VOLTAGE OPTIMISATION

Industrial Compliance Guide | Design, Installation & Verification

A practical guide to assessing and integrating voltage optimisation (VO) equipment within industrial low-voltage electrical installations. Compliance depends on the site design, equipment ratings, operating environment and applicable standards.

01 | Legal and regulatory framework

The **Electricity at Work Regulations 1989** require electrical systems to be constructed and maintained to prevent danger, with suitable working practices and competent persons. The **Health and Safety at Work etc. Act 1974** and relevant site safety duties also apply. Voltage optimisation is not itself a universal legal requirement or a guaranteed energy-saving measure.

02 | Standards and product conformity

BS 7671 applies to the design, erection, inspection and testing of the associated electrical installation. Relevant product standards depend on the VO technology and its construction; they may include standards for transformers, assemblies, controlgear and EMC. Confirm the manufacturer’s declared standards, conformity documentation, ratings and installation instructions rather than assuming one standard covers every system.

03 | Establishing a defensible business case

Before specifying VO, assess incoming voltage trends, maximum demand, load profiles and connected equipment. Use representative monitoring periods that include normal production, shifts and seasonal variation where relevant. A high supply voltage alone does not establish energy savings; regulated loads and inverter-driven equipment may show little reduction in consumption.

04 | Suitability of industrial loads

Review motors, variable-speed drives, process machinery, compressors, lighting, controls, UPS equipment and sensitive electronics. Confirm permitted operating voltage ranges, starting characteristics, torque requirements, process tolerances and manufacturer restrictions. Voltage reduction must not cause undervoltage, stalled motors, process instability or nuisance trips.

DESIGN & INSTALLATION REQUIREMENTS

05 | Electrical design assessment

Confirm supply arrangement, phase configuration, nominal voltage, frequency, earthing system, available fault current, load current and future capacity. Size the equipment for continuous and transient duties, including motor starting and harmonics where relevant. Assess voltage drop and minimum voltage at the most remote equipment under worst-case operating conditions.

06 | LV switchgear and protection coordination

Check the compatibility of the VO unit with existing main switchboards, MCCBs, ACBs, submains and distribution boards. Evaluate overload and short-circuit protection, prospective fault current, selectivity, thermal limits, isolation and emergency switching. Changes to an existing assembly must not invalidate its safety or declared characteristics; obtain competent assessment and manufacturer input where required.

07 | Earthing, neutral and protective measures

Review protective conductor arrangements, neutral continuity, bonding, automatic disconnection of supply and any switching of neutral conductors. Confirm that bypass or maintenance arrangements preserve the necessary protective measures in every operating state. Earthing and fault protection must be verified against the actual installation and VO topology.

08 | Bypass, isolation and maintenance

Provide safe means of isolation and suitable arrangements for inspection, servicing and fault recovery. If a bypass is proposed, design appropriate interlocking, switching sequence, protection and signage. Do not assume a manual or automatic bypass is acceptable without evaluating the potential for paralleling, transient conditions and equipment damage.

09 | Harmonics, EMC and power quality

Industrial sites may contain variable-speed drives, rectifiers, welders and nonlinear loads. Consider harmonic distortion, imbalance, voltage dips, transients and electromagnetic compatibility. VO equipment must be compatible with the site’s power-quality characteristics and should not be presented as a universal harmonic filter or power factor correction solution.

10 | Physical installation and operational safety

Assess space, access, lifting, structural support, ventilation, temperature, ingress protection, noise and fire precautions. Plan shutdowns, lock-off, proving dead and commissioning around production needs. Use a documented risk assessment and method statement, particularly for live operational factories and critical processes.

VERIFICATION, RECORDS & ONGOING REVIEW

11 | Inspection, testing and commissioning

Complete appropriate inspection and testing under BS 7671 for the work undertaken. Verify polarity, protective conductor continuity, insulation, fault protection, phase sequence, functional controls and protective-device settings as applicable. Commission all operating modes, alarms, bypass arrangements and response to abnormal supply conditions according to the manufacturer's instructions.

12 | Demonstrating energy performance

Where savings are claimed, agree a measurement and verification method before installation. Compare representative pre- and post-installation energy use, accounting for changes in production output, operating hours, weather, occupancy and other major influences. Metering should distinguish real energy (kWh) from voltage or apparent power changes. Savings estimates should be clearly qualified.

13 | Documentation and handover

Retain design calculations, load assessment, voltage monitoring, product declarations, schematics, equipment settings, commissioning results, certificates where applicable, operating instructions, maintenance requirements and any energy-performance baseline. Update distribution labels and as-built information to reflect the final arrangement.

INDUSTRIAL COMPLIANCE CHECKLIST

Site assessment	Representative voltage, demand and load profile reviewed
Load compatibility	Machinery and electronic equipment voltage tolerances checked
Protection	Fault levels, disconnection, coordination and isolation verified
Integration	Switchgear, neutral, earthing and bypass arrangements assessed
Environment	Ventilation, access, temperature and installation space suitable
Commissioning	Normal, bypass and abnormal-condition functions verified
Energy claims	Savings assumptions and verification method documented
Handover	Drawings, settings, records and maintenance information supplied

QUEST Electrical: Industrial electrical infrastructure assessments, voltage monitoring, LV distribution integration, installation, testing and commissioning, subject to the requirements of each project.

Note: General guidance only; not a project-specific design, guarantee of savings or certification. Confirm applicable editions of standards, manufacturer requirements and site-specific safety arrangements before work.