ENERGY SYSTEMS

Quality Management, Environmental Management & Health & Safety Standards

ISO 9001 CERTIFIED UKAS MANAGEMENT SYSTEMS 8209 British Assessment Bureau

ISO 14001 CERTIFIED UKAS MANAGEMENT SYSTEMS 8209 British Assessment Bureau

ISO 45001 CERTIFIED UKAS MANAGEMENT SYSTEMS 8209 British Assessment Bureau

ACCREDITED LR NERS NATIONAL ELECTRICITY REGISTRATION SCHEME

DESIGN - INSTALLATION – COMMISSIONING – OPERATION

Grid Connections	Energy Storage
Transmission and Distribution	Protection and Control Systems
Industrial Installations	Operation and Maintenance
Commercial Installations	Civil Designs
Renewable Energy Systems	Construction and Structural Works

ENERGY SYSTEMS

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1. Preparation and Management:

- Technical feasibility assessments
- Cost estimates
- Completion of technical documents
- DNO and ENA G99 grid connection applications
- Review of DNO grid connection offers
- Negotiation of Offers
- Liaison with 3rd party landowners
- Consultation with Statutory and Utility organisations

2. Design and Compliance Studies:

- HV & LV energy systems complete design packages
- Power quality monitoring and assessment
- ER G5/4: Harmonic distortion assessment
- ER P28: Voltage fluctuations assessment (Transformer Inrush)
- Earthing design studies, incl. soil resistivity test reports
- Cable selection & verification
- Switchgear selection & verification
- Protection systems design
- Protection system grading study
- Controls and communications design
- Civil and construction works designs
- Due Diligence reporting on 3rd party designs

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3. Supply and Site Installation Works:

- Complete substation building and compound construction, incl. groundworks, roads, structures and building services.
- High Voltage (HV) conductors, cables and busbar systems supply and installation, including containment, jointing and terminations.
- Low Voltage (LV, incl. control, auxiliary, LV power) cables and busbar systems supply and installation, including containment, jointing and terminations.
- Earthing conductors, cables and electrodes, DNO specific (where req.) and installed to bespoke design.
- Power transformers, instrument transformers and Neutral Earthing Transformers for all applications.
- HV switchgear and ancillary equipment, such as battery charger units, marshalling kiosks, Remote Terminal Units (RTUs), Interface panels, Control panels and active management systems.
- Electrical system protection; whether integral to the HV switchgear, or installed as separate protection panel systems.
- Senior Authorised Person (SAP) duties on 'live' HV systems, such as switching and issuing of safety documents.

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4. Testing & Commissioning:

Switchgear, Protection and Controls

- Functional checks and switchgear integrity
- Ductor testing
- AC pressure testing
- Insulation Resistance tests
- Primary injection tests (CTs and VTs)
- Protection settings and logic setup
- Secondary injection of protection relays
- Protection timing tests
- Auxiliary relays and intertripping
- SCADA interface (control & comms)
- Auxiliary DC supplies and alarms
- G99 device setup and testing
- Firm and Enhanced Frequency Response (FFR / EFR) testing

- 'Testing & Commissioning' continued overleaf -

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Cables

- Verification of manufacturer's recommendations
- Continuity of cores and earth screens
- Phase Sequence verification
- Insulation Resistance (before and after acceptance test)
- DC Overvoltage or Pressure testing
- AC Low Frequency – VLF
- Sheath integrity
- Dielectric quality testing – Partial Discharge / Tan-Delta

Power Transformers

- Insulation Resistance (before and after acceptance test)
- Voltage withstand test
- Induced voltage test
- Voltage ratio measurement and check of polarities and connections
- No-load current and no-load loss measurement
- Winding resistance measurement
- Short-circuit impedance and load loss measurement
- Partial discharge measurement
- Dielectric oil sampling and analysis

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5. Operation & Maintenance

365 day / 24hr SAP on-call facility. Site attendance assured within 24hrs of receiving call-out request (Mainland UK).

Periodic HV Inspection and Maintenance

Preventative maintenance. Designed to monitor for deterioration and help prevent significant failures leading to costly repairs and downtime of your plant.

We offer bespoke packages, tailored to meet your technical and commercial requirements. The following 1-4 levels of cover may be developed to suit the design, age and commercial obligations of the assets covered.

Level 1

Desktop review of HV systems as-built drawings, technical specifications, commissioning and maintenance records. Report to include executive summary, observations and recommendations.

Recommended period: Once - initial site appraisal

Level 2

High-level visual inspection of HV systems. Observe and record condition of assets. Reported as an Executive Summary, within 5 working days of site attendance.

Recommended period: 6 months

- 'Operation & Maintenance' continued overleaf -

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Level 3

Comprehensive visual inspection of HV systems. Switchgear functional checks. Access cable termination compartments for inspection. Recording and documenting of asset technical data. Photographic reporting to include conclusions and recommendations. Detailed schedule of assets appended to report, provided within 5 working days of site attendance.

Note: in order to check switchgear functions and safely access cable terminations a controlled shutdown is necessary; logically planned by our SAPs with prior customer consultation to minimise disruption.

Recommended period: 1 year

Level 4

As Level 3, plus critical verification of HV system performance to include;

<u>Switchgear and protective devices:</u>

Verification of protection settings and software logic
Voltage and current measuring device (CT & VT) point values recorded
Trip relay actuation testing
HV circuit breaker timing testing
Alarm signaling checks
Interlocking checks
Automated/motorised mechanism operation

<u>Cables:</u>

Insulation Resistance testing
Partial Discharge testing
Earth screen bonding inspection

- 'Level 4' continued overleaf -

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Transformers:

Desiccant breather replacement (free-breathing, oil-filled transformers)
Dielectric oil sampling and analysis (oil-filled transformers)
Insulation Resistance testing of windings (where possible)
Mechanical trip testing

Ancillary systems:

DC tripping units (battery chargers) load testing
SCADA and communications simulation checks
Building electrical installation BS7671 periodic testing

Full report with test documentation issued within 10 working days of site attendance.

Recommended period: 5 years