person having two years vocational technical training as defined by PEC with at least 7 years of experience in a relevant engineering discipline of which at least three years shall have been spent working in an engineering discipline associated with the Inspection of Non-public High Voltage Electrical Systems.

Category 5.


Person having three years apprenticeship training as defined by PEC with at least 9 years of experience in a relevant engineering discipline of which at least 5 years shall have been spent working in an engineering discipline associated with the Inspection of Non-public High Voltage Electrical Systems.

Category 6.

Person employed prior to the date of application for accreditation in the inspection of pressure systems with less than tradesman's apprenticeship but having minimum Matriculation qualification with a minimum of 10 years spent working with an industry associated with relevant field of inspection and has general knowledge of relevant field of inspection and its operating environment

Note 1: All qualifications shall be from Higher Education Commission (HEC), Inter Board Committee Chairman (IBCC) & Board of Technical Education approved Universities, Colleges & Institutes.

Note 2: The persons from category 1-6 shall have training on relevant standard including the ISO/IEC 17020.

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Appendix 2

LEVELS OF SUPERVISION

Regular documented meetings of inspection personnel with their management shall be conducted to resolve specific issues and to review work undertaken.

In the Levels described below, ‘Supervisor’ means a more qualified / and or experienced technical person, however named. Direct Contact means on the job contact at the site of operation.

Level A: Occasional

Formal, direct contact to review work with Supervisor at least annually. More frequent direct contact with Supervisor may be necessary. Authoritative technical support from personnel of Category 1 or 2 to be readily available.

Level B: In-frequent


Direct contact with Supervisor at least every 3 months. Access to supervision and technically authoritative support to be available as needed.

Level C: Frequent

Direct contact with Supervisor at least weekly. Authoritative technical support from Category 1 or 2 personnel.

Level D: Constant

Direct daily contact with Supervisor at site of operation. Authoritative technical support from Category 1 or 2 personnel to be readily available.

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Appendix 3

CONSTRAINTS PLACED ON ACTIVITIES

Inspection personnel shall restrict their tasks to those within the bounds of their authorization and responsibilities.

Safety access documents such as Permits to Work are required before most tasks are undertaken on non-public HV systems. Only when these have been authorized by the responsible person, can relevant work be undertaken. All the requirements, including signing off on completion, shall be strictly adhered to.

Inspection activities or tests shall be in accordance with relevant Standards, Codes of Practice, Performance Specifications, and related National Statutory legislation.

Inspection staff must not:

- (a) Become involved with technology outside their field of declared competence other than when in consultation with, and acting with the approval of, competent persons.
- (b) Carry out any repairs to equipment or to initiate changes to operating parameters unless it is in accordance with their assigned duties.
- (c) Authorize or undertake any remedial action beyond their authorization. Where such action, which is believed to be required, but is outside their authorization, inspection staff should consult with an authorized responsible persons who shall authorize any agreed requirements in writing.