Department
for Environment
Food & Rural Affairs

Sunbelt Rentals Ltd
[redacted]

Attn: [redacted]

Date: 02/10/2023
Your ref: BME-
[redacted]

Dear [redacted]

The Purchase of 12 inch Submersible pumps

Following your tender for the supply of 12 inch Submersible pumps to the Environment Agency, we are pleased confirm our intention to award this contract to you.

The attached contract details ("**Order Form**"), contract conditions and the ***Annexes*** set out the terms of the contract between the Environment Agency for the provision of the deliverables set out in the Order Form.

We thank you for your co-operation to date and look forward to forging a successful working relationship resulting in a smooth and successful delivery of the deliverables. Please confirm your acceptance of the Conditions by signing and returning the Order Form via DocuSign on Atamis within 7 days from the date of this letter, which will create a binding contract between us. No other form of acknowledgement will be accepted. Please remember to include the reference number above in any future communications relating to this contract.

We will then arrange for the Order Form to be countersigned so that you have a signed copy of the Order Form for your records.

Yours faithfully,

[redacted]

Order Form

1. Contract Reference	[redacted]
2. Date	18th September 2023
3. Authority	Environment Agency [redacted]
4. Supplier	Sunbelt Rentals Ltd [redacted] [redacted]
4a. Supplier Account Details	
5. The Contract	The Supplier shall supply the Deliverables described below on the terms set out in this Order Form and the attached contract conditions ("**Conditions**") and any ***Annexes***. Unless the context otherwise requires, capitalised expressions used in this Order Form have the same meanings as in Conditions. Special Conditions that shall apply to this Order are as follows: 1. The Supplier shall have the ability to subcontract under this agreement. The Supplier shall remain responsible for any Supplier subcontractor. 2. Where the Authority terminates the Order for convenience, the Authority agrees to cover any costs that the Supplier has reasonably incurred. 3. Neither party shall be liable for any indirect or consequential losses. The In the event of any inconsistency between the provisions of the Order Form, the Conditions and the Annexes, the inconsistency shall be resolved by giving precedence in the following order: 4. Order Form, Annex 2 (*Specification*) and Annex 3 (*Charges*) with equal priority. 5. Conditions and Annex 1 (*Authorised Processing Template*) with equal priority. 6. Annexes 4 (*Tender Submission*) and 5 (*Sustainability*). In the event of any inconsistency between the provisions of Annexes 4 and 5, Annex 5 shall take precedence over Annex 4.

	Please do not attach any Supplier terms and conditions to this Order Form as they will not be accepted by the Authority and may delay conclusion of the Contract.	
6. Deliverables	**Goods**	Purchase and Delivery of 24 x 12" electrical submersible pumps and ancillary equipment. Delivered in accordance with the following instructions:

		Delivery Address: [redacted] Date of Delivery: To be confirmed. Packaging Instructions: Equipment must be delivered with suitable protection against damage and ingress of moisture at all times, including any bespoke and/or fabricated supports to protect or correctly orientate items during transportation and offloading. Equipment and the associated documentation must be clearly marked showing dry weights in Kg.
	Services	
7. Specification	The specification of the Deliverables is as set out in Annex 2.	
8. Term	The Term shall commence on **18th September 2023** (the **Start Date)** and the Expiry Date shall be **17th September 2025**, unless it is otherwise extended or terminated in accordance with the terms and conditions of the Contract. The Authority may extend the Contract for a period of up to 2 x 12 month periods by giving not less than 3 months' notice in writing to the Supplier prior to the Expiry Date. The terms and conditions of the Contract shall apply throughout any such extended period.	
9. Charges	The Charges for the Deliverables shall be as set out in Annex 3.	

10. Payment	The Authority's preference is for all invoices to be sent electronically, quoting a valid Purchase Order Number (PO Number), to: [redacted] Within **10** Working Days of receipt of your countersigned copy of this Order Form, we will send you a unique PO Number. You must be in receipt of a valid PO Number before submitting an invoice. To avoid delay in payment it is important that the invoice is compliant with Annex 3 Non-compliant invoices will be sent back to you, which may lead to a delay in payment. If you have a query regarding an outstanding payment please contact the Authority's Authorised Representative(s).
11. Authority Authorised Representative(s)	For general liaison your contact will continue to be [redacted] or, in their absence, [redacted]
12. Address for notices	**Authority:** **Supplier:** **Environment Agency** **Sunbelt Rentals Ltd** [redacted] [redacted] Attention: [redacted] Attention: [redacted] [redacted]

13. Key Personnel	**Authority:** **Environment Agency** [redacted] Attention: [redacted] [redacted]	**Supplier:** **Sunbelt Rentals Ltd** [redacted] Attention: [redacted]
14. Procedures and Policies	For the avoidance of doubt, if other policies of the Authority are referenced in the Conditions and Annexes, those policies will also apply to the Contract on the basis described therein. The Authority may require the Supplier to ensure that any person employed in the delivery of the Deliverables has undertaken a Disclosure and Barring Service check. The Supplier shall ensure that no person who discloses that they have a conviction that is relevant to the nature of the Contract, relevant to the work of the Authority, or is of a type otherwise advised by the Authority (each such conviction a "Relevant Conviction"), or is found by the Supplier to have a Relevant Conviction (whether as a result of a police check, a Disclosure and Barring Service check or otherwise) is employed or engaged in the provision of any part of the Deliverables.	

[redacted]

16. Insurance	The Supplier shall hold the following insurance cover from the start date for the duration of the Contract or earlier or later termination in accordance with this Order Form 1. [redacted]

	[redacted] -
Signed for and on behalf of the Authority	**Signed for and on behalf of the Supplier**

[redacted]

Annex 2 – Specification

Appendix 4.1 - MEICA - Specification - General

What's this document about?

This document describes the general approach to specifying MEICA assets, elements and systems which must be followed by all Environment Agency staff and suppliers.
This document is supported by a suite of supporting MEICA Specifications which are listed at the end of this document.
The specifications define the minimum technical requirements for the selection, design, construction, inspection and testing of MEICA assets, elements, and systems.
The purpose of the specifications is to ensure that assets, elements, and systems meet the required standards of design and engineering to ensure:

- - safe and reliable operation and maintenance.
- - an acceptable level of risk associated with the equipment and systems.
- - carbon, cost, and environmental impact are taken into account.

Any deviation from these specifications must be applied for, and documented, using the MEICA concession process.

Who does this apply to?

This document applies to:

- Environment Agency Staff.
- Suppliers working on Environment Agency projects.

Contact for queries and feedback

- MEICA.Directorate@environment-agency.gov.uk

Contents

Introduction

Purpose of this document

The purpose of this document is to ensure that equipment and systems supplied:

- are carbon neutral in operation and minimise carbon in construction
- comply with relevant safety standards.
- meet consistent standards of engineering in design, materials and construction.
- provide the minimum whole life cost.

Where equipment standards cannot be met you must seek advice from the supra-area MEICA team.

Note: The MEICA standards are not retrospective unless otherwise stated so if the MEICA installation complies with superseded British or international standards, then you can continue to use them provided it is legal, safe and operable.

Sustainability

General

The Environment Agency has published its ambition to be a net zero carbon organisation by 2030. As a result, we must improve the sustainability around our assets and their management. In the design of new assets or the refurbishment of existing assets consideration must be made to the carbon emissions generated by a new asset and/or activity related to the design, build, operation and maintenance.
The following considerations must be made of the following when designing and installing new assets:

- Have whole life carbon emissions been assessed in order to produce an optimal whole life low carbon design?
- Have the following been considered:
- Are more sustainable materials available that will not compromise the whole life carbon footprint?
- Are more carbon efficient manufacture methods available, which will reduce the associated carbon emissions (e.g. can the asset be built offsite, Design for Manufacture and Assembly (DfMA methods be used)
- Can renewable energy technologies be used as a power source?
- Has a sustainability risk assessment been carried out?
- Is the contractor PAS 2080 verified or have the standard PAS 2080 standards been consulted?

