AUDITING OF HIGH VOLTAGE INSTALLATIONS

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The purpose of a High Voltage Audit is to minimise the risk to people, plant, and environment from the normal and abnormal operation of High Voltage Power Equipment through Design Examination and Physical Inspection.

High Voltage Audits may be applied to:

• New or Altered Installations
• Existing Installations
New Installations
NEW OR ALTERED INSTALLATIONS

• HV Auditing is required under the Queensland Electricity Act 2002.

• Any New or Altered High Voltage Installation in Queensland must be audited prior to connection to a source of Power.

• HV Auditors are accredited by the Queensland Government.

• Similar provisions apply in most, but not all other States.
Existing Installations
Existing Installations
EXISTING INSTALLATIONS

Reasons for auditing Existing Installations include:

• Safety and Compliance
  – Obligation under Safety Management Plan
  – Often required by Mines or Industry Inspectors

• Criticality of Installation
  – Public Utilities, High Risk Operations

• Reliability Issues
  – Unacceptable fault or downtime records

• Lifetime Expectations
  – Ageing or Obsolescent Equipment
New HV Installations were generally inspected by a representative of the Power Supply Entity before connection.

Changes in the Power Supply Industry resulted in external and independent audit inspection.

Final Certification for connection is by:

- Accredited HV Auditor in Queensland
- Class V Electrical Inspector in Victoria
- Professional Engineer in WA
- Competent HV Practitioner in Tasmania
REQUIREMENTS OF HV AUDIT

• To ensure that the installation meets the requirements of the Electricity Act and Regulation and other relevant Legislation.
• To ensure that the installation may be safely connected.
• Independent Review – No other involvement in the design or implementation of the installation by the HV Auditor.
WHERE DOES HV AUDIT APPLY?

• Statutory requirement in Qld with some significant exemptions. (eg Coal Mines, Queensland Rail, defined entities)
• Most State jurisdictions have similar requirements.
• Exempt bodies including Coal Mines and Queensland Rail are now requesting HV Audits as part of their Risk Management and Acceptance Procedures.
COMPLIANCE

• Under the Electricity Acts and Regs:
  – ASNZS3000 – Wiring Rules
  – AS2067 – High Voltage Installations
• Coal Mining Safety & Health Act and Regs
• Other Relevant Standards include:
  – AS1768 – Lightning Protection
  – AS3007 – Surface Mines
  – AS/NZS7000 – Overhead Line Design
HV AUDIT PROCESS

1. System Studies sign-off
2. Design sign-off
3. Equipment Compliance
4. Equipment Testing
5. Installation Compliance
6. Installation Testing
7. Operational Procedures
1. SYSTEM STUDIES

Assurance that the following studies and calculations have been performed:

• Fault Level Calculations
• Protection Studies
• Earthing Study/Design
• Step & Touch Potential Studies
• Professional Engineer sign-off (RPEQ in Queensland)
2. DESIGN

Assurance that the design has been adequately carried out and recorded:

- Equipment selection
- Power Circuit Design
- Earthing System
- Protection and Control
- Professional Engineer sign-off (RPEQ in Queensland)
3. EQUIPMENT COMPLIANCE

Design to AS or International equivalent including:

• Rated Voltage
• Rated Current
• Over-voltage limits
• Surge Voltage withstand
• Short-circuit Current Rating
• Degree of Enclosure
• Arc Fault Containment
4. EQUIPMENT TESTING

New or refurbished equipment subject to appropriate:

- Type Tests
- Factory Acceptance Tests
- Pre-operational Tests
- Functional Tests
5. INSTALLATION COMPLIANCE

Site Inspection includes:

- Structures, Buildings and Enclosures
- Equipment
  - Switchgear
  - Transformers including NER’s
  - Power Factor Correction Units
  - Generators and Motors
- Installation
  - Power Lines and Cables
  - Earthing, Bonding and Lightning Protection
  - Equipment Identification and Safety Signage
6. INSTALLATION TESTING

- Insulation Resistance
- High Voltage testing (where appropriate)
- Phasing/Phase Rotation
- Protection Relay Testing
- Earthing Integrity
- Functional Testing
- Auxiliary Equipment
- Operational Testing
7. OPERATIONAL PROCEDURES

Formal Written Procedures including:
• Normal Operational Procedures
• Isolation and Access (HVIA)
  – Switching Procedures
  – Dissipation of Stored Charge
  – Isolation and Earthing
  – Work Permits
  – Access Permits
  – Test Permits
TYPES OF INSTALLATIONS AUDITED

• Utilities and Infrastructure
  – Rail Electrification, Ports, Water Supply, Coal Seam Gas

• Industry
  – Alumina, Aluminium Smelting, Cement, Chemicals, Explosives, Magnesia, Shale Oil Extraction, Waste Management, Zinc Smelting

• Mines
  – Coal, Gold, Ilmenite, Magnesite, Salt, Silica, Wolfram

• Commercial and Institutional
  – Hospitals, Shopping Centres
SOME FINDINGS

• An analysis of some 60 new or altered HV Installations.
• Similar findings from Audits of Existing Installations
Observed Non-Conformances

ID Labelling and Safety Signage
Earthing and Bonding
HV Cable Installation
Security, Enclosures and Barriers
Drawings, Documentation and Barriers
Fault Level, Installation, Records
HVIA and Operating Procedure
Equipment Condition or Fault
Factory Acceptance/Oil Containment
Fire Protection/Prevention
Access Controls
Protection System Functional
Testing
Fault Level
ONGOING ISSUES

• Incomplete Work
• Interim Acceptance?
• Replacement of Existing Equipment
  – Maintenance or Alteration?
• Existing Installations outside Scope of Audit, but non-conforming?
• Lack of a Forum for HV Auditors
QUESTIONS?