Equipment selection and design

Passive design

Passive design is the primary choice in our Asset Management Strategy; it is the principle of reducing carbon emissions and flood risk by minimising the number of assets that actively operate. Adopting passive designs allow manpower to concentrate on other front-line work, particularly during floods.
Passive systems are designed to fulfil their primary function with minimum or no need for human or other intervention. They are designed to act to the highest standards and reduce health and safety and operational risk. This directly translates to the design of systems. The most passive elements are those that remain as far as possible unchanged between normal and operating conditions and maintain their integrity.
A passive design will be more reliable than an active design, reducing the risk associated with asset failure.
Further information on passive design can be found in LIT 13010 Passive design guidance.

Equipment selection

Equipment and materials selection must have the lowest whole life carbon footprint, suit the purpose and type of duty defined in the specification and must take into account all possible operating conditions including possible exceedance.
All equipment supplied under the project specification must be:

- of current manufacture.
- supported by the manufacturer for the minimum design life.

Note: Obsolete equipment is not permitted.

Construction materials

Equipment and materials must be selected to resist corrosion, wear or seizure as a result of materials and substances that they might reasonably be expected to come into contact with during operational service.

UKCA Mark

Where required by the appropriate regulations, all equipment supplied must be UK Conformity Assessed (UKCA). This compliance requirement replaces the requirement for an EU declaration of conformity (CE) marking and came into force for the UK market on 1st January 2021. Products in stock before 1st January 2021, which were CE marked, are still eligible for sale in the UK market until 31st December 2021.
Similar to CE marking, UKCA conformity requires a declaration that the product meets the applicable statutory requirements. The UK government has provided guidance on the use of and requirements for UKCA compliance. The guidance can be found on the UK government website: Using the UKCA marking - GOV.UK (www.gov.uk).

Planned preventative maintenance

Details of all planned preventative maintenance (PPM) tasks required to achieve the minimum design life must be submitted as part of the design and as part of the Operation & Maintenance (O&M) manual.
These should include a schedule of tasks with:

- suggested low carbon footprint maintenance techniques
- Reliability based activities.
- recommended frequencies
- recommended number, discipline and expertise level of personnel required to undertake each task.

Major Assets

Major assets are defined in Lit 11283 Identifying flood and coastal risk management (FCRM) major assets.

Strategically Important Assets

When using MEICA specifications, suppliers must reference

- Lit 14717 - 17_17_SD02 Fire - Minimum Technical Requirement for Fixed Operational Assets
- Lit 14718 - 17_17_SD03 Resilience - Minimum Technical Requirement for Fixed Operational Assets
- Lit 14719 - 17_17 SD 04 Security: Minimum Technical Requirements for Fixed Operational Assets

These documents must have been completed by the Asset Owner and provide the Minimum Technical Requirements.

Design life

The design, workmanship and general finish must be of sound quality in accordance with good engineering practice.
Designs must be:

- robust.
- rated for the appropriate duty under prevailing operational site conditions.
- in accordance with the design life requirements identified elsewhere in the specification (except if varied for a specific application).

The design life must be defined as the expected time to the first complete replacement, given adequate maintenance.
Adequate maintenance is defined as:

- inspection, adjustment, cleaning, and lubrication of the plant.
- replacement of minor parts and consumable spares;
- minor repairs.

Note: Where this or any other relevant specification refers to 'hours', this means 'actual running hours'.
Minimum design life for specific MEICA equipment, systems and other assets is stated in the appropriate specification.

Ancillary equipment

The design life of any ancillary equipment required must be as detailed in the applicable Environment Agency specification.
Any components requiring regular replacement must be identified.

Deviations from specifications. (concession)

If the designer, contractor or supplier wishes to deviate from the specifications as listed in this document, it is permitted only if the alternative specification has been agreed by the Environment Agency through the concession process, as described in LIT 18692 – MEICA – Assurance - Concession process and LIT 18691 MEICA - Assurance - Concession form

Regulations

The design and construction of equipment and systems must meet:

- all relevant statutory regulations.

- all environmental legislation
- all relevant Environment Agency procedures/requirements.
- all applicable editions/sections (current at the time of tender) of all British and International Standards.

Whole life costs

Whole life carbon and monetary cost assessments must be performed for the equipment. This assessment must include cost of installation (including any associated civil works), operation and maintenance.
The following must be submitted as part of any tender or design:

- whole life carbon cost
- expected service life of the components (where applicable).
- mean time between failures (MTBF).
- design life.
- replacement costs/frequencies.

Innovation

Details of any solution that incorporate innovative design features to reduce the whole life carbon costs or enhance performance, but do not comply with a specification, must be agreed in the first instance with the Environment Agency supra area MEICA team and a concession applied for.

Efficiency and performance

Equipment must be designed to maximise efficiency and minimise carbon footprint over its lifetime. Production of energy, or its consumption over the operational life of an asset is a major factor in quantifying efficiency of a solution. Consideration must be given to, power sources such as river flow or float operation, as well as service life and any regular maintenance/servicing requirements.

Disposal

Any equipment that is taken out of service must be assessed for condition.
If equipment is assessed as not having reached the end of its useful service life, it must be offered to the Supra-Area MEICA Team Leader who may wish to retain the equipment for use elsewhere, or for spares.
Where equipment is assessed as having reached the end of its useful service life, a discussion with the Supra Area MEICA Team Leader must take place prior to disposal. This will determine if there are any components or modules that can be removed and retained as strategic spares.
Equipment to be disposed of must be recycled. if recycling is not possible, it must be disposed of in an environmentally friendly manner.

Technical submissions

Drawings, technical literature and diagrams

All documentation associated with MEICA assets, elements and systems must be provided in accordance with MEICA-Specification-Documentation

Spares and consumables and special tools

A list of recommended consumables and spares to support the equipment for a minimum of five years must be provided with the technical submission.
Special tools and test equipment, including setting tools, must be provided with the equipment to enable any routine in house maintenance and operation to be carried out.
A special tool is any piece of equipment that the Environment Agency Operations and Maintenance teams would not regularly carry with them or be present at an asset.

Delivery and storage

Equipment must be delivered with suitable protection against damage and ingress of moisture at all times, including any bespoke and/or fabricated supports to protect or correctly orientate items during transportation and offloading.
Equipment and the associated documentation must be clearly marked showing dry weights in Kg.

Related documents

Operational instructions

- LIT 13010 Passive design guidance.
- OI 17_17 Strategically Important Assets

Associated specification documents.

- MEICA-Specification- Materials and mechanical installations
- MEICA-Specification- Painting and protection systems
- MEICA-Specification- Hydraulic and pneumatic equipment
- MEICA-Specification- Water control structures
- MEICA-Specification- Valves and penstocks
- MEICA-Specification- Gate and valve actuators
- MEICA-Specification- Lifting equipment
- MEICA-Specification- Powered weedscreens
- MEICA-Specification- Pumps
- MEICA-Specification- Kiosks and enclosures
- MEICA-Specification- Electrical installations
- MEICA-Specification- Switchboards
- MEICA-Specification- Uninterruptible power systems
- MEICA-Specification- Rechargeable batteries
- MEICA-Specification-Engine generating sets

- MEICA-Specification- Electric motors
- MEICA-Specification- Pump starters
- MEICA-Specification-Security systems (Security and Fire)
- MEICA-Specification- Instrumentation
- MEICA-Specification- Programmable logic controllers
- MEICA-Specification- Documentation
- MEICA-Specification- Electric vehicle charging points
- MEICA-Specification-Pipelines
- MEICA-Specification-Flood Gates

Appendix 4.2 - MEICA - Specification - Kiosks and enclosures

What's this document about?

This document sets out the MEICA specification to be followed by all Environment Agency staff and suppliers when specifying kiosks and enclosures. Any variation to this standard must be applied for through the concession process.
! Users must read MEICA – Specification - General prior to using MEICA any Specifications.

Who does this apply to?

This specification applies to:

- Environment Agency Staff;
- External suppliers working on MEICA projects.

Contact for queries and feedback

- MEICA.Directorate@environment-agency.gov.uk
- Please give anonymous feedback for this document via email.

Contents

Introduction

Scope of the specification

Kiosk and weatherproof cabinets shall comply with all applicable Statutory Regulations, Environmental Legislation (including The Waste Electrical and Electronic Equipment Regulations), the relevant Environment Agency procedures/requirements and the latest editions (at the time of Tender) of all applicable British and Harmonised European and international Standards. All Regulations and Standards referenced by this Specification are detailed in Related Documents.

Other requirements

Kiosks and weatherproof cabinets must also comply with:

- MEICA - Specification - General
- this specification;
- project specification;
- any other documentation issued by the Environment Agency.

Note: Where such documentation imposes additional requirements to the Standards listed in Related Documents, the requirements of the specific project documentation take preference.

Design life

The table below sets out the equipment type and minimum design life of kiosks and weatherproof cabinets at the rated conditions.

Equipment Type	Design Life
Kiosk	20 years
Weatherproof cabinet	20 years

General

General requirements

This specification covers weatherproof cabinets of the following types:

- Kiosks with walk-in access
- Kiosks with front outside access (close fitting)
- Wall or Floor mounted cabinets (non access)

Kiosks and weatherproof cabinets must be designed to withstand the site ambient conditions for 20 years and incorporate ultraviolet (UV) inhibition during manufacture. Kiosks and cabinets must be manufactured to provide strength, durability, vandal resistance and a long service life. The position of a kiosk must be assessed and where vulnerable to damage by accident or vandalism appropriate measures such as crash barriers or similar shall be provided.
Kiosks and cabinets must provide a dry, temperate, clean and dust free environment for the housing of the apparatus. They must be designed to be:

- Weather and corrosion proof
- Vandal and vermin proof
- Low Maintenance
- Fire resistant
- Thermally insulated to minimise solar heat gain
- Adequately ventilated for equipment and personnel
- Adequately lit to enable safe operation and maintenance of internal equipment
- Capable of restricting access to unauthorised persons
- Energy efficient, minimising energy consumption

Resilience

The design, selection and positioning of kiosks and cabinets must take into account the resilience requirements of the site. In particular the design must consider the likelihood of an ingress of water due to exceedance events as described in OI 17_17 Criticality assessment of FCRM assets. It is therefore critical that the positioning of cable ducts, drains, cat flaps, etc are fully assessed.

Sizing

Design of the kiosk/cabinet and equipment layout, including heating and cooling calculations, must be submitted to the Environment Agency for review prior to manufacture. The size of the kiosk must take into account the following, as a minimum:

- Limits due to planning/size constraints
- Clearance around equipment and MCC/switchboards (refer to LIT UNASSIGNED Special Locations for gangway requirements)
- Is top or bottom MCC/switchboard cable access required?
- Location of other equipment that may need to be housed internally such as electricity meters, distribution boards, generator connection boxes, instruments, outstations, etc.
- Ability to operate and remove equipment;
- Flood risk vulnerability

Depth

The minimum recommended depth of kiosks (for walk-in access) housing MCC/ switchboards will be determined by the following:

- the panel depth
- the largest open panel door
- equipment withdrawal distances (as advised by the manufacturer)
- an unobstructed exit route
- recommended rear & side access clearance (as detailed by the manufacturer)
- the depth of any ancillary items which may be installed within the kiosk

Environmental considerations

Where fluid enters a kiosk/cabinet, such as hydraulic pipework, that part of the assembly shall be sealed from all other parts when the doors are closed. All cables entering the sealed compartment must have glands.
Kiosks and cabinets must have an ingress protection (IP) rating as specified in the project specification or user requirements specification. The method of fixing the kiosk must not affect this IP rating.
Kiosks must be located and orientated so as to minimise the effect of solar heat gain. Where solar heat gain may be excessive consideration must be given to the provision of shading e.g. trees or a canopy, and kiosk colour (where appropriate).
Door and openings must also take into account the prevailing wind, and rain protection for the panels and the personnel.

Construction

Materials

Heavy-duty kiosks or cabinets for outdoor use must be constructed from cast iron (with zinc-sprayed steel hinged doors), glass fibre-reinforced polyester, plastic coated steel, or similar corrosion and vandal resistant material. Metallic cubicles for indoor use must be constructed from 2 millimetres (mm) sheet steel. Where mounting plates are used, these must be constructed from 3 mm sheet steel.

GRP Kiosks

Glass reinforced polyester (GRP) kiosks and cabinets must be constructed from fire resistant resin to Class 2 or better of BS 476-7 and be tested to BS 476-20, BS 476-21, BS 476-22 and BS 476-23 and exceed a ½ hour fire rating.
GRP kiosks and cabinets must be constructed with the following minimum requirements;

- Walls, GRP/18 mm Ply/GRP composite with thermal transmittance (U Value) of 1.5 Watt per metre squared per degree Celsius ($W/m^2/°C$)
- Roof, GRP/9 mm Ply/GRP composite with thermal transmittance (U Value) of 0.6 $W/m^2/°C$

GRP kiosks and cabinets must be constructed with an inner rigid core of marine ply to BS 1203 encapsulated by resin bonded glass fibre inner and outer skins. Large panel sections must be stiffened by encapsulated box section steel. Timber reinforcement and stiffening must be completely encapsulated in GRP and all cut, sawn or filed edges must be resin sealed to prevent the ingress of moisture. The external and internal surfaces must be suitably dressed and resin sealed to give a good visual appearance. GRP encapsulated high density V313/moisture resistant chipboard is an acceptable alternative to the above GRP-encapsulated ply construction.
GRP kiosk and cabinets shall be either of colour-impregnated gel coated smooth colourfast resin or approved brick effect finish as detailed in the project specification. The interior and exterior colour of the kiosk must be agreed with the Environment Agency and must comply with any planning constraints.

Plastic coated steel kiosks

Plastic coated mild steel kiosks must be constructed with the following minimum requirements;

- Steel frame
- Walls to be 2 mm thick plastic coated mild steel 60 mm box section with a thermal transmittance (U Value) of 0.6 $W/m^2/°C$
- Roof to be 2 mm thick plastic coated mild steel 40 mm box section with a thermal transmittance (U Value) of 0.6 $W/m^2/°C$

Where amendments to the construction are required to achieve the required thermal insulation, the supplier must consult the Environment Agency. The strength and robustness of the kiosk must not be adversely affected by the non-inclusion of insulation.

General requirements

Kiosks must incorporate a sloping roof to facilitate drainage and prevent build-up of water on the roof.
Wall-mounted equipment must be mounted on suitable frames specifically designed to take the expected loading. The frames must facilitate easy installation/removal of equipment from the front and without the need for specialist tools. If the mounting frame

entails the use of plywood, this must be a minimum of 18 mm thick and suitably treated to be fire-resistant.
Where larger equipment is specified for removal through the kiosk roof, the kiosk must be designed to facilitate this.
All plywood supplied must be produced from sustainable sources and must be manufactured without the use of formaldehyde. The manufacturer must provide evidence of compliance with the above requirements.

Fixings

All foundation, panel jointing and component retaining screws, nuts, bolts and washers must be stainless steel to BS EN ISO 3506-1 or BS EN ISO 3506-2 as appropriate with fibre or nylon washers fitted beneath nut and bolt head washers to prevent damage to the GRP or its adjoining component. Kiosks must incorporate reinforced areas or backboards to accommodate installation of all wall-mounted equipment together with reinforcement as necessary for installation of the domestic equipment and associated conduit runs.

Cable entry

All cables must enter/leave the enclosure from below ground level wherever flood levels allow. Where a kiosk is required to be flood resilient, cables shall enter/leave the building or enclosure above the flood level to minimise floor penetrations.

Inspection windows

Where indicators, gauges or LEDs requiring frequent inspection are fitted, clear polycarbonate impact-resistant windows must be used.

Doors – kiosks

Doors must be outward opening and constructed in the same material as the enclosure. Doors must be fitted with vandal proof and self-latching stays to restrain them in the fully open position. The mechanism must be designed to withstand high wind speeds and direction in the open position and must only de-latch using a positive operator latch. Doors must open and close in an unstrained manner and be hung to give a uniform gap between it and the door jamb. Gaps around and between doors must be protected internally. Door seals must be non-moisture-absorbing so ice will not form in the rubber and prohibit opening of doors. Seals must be formed from materials resistant to deformation and abrasion.
Doors must be dust and weather-proofed to a minimum IP 54.
Doors must provide a half hour fire resistance to BS476-22.
Double doors must not be provided with a centre pillar.

Doors - cabinets

Cabinets must have either a single or a double door as specified and doors provided with a lock approved by the Environment Agency. When a cabinet is mounted next to another cabinet, a minimum door opening of 90 degrees must be maintained.

Doors – hardware and fixings

Hinges, catches, fixing screws and locks must be of stainless steel, nylon or similar approved corrosion-resistant material. Hinges must be of high tensile alloy with

stainless steel pins and through bolts. Door hinges must be robust and concealed to enable the door to be removed in the open position only.

Doors – lock arrangement

Locking arrangements must be designed in conjunction with OI_17_17_SD04 Security Minimum Technical Requirements for Fixed Operational Assets.
Cabinets must have a three-point locking system utilising triangular locks top and bottom and either a cylinder lock centrally or a hasp and staple with suitable padlock protection.
The kiosk door must include an exterior handle with a lock/finger opening facilities complete with 3-point latching and internal lever handles. Each door will have a lock of the flush rim cylinder lock type chosen to suit the particular site security system. Locks and barrels must be provided as specified in Each door lock must have an interior handle that is easy to operate in an emergency. The door thresholds must incorporate galvanised steel weather strips against which the door will close.

Doors – clear opening

As a minimum, kiosks must have a nominal clear door opening of not less than 750 mm wide by 2000 mm high where more onerous requirements do not exist (refer to LIT UNASSIGNED Special Locations). Numbers of exits and recommended access arrangements must be designed in accordance with the relevant legislation for the equipment being housed, the Building Regulations Approved Document Part B (Fire Safety) Volume 2 - Buildings other than dwelling houses and the designer's risk register. Door sizes and configuration of doors must be selected to ensure distortion and cracking of the structure is prevented. The egress and access arrangements must be reviewed by the Environment Agency during the design stage. A removable overhead transom, 0.5 m high, to facilitate switchboard access must be provided where specified.

Sound Attenuation

Kiosks must achieve sound attenuation over a centre band frequency range of 31.5 Hertz (Hz) to 16 kHz as detailed in the Project Specification. Where no sound reduction levels are specified the kiosk must achieve a minimum sound attenuation of 15 decibels (dB).

High Security Kiosks and Cabinets

Cabinets and kiosks must meet the Loss Prevention Certification Board (LPCB) standard written in the specification as a result of the critical asset assessment. Refer to OI_17_17_SD04 Security Minimum Technical Requirements for Fixed Operational Assets.

Handling and Installation

A set of detachable galvanised lifting eyes must be provided. The lifting eyebolts must be removed when not in use, and sufficient plugs to fit these holes must be provided with the kiosk. The walls of cabinets and kiosks must have internal bottom flanges, drilled for bolting securely to the concrete plinth. Fixing holes must be reinforced.

Unless specified, floor mounted external kiosks or cabinets must be fixed to the concrete base on an integral cast ledge below finished floor level. The joints between the kiosk and base concrete must be fitted with a weatherproof seal. Anchor bolts, fitted inside the kiosk, should be covered with granolithic screed to provide a flush floor level to the wall. Concrete flooring must be treated with a chemical resistant two-coat epoxy floor coating.
Where a kiosk is supplied with an integral floor, the floor must be load-bearing.
The kiosk must be delivered with all required supports necessary for transportation, offloading and positioning.

Heating and ventilation

General

An external ambient temperature range of +40ºC and -15°C (with an average in any 24 hour period of not more than 35ºC) and relative humidity up to 95% shall be assumed for worst case conditions, except where stated otherwise when determining heating and ventilation requirements for the kiosk and cabinets.

Heating

Anti-condensation heating should be provided if there is likelihood of condensation forming. If tubular heaters are to be used, they must be provided with steel mesh guards and mounted at low level.
A controlling tamper-proof thermostat shall be provided. The heating system shall maintain the ambient temperature inside the kiosk to +5°C.
Heaters must be suitable for the environment in which they are to be installed. The final connection to the heater must be made with heat resistant flexible cable 85ºC rubber insulated heat oil and flame resistant (HOFR) to BS 6004 and BS EN 50525-1 and BS EN 50525-2-83. The cable must be coloured white.

Ventilation

The ventilation system must maintain kiosk internal air temperature below 35°C and prevent condensation with the worst case conditions and the kiosk doors closed. Where the kiosk/cabinet contains equipment sensitive to high temperatures, the contents must be maintained at a temperature such that their performance is not adversely affected. Similarly the kiosk internal temperature must be maintained to ensure that personnel entering the kiosk are not subject to hazardous conditions.

Ventilation requirements

Heat dispersion requirements must take account of heat generated by internal equipment and processes and also environmental conditions, especially solar gain. Ventilation requirements must be calculated in accordance with the current CIBSE Guide and the design criteria contained therein. Calculations carried out to establish the recommended ventilation design solution must be submitted for review.

Ventilation types

The kiosk ventilation system must be chosen from one of the following types:

- Natural ventilation with inlet vents at low level and outlet vents at roof level at opposite ends of the kiosk.
- Forced ventilation with inlet vents at low level and extract fan(s) at roof level at opposite ends of the kiosk.
- Air conditioning with external heat exchanger and heating / cooling temperature control.

Natural ventilation should be used wherever possible.

Ventilation – vents and louvres

IP54 vents must be vermin and insect proof and have manual closures to retain heat in winter conditions. The louvres must be positioned to avoid short-circuiting and located so that the flow of air is across any equipment dissipating heat.

Ventilation – temperature control

Extract fans must be controlled from a thermostat. The fans must start at 25°Cand cease when temperature inside the kiosk is 20°C. Where the heat output from the equipment installed within the kiosk exceeds the limits of forced ventilation, air cooling units should be considered.

Equipment and fittings

Lighting

Kiosk interior lighting must be designed to provide a maintained luminance level of 300 lux at floor level unless otherwise specified. Kiosk interior lighting must include the following:

- LED luminaires, twin tube, IP65 with prismatic diffuser, electronic starter mounted on lighting trunking
- Splash proof on/off light switch to BS EN 60669-1, IP65 adjacent to doors
- Lighting timer control circuit for walk-in kiosks
- Emergency lighting pack to BS EN 60598-1 and BS EN 60598-2-22, type NM3 to fluorescent luminaire(s) in front of switchboards for walk-in kiosks
- Emergency exit sign(s) to BS EN 60598-1 and BS EN 60598-2-22, type NM3 for walk-in kiosks

An external LED floodlight or LED bulkhead where detailed in the project specification must be installed above the kiosk main access door. The light must be passive infrared sensor (PIR) controlled.

Socket Outlets

Kiosks and cabinets must be supplied with one splash proof, twin 13 amperes (A), 230 volts (V), IP54 socket outlet to BS1363-2 with 30 mA RCD (residual current device) protection, mounted internally on the front wall, adjacent to the door.

Where specified the following must be provided:

- 230 V outlet, 16 A, IP54 EN 60309, coloured blue, incorporating isolation mechanically interlocked with the plug and the ring main or radial circuit from which they are supplied must be protected by a 30 mA RCD.

- 110 V outlet(s) for portable tools, 16A, two pole and earth to EN 60309, coloured yellow, fed from a 230/115 V 2 kilovolt amps (kVA) isolating transformer having a centre tapped to earth connection, protected with 2 pole RCD/MCBs (miniature circuit breakers).

Electrical Installation

The electrical installation must be designed, supplied, installed, inspected and tested in accordance with BS 7671 and MEICA – specification - Electrical Installations. All electrical kiosk services must be connected, using rigid PVC conduit and PVC insulated stranded cables, to a consumer unit located within the kiosk.

Where the electrical installation is provided prior to delivery to site the necessary test certification shall be provided to facilitate the overall electrical testing and electrical certification of the site.

Supply headers and metering shall be located in a separate compartment within the kiosk the door of which shall open externally and be fitted with a triangle lock and/or a window to facilitate meter reading.

Cat Flaps

Where the kiosk houses a panel with a portable generator connection a hinged “cat-flap” must be provided. This must be located to allow the safest connection of the generator cables, avoiding trip hazards, not trailing over equipment, etc. The cat flap must be hinged at the top, open outwards and be lockable in the closed position from inside the enclosure with internal shoot bolts. It must not be located on a door. Cat flaps must not increase the risk of water ingress by weather or flooding.

Testing

The installer must test the kiosk/cabinet and all associated equipment and fittings as required by the Particular Specification.

Defects

General

Installers must ensure that kiosks and cabinets are be free from defects and adequate in all respects for the purposes intended. Kiosks must be constructed in accordance with the Quality Controls detailed in BS 4549.

The works will be deemed to have failed if any defect is noted by the Environment Agency or Environment Agency’s authorised inspector during visual inspection or site test.

Documentation and labels

Labels

Labels must be provided on the cabinet and kiosk for:

- Manufacturer, address, telephone number, e-mail, reference and date
- Weight
- Description and/or Site Name

Documentation

The supplier shall provide the following documentation:

- General arrangement drawings, including plan and elevation.
- Kiosk bottom seal drawing
- Schedule of parts
- Specification of materials and components, including sustainable resource certificates
- Lighting calculations
- Calculations, including solar heat gain and heat dissipation from the electrical and mechanical equipment in the kiosk
- Electrical inspection and test Certificates
- Technical submissions

Technical Submissions

Documentation

As part of the technical submission specifications, sketches, method statement for preparation & application and technical literature must be provided in the original file format (.dwg/.dxf/.doc/etc) and a pdf version of the same file.

Related Documents

BS series

- BS 476- 7 Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products
- BS 476-20 Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)
- BS 476-21 Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction
- BS 476-22 Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction
- BS 476-23 Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure
- BS 1203 Hot setting phenolic and aminoplastic wood adhesives. Classification and test method.

- BS 1363-2 13 A plugs, socket-outlets, adaptors and connection units. Specification for 13 A switched and unswitched socket-outlets
- BS 4549-1 Guide to quality control requirements for reinforced plastics mouldings. Guide to the preparation of a scheme to control the quality of glass reinforced polyester mouldings
- BS 6004 Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting
- BS 7671 Requirements for electrical installations. IET Wiring Regulations

BS EN series

- BS EN 50525-1 Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). General requirements
- BS EN 50525-2-83 Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Multicore cables with crosslinked silicone rubber insulation
- BS EN 60309 Plugs, socket-outlets and couplers for industrial purposes
- BS EN 60598-1 Luminaires . General requirements and tests
- BS EN 60598-2-1 Luminaires. Particular requirements. Specification for fixed general purpose luminaires
- BS EN 60598-2-22 Luminaires. Particular requirements. Luminaires for emergency lighting
- BS EN 60669-1 Switches for household and similar fixed-electrical installations. General requirements

BS EN ISO Series

- BS EN ISO 3506-1 Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs
- BS EN ISO 3506-2. Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts

Others

- LPS 1175 The Loss Prevention Certification Board (LPCB) - Loss Prevention Standards
- The Building Regulations Approved Document Part B (Fire Safety) Volume 2 - Buildings other than dwelling houses

Standard specifications

All MEICA Specifications are listed in:

- MEICA - Specification - General

Appendix 4.3 - MEICA - Specification - Electrical installations

What's this document about?

This document sets out the MEICA specification to be followed by all Environment Agency staff and suppliers when specifying the requirements for the design, installation, inspection and testing of low voltage (up to 1000 volts) electrical installations. Any variation to this standard must be applied for through the concession process.
! Users must read MEICA – Specification - General prior to using MEICA any Specifications.

Who does this apply to?

This specification applies to:

- Environment Agency Staff;
- External suppliers working on MEICA projects.

Contact for queries and feedback

- MEICA.Directorate@environment-agency.gov.uk
- Please give anonymous feedback for this document.

Contents

Introduction

Scope

This specification defines the requirements for the design, construction, inspection and testing of low voltage electrical installations (up to 1000 V).

Other requirements

The low voltage electrical installation must also comply with:

- MEICA - Specification - General
- this specification;
- project datasheets;
- any other documentation issued by the Environment Agency.

Note: Where such documentation imposes additional requirements to the Standards listed in Related Documents, the requirements of the specific project documentation take preference.

Whole life costs

In addition to the documentation requirements in MEICA - Specification - General , the following must be submitted as part of the tender:

- electrical installation power output and specific energy consumption.

Critical Assets

Low voltage installations installed or being designed for Critical Assets must be assessed under OI 17_17 Critical Assets.

Design life

The table below sets out the minimum design life.

Equipment Type	Design Life
Low voltage electrical installations	20 years

General

Service conditions and application

The electrical installation must be capable of satisfactory operation within the following temperature ranges:

- Internal: from -10 degrees Celsius (°C) to 40°C (with an average in any 24-hour period of not more than 35°C) and relative humidity up to 80 per cent;
- External: from -15°C to 40°C (with an average in any 24-hour period of not more than 35°C) and relative humidity up to 95 per cent.

Particular requirements to meet special service conditions in terms of temperature, altitude and degree of pollution must be complied with or special agreements made with the Environment Agency.

Special locations

The IET Guidance Note 7: 'Special Locations' must be adhered to for installations in special locations where additional measures are required to comply with BS 7671.

Electrical system characteristics

The design of the installation must consider the minimum following characteristics of the electrical system:

- voltage, frequency and number of phases;
- maximum prospective short circuit current;
- earthing arrangement (TN or TT supply);
- external earth fault loop impedance (Ze);
- type and rating of protection device external to installation;
- harmonic voltage and current distortion;
- load capability of supply source.

! Important If a new power supply application is to be submitted, a TNS earthing arrangement must be requested.

Hazardous area installations

All equipment selected for use in a hazardous area must have undergone an appropriate conformity assessment procedure (CAP) to demonstrate compliance with the essential health and safety requirements of 2014/34/EU (A TEX 95) as enacted in the UK by:

- Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016

The design, selection and erection of the electrical installations in explosive atmospheres must comply with all appropriate parts of BS EN 60079 and as a minimum the following.

- Electrical apparatus that does not comply with IEC standards or equivalent must not be used in hazardous areas.
- Isolation/disconnection of circuits must always be in a non-hazardous area.
- Cable joints are not permitted in hazardous areas.
- Labels for all intrinsically safe (IS) equipment and junction boxes must be coloured blue with white lettering.
- The IS circuit cable outer sheath and IS terminals must be coloured light blue.

On completion of the erection/installation, initial inspection of the apparatus and installation must be carried out in accordance with appropriate parts of BS EN 60079.

Selection of equipment and components

General

Surface-mounted fittings/accessories must be used with surface wiring.
Recessed-mounted fitting/accessories must be used with concealed wiring.
High Efficiency Lighting Units (HELUs) and White Light Emitting Diodes (LEDs) can be used for interior and exterior lighting. Lighting control measures such as localised switching and time switching may be considered to optimise efficiency of lighting system.

Further guidance on daylight installations is given BS EN 17037

Distribution boards

Distribution boards must comply with BS EN 61439-3 and BS 7671.
If upstream overcurrent protection is provided, the incoming supply switching and isolation device can be:

- circuit breaker;
- circuit breaker with integral residual current device (RCD) (residual current circuit breaker with overload protection, RCBO);
- fuse switch disconnector; or
- switch disconnector.

The neutral and earth bars provided in the distribution board must have terminals equal to the total number of outgoing ways on the board.
The loading of the branch circuits must not exceed 80% of the rating of the branch circuit protective device rating.
The distribution board must be provided with 30% spares circuit positions.
Approximately 50% of the spares circuit positions must be provided with circuit protective devices. The remaining positions must be provided with necessary facilities that require only the addition of the circuit protective device for future use.

Control boxes, junction boxes, local control stations

Local isolators must be provided where shown on the outline block cable diagrams. These must be manufactured from glass-reinforced plastic (GRP), polycarbonate or an appropriate material approved by the Environment Agency.
All cables must be bottom entry into the unit. The Supplier must ensure there is adequate surface area on the bottom gland plate to gland and terminate all required cables.
Gland plates and cable boxes shall be designed/installed so to minimise the effects of eddy currents; single core cable gland plates shall be made from non-ferrous material.
Emergency stop pushbutton and pushbutton control stations must be provided where shown on the outline block cable diagrams. These must be manufactured from glass reinforced plastic (GRP), polycarbonate or an appropriate material approved by the Environment Agency. All cables must be bottom entry into the unit.
Junction boxes must be provided where shown on the outline block cable diagrams. These must be manufactured from GRP, polycarbonate or an appropriate material approved by the Environment Agency.
The local final cabling from junction boxes to individual connection points must be provided with allocated tag numbers, identified and shown on the cable schedules and detailed block cable diagrams. Propriety cables associated with instruments must be identified and included on the cable schedules.
The doors of isolators, control stations and the covers of junction boxes must be fitted with:

- a red/white/red Traffolyte hazard label ‘Danger [XX] Volts – Isolate Before Opening’;
- a yellow/black/yellow Traffolyte warning label ‘Isolate at [Specified location] Before Opening’; and
- other applicable safety labels identifying the potential danger in accordance with appropriate parts of BS 5499 and BS ISO 3864. See also Labels and safety signs.

All enclosures must be provided with an adequate means of earthing.
Terminals must be clipped to rails fixed to the back of the enclosure or supported off brackets integral with the enclosure.

Socket outlets

Plugs and socket outlets must comply with BS EN IEC 60309 and BS 1363.
Socket outlets for installation in offices, laboratories, mess rooms, accommodation and similar public areas must be rated at 13 Amperes (A) and 250 V, and comply with BS 1363.
All 230 V final circuit socket outlets must be protected by a suitable rated residual current device. Please refer to BS 7671 for maximum disconnection time.
All general purpose 13 A sockets must have automatic shutters closing phase and neutral apertures when not in use.

Outlet and switch boxes located outdoors must be suitable for the environment where outlets are to be installed and be a minimum of IP65 enclosures in accordance with BS EN 60529/IEC 60529 made of a corrosion-resistant material such as fibreglass, copper-free aluminium, galvanised steel or stainless steel.

Fused connection unit

Fused connection units must be rated at 13 A and 250 V, and comply with BS 1363.
They must incorporate a correctly rated cartridge fuse link complying with BS 1362.
The fused connection units can be switched or unswitched, and must be provided with a flex outlet in front.

Shaver sockets

All shaver socket outlets must be dual voltage (250/120 V AC) complying with BS EN 61558-2-5. They must incorporate a double wound isolating transformer with thermal overload protection on the primary side.

Industrial plug and socket outlets

Industrial plug and socket outlets must comply with BS EN 60309 and must consist of a single-phase or three-phase unit rated at 16, 32, 63, 125 A.
All industrial plug and socket units must be provided with an integral isolator and interlocked to prevent socket contacts from breaking the load current.

Isolators

For a single phase system, the isolators must be double pole and comply with BS EN 60669. For a three phase system, the isolators must be four pole and comply with BS EN 60947.

Ceiling rose

Ceiling roses must comply with BS 67. They must have three terminals and an earth terminal.
Plug-in ceiling roses used for lighting fixture connections must comply with BS 6972.

Accessory mounting boxes

Plastic mounting boxes must be used with polyvinyl chloride (PVC) conduits.
Steel accessory boxes must be used with metallic conduits.
The accessory mounting boxes must comply with BS 4662.

Lighting switches

All lighting switches must be rated at 250 V and must comply with BS EN 60669.
In a multi-gang switch box, different phases or dissimilar voltages must be separated by earthed metallic barriers.

Installation of electrical equipment

General

All support steelwork required for the electrical installation must be installed electrically clear of floor-reinforcing metalwork.
The floor screed area below the switchgear and in front of withdrawable equipment must be level within the manufacturer's recommendations but, as a minimum, ±3 mm over the whole area.
Packing material and constraints must be removed and equipment thoroughly cleaned.
Before the switchboard is commissioned, withdrawable portions of switchgear and motor control centres must be checked for correct mating with the stationary portions and correct function of locking devices.
The Supplier is responsible for locating all minor equipment not otherwise located on the drawings (for example, control stations, junction boxes, etc.) to ensure all services are co-ordinated with other services on-site.
Local control stations must be mounted adjacent to their equipment.
Distribution boards must be provided with an interior sub-circuit identification schedule to indicate the equipment served.

Bus duct

Where bus ducting is used (for example, to connect transformers to switchgear), the Supplier must carry out the installation in accordance with the manufacturer's recommendations and drawings with regard to route locations, support steelwork and, if applicable, building penetrations.
Bus ducting can be any one of the following types (all are supplied in pieces for site assembly):

- air-insulated copper bar assemblies;
- sleeved copper bar assemblies;
- encapsulated copper bar assemblies.

Bus ducting systems must be supplied complete with butt right-angled, tee and flexible inter-connecting kits and connection insulation kits as applicable. The manufacturer must also supply all support assemblies for encapsulated bus ducting.
The Supplier is responsible for the installation of air-insulated and sleeved copper bar types of bus ducting.
The Supplier is also responsible for the installation of encapsulated type bus ducting but under the supervision of the manufacturer's representative.

Transformers

The Supplier must ensure that transformers are installed in the locations shown on the drawings and in accordance with the manufacturer's drawings and recommendations.
Only designated jacking and lifting points must be used when the transformers are being put into position. Where there are separate lifting facilities for tank tops, cores and coils, these must be removed or rendered unusable during transport and erection.
Where bus ducting is to be used for connections to transformers and reactor terminals, checks must be made before the tank base is bolted or welded down to ensure the bus ducting connections can be made without imposing stress on the bus ducting copper-work or transformer terminal bushings.
When correctly located and inspected, an insulation test must be carried out and recorded:

- between each phase and earth/ground; and
- between high-voltage (HV) and low-voltage (LV) windings.

On completion of the installation of all fittings and cables, etc., an insulation test of all windings and connections must be made.
The following apply where applicable.

- The fluid level in transformers and the colour of any breathing desiccants must be checked and rectified where necessary.
- Transformer oil or other liquid insulation must be checked/tested in accordance with the manufacturer's recommendations.
- The transformer tap changer must be securely padlocked in its required position. The Supplier must provide approved types of padlock and keys to the Environment Agency.
- Any transformer protection measures must be checked/tested prior to energising the transformer.

Batteries, battery chargers and inverters

Refer to MEICA - specification - Rechargeable Batteries for information regarding the installation of batteries, battery chargers and inverters.

Generators

Refer to MEICA - Specification - Engine Generating Sets for information regarding the installation of generating engines and associated equipment.

Cable selection

General

Cables must be selected and sized in accordance with latest edition of BS 7671.
The cable manufacturer must be approved and licensed by the British Approved Service Cables (BASEC). The outer sheath of cable must be embossed with the BASEC logo. Following the United Kingdom's exit from the European Union, on the 1st January 2021 BASEC is the only appointed approval agency of cables to UKCA (UK Conformity Assessed) certification, which replaces CE certification.

General selection criteria

Power cables must be selected in accordance with their suitability for the application and operating environment. Available power cables are detailed within BS 7671 Table 4A3; cables not in this table must be approved by the Environment Agency before purchase.

! Important

Cable selection must match insulation type with application and operational environment.
Cables must be sized to operate within their current carrying capacity and as determined by the maximum continuous insulation temperature.
Cables must have copper conductors complying with BS EN 13602.
The minimum cross-section of cables must be as follows

- power cables 2.5 mm^2
- control cables 0.75 mm^2;
- signal/instrument cables 0.75 mm^2;

- data transmission cables 0.5 mm^2.

The colours of wiring insulation must be as shown in the table below.

Abbreviation	Meaning
L1 Phase 1	Brown
L2 Phase 2	Black
L3 Phase 3	Grey
N Neutral	Blue
110 V AC Control only	Red
110 V AC Power	Brown and Blue
48 V AC and below	Pink
Star contactor link and current transformer (CT) secondaries	Brown
DC positive	Brown
DC negative	Grey
Intruder/interlocking voltage circuits (entire circuit must be continuous and consistent colour)	Orange
Telemetry	White
Instrumentation 4–20 mA analogue	White
Protective earth conductors	Green and yellow *
Functional earth	Cream
Intrinsically safe (IS) circuit	Light blue
*On sites with issues of theft and for larger protective earth conductors installed in the field black coloured cables can be used with cable ends marked with green and yellow tape to identify the cable. This must be approved by the Environment Agency prior to purchasing the cables.	

! Important

The Supplier shall review appropriate standard to assess the need to apply for an exemption quoting the appropriate IEC, BS or BS EN to support the exemption.

Cable segregation/separation

As per BS 7671, the cables must be classified as follows:

- Band 1: Extra low voltage cables (signal / instrument, data transmission and telecommunication);
- Band 2: Low voltage cables (power and control cables);
- intrinsically safe cables;
- HV cables.

The cable guidelines for segregation are provided in the table below. Cables of different categories must cross each other at right angles.
Note The separation distance need not apply to short lengths of cables.

	Separation distance (mm)					
	Band 1	Band 2	IS	HV	Other underground services	Other above ground services
Band 1	–	300	50	500	150	500
Band 2	300	–	300	300	150	500
IS	50	300	–	500	150	500
HV	500	300	500	–	300	500

Cable sizing

Cables must be adequately rated for current-carrying capacity under normal and short-time fault conditions at the specified voltage.
Assessing the rating and cross section of any cable must be in accordance with BS 7671 and IEC 60287.
Where electrical design packages have been used, such as AMTECH, they must submit PDF copies of cable calculations and protection setting to the Environment Agency as part of their design submission. The AMTECH model for the works must also be submitted in its original file format to the Environment Agency.

Mineral insulated copper sheath (MICS) cables

All mineral insulated cables must comply with BS EN 60702 and must be 500 V grade unless otherwise specified.
Restrictions on the use of MICS cable are detailed below.

- MICS cable must not be used between discharge type lighting fittings and associated control equipment unless an appropriate surge suppressor has been correctly positioned in the circuit.
- When MICS cable is specified for a.c. power circuits or d.c. circuits, consideration must be given to inductive load switching and the possible need for surge diverters in the circuit.
- Through joints must comprise jointing sleeves and appropriate accessories supplied by the cable manufacturer for this purpose. After completion, the joint must be protected with a sleeve of material similar to the cable outer sheath.
- MICS cable installations must not be used in hazardous areas unless approved by the Environment Agency.

Cable, glands, pot seals, sleeving, tools and other accessories used together must be compatible and supplied by the same manufacturer. Glands must be a hexagon type and, where applicable, be certified or approved for use in the hazardous area concerned.
Terminations must be made using cold pot seals supplied by the cable manufacturer and the following procedures.

- The pot must be contained in the gland body and must not protrude into the equipment.

- The pot must be effectively screwed onto the cable sheath and its self-cutting thread fully engaged, or in the case of wedge type fittings, correctly fitted in accordance with the manufacturer's instructions.
- The manufacturer's recommendations for excluding moisture from the cable immediately prior to making an end seal termination must be observed rigidly.
- At terminations, conductors must be insulated with neoprene sleeving, or where connections are to be made into high temperature enclosures (for example, tungsten fittings, etc.), silicone rubber sleeving or sleeving as recommended by the cable manufacturer must be used.

In all cases, except where positive earth/ground continuity must be maintained such as via threaded entries of metallic enclosures, cable end seals with earth/ground bonding tails must be used. Earth/ground bonding tails must be properly terminated on earthed/grounded terminals provided for the purpose within the enclosures.

ICA cables

Instrumentation, control and automation (ICA) cables must be in accordance with BS EN 50288-7.
All panel and trunking cables must be of copper conductor with a minimum cross section area of 0.75 mm^2, PVC insulated and cross-linked polyethylene (XLPE) sheathed. Screened cables must have aluminium tape screen.
In general ICA cables are categorised as shown in the table below.
The conductors of any multi core cable must carry signals of the same category.
The conductors forming part of an intrinsically safe circuit must be contained within multi-core cables reserved solely for such circuits.
ICA cables running in parallel with other power cables must be separated as detailed in Cable segregation/separation.

Category	Application
1	Instrument power and control (above 50 V)
2	High level signalling (6–50 V DC) for digital status, analogue current and voltage signals
3	Low level signalling for telemetry, data transmission, telephones, etc.

Fibre optic cables

Fibre optic cables must each contain six secondary coated multi-mode graded index 50/125 mm^2 optical fibres together with two 0.9 mm diameter conductors insulated with polythene, stranded around a 1.83 mm diameter steel strand and plastic coated up to 2.4 mm diameter.
The cable core must be inner sheathed with low density polythene of radial thickness 2.5 mm.
A steel or plastic laminate tape 44 mm in width must be applied longitudinally under the bedding sheath.
The final outer sheath must be a 3 mm radial of high density polythene with an overall diameter of 25 mm.
The minimum cable bending radius must be in accordance with the manufacturer's recommendations.

Connectors shall be suitable for the type of cable being installed as well as the type of socket the cable will be connected to. Connectors shall comply with the relevant parts of BS EN 60874-1.
Connectors shall be attached to cables strictly in accordance with the connector manufacturer's instructions.
Patch panel shall be designed based on the requirements of the fibre optic network. Considerations shall be made for port types, number of ports, type of cable, mounting, etc.
Laser optimised multimode glass fibre type cables shall comply with relevant parts of BS EN IEC 60793-2-10. Plastic optical fibre type cables shall comply with relevant parts of BS EN 60793-1.

Cable installation

General

The cables for each circuit must be the type and size specified for that circuit.
All cable routes must be approved by the Environment Agency. There must be no deviation from the cable routes shown on drawings unless agreed by the Environment Agency.
Where cable is installed overhead, the locations of the cable tray and ladders must be designed to ensure that:

- there is no conflict between them and other equipment, steelwork, piping, ducting, etc.;
- they do not cause any hazard to personnel, block access ways or prevent removal of equipment.

The Environment Agency must be given the opportunity to examine the installation before backfilling of buried cables.
The bending radius of a cable must not be less than the manufacturer's recommended minimum.
Cables must be run in continuous unbroken lengths. Joints are not permitted unless the route length exceeds the maximum manufactured drum length.
Unless otherwise specified, single core cables must be provided with an outer protective sheath (for example, PVC); if laid direct in the ground and/or if unsupported over any part of their entire length, they must include non-ferrous armouring.
Where single core cables are to be used for three-phase circuits, special attention must be given to minimising the likelihood and effects of circulating currents. Insulated glands for cable terminations must be fitted at one end and must be assembled and tested strictly in accordance with the manufacturer's instructions. Each set of single core cables comprising a three-phase circuit must be run close together and under no circumstances must ferrous metal be interposed between the single core cables. Trefoil formation must be used for each three-phase group of single core cables; this requirement can only be relaxed if agreed with the Environment Agency.
Cables must be installed in accordance with the manufacturer's recommendations.

Directly in the ground

All underground cables must be steel wire armoured and PVC sheathed.

Cables must be surrounded by not less than 75°mm of washed sand, loam or sifted soil under and over the cable. A first marker tape must be laid directly on top of the sand layer and the trench must be partially backfilled. The second marker tape must be laid at 300 mm below ground level and the remainder of trench backfilled with top soil.
HV cables (and where specified LV cables) must be protected by suitably sized concrete or earthenware cable covers. These covers must be laid directly above the 50 mm fill of screened material and must extend full width of the trench giving an overlap of at least 50 mm beyond the outer cables.
The minimum depth of cover required from cable to finished grade must be as shown in the table below.
Accurate and detailed drawing records of buried cables must be prepared by the Supplier as each section of cable is installed. Recorded information on the 'as-built' drawings must include:

- dimensioned trench positions;
- duct and trench sections indicating circuits installed;
- location of underground joints taken by measurement from fixed and permanent landmarks.

Type of cable	Minimum depth of cover
Street lighting and telephone cables	600 mm
Power cables up to and including 1000V and control cables *	600 mm
Power cables above 1000 V	1000 mm
*In agricultural and horticultural premises where vehicles and mobile agricultural machines are operated, the minimum depth of cover should be 600 mm, with added mechanical protection. Cables in arable or cultivated ground must be buried at a depth of at least 1000 mm (Guidance Note 1 (705.522).	

As stated in Guidance Note 1 (522.8.10), a depth of burial of less than 500 mm is usually inadvisable as shallow laid cables may be inadvertently damaged by general gardening, etc. Cables that cannot be buried at a reasonable depth should be specifically protected, e.g. by ducts encased in concrete, or installed along an alternative route.

As stated in Guidance Note 1 (708.521.1.1), in caravan parks, campgrounds and similar locations, cables must be buried at a depth of at least 600mm having additional mechanical protection, be placed well outside any caravan pitch or away from areas where tent pegs or ground anchors were expected to be hammered into the ground.

As stated in Guidance Note 1 (709.521.1.7), in marinas, the recommended minimum buried depth is 0.5 m.

In concrete trenches (including troughs)

Cables must be fixed to the walls of cable trenches by means of cable cleats bolted to vertical sections of heavy duty, galvanised, fixing channel fixed securely to the wall of the trench by an expansion bolt.

In cable ducts

Cables must be installed in rigid ducts of unplasticised PVC complying with BS 4660 and BS EN 13598 or corrugated plastic.
Sufficient ducts must be installed to provide 20% spare capacity and 50% spare for roadway crossing.
Ducts carrying different categories cables must be separated as per BS 7671 recommendations and also as per Cable segregation/separation.
Ducts must be left with a 1 m excess length of 8 mm diameter of nylon draw cord in place, anchored at each end.
Cables entering or leaving ducts must be sealed with a 100 mm thick ring of expanding polyurethane foam. Where the water table is identified as a problem, ducts must be sealed using Densomastic 16A sealant. The Supplier shall consider if gas and fire proof duct sealant is required – please see OI 17_17 SD02 Fire Minimum Technical Requirements for Fixed Assets.
Ducts passing through floors must terminate approximately 75 mm above the surface of the floor.
Cable ducts must extend for a minimum 1000 mm beyond the limit of roadways and paved areas.
Draw pits must be installed for every 50 m straight run length of ducts or at the change of direction of ducts. As a minimum, draw pits must be 750 mm × 750 mm × 1000 mm in size and must maintain the required cable separation and facilitate the minimum bending radius of the cable. If alternative standard draw pit sizes are required due to scheme requirements/constraints, the Supplier to submit a Concession request - detailing the reason for deviation for the acceptance of the Environment Agency.

General cable routes

Cables must be allocated to ladders, trunking, trays or racks in the particular grouping arrangement detailed in drawings. Where specified, the racks must be colour-coded.
Care must be taken to maintain the segregation distances between power and instrumentation cables as detailed in Cable segregation/separation.
Electrical continuity must be maintained:

- between sections of cable tray or ladder by the use of flanged fishplates;
- between the tray or ladder and the main structure, either through earthed/grounded support steelwork or by earthing/grounding cable connections to the main structure at each end of the tray or ladder run.

Standard prefabricated bends, tees, reducers and other accessories must be used.
Unless approved by the Environment Agency, sections fabricated on site from straight sections must not be used.

Tray

Metal cable trays up to and including 150 mm wide must be of medium duty type with minimum gauge of 0.9 mm.
Cable trays greater than 150 mm wide must be of heavy duty type and with minimum gauge of 1.4 mm.
Spacing between horizontal tray tiers must be a minimum of 300 mm.
The choice of materials for cable trays and ladders will depend on the severity of the environment and the design life of the installation. As a minimum requirement, they must be heavy duty mild steel hot dipped galvanised unless specified. For corrosive environments, deep galvanised Corten ‘A’ steel or Type 316 516 ‘marine’ grade

stainless steel are acceptable materials. GRP may be used if weight saving is an important factor and adequate earthing is provided.
Where tray is to be installed in fire escape routes it, and all fittings, must be manufactured from metal as specified above. In these locations, fixings into the walls and ceilings must be by steel plugs. Plastic plugs are not permitted. Consideration must also be given to the fire resistance of the substrate that is being fixed to.
Plastic cable trays must be manufactured from rigid un-plasticised PVC having a thickness of not less than 3.0 mm. The material must be self-extinguishing and non-flammable.
Cable trays or ladders must be bolted or clamped to supports. Each length of cable tray must be bolted securely to an adjacent length with factory made coupling plates.
The cable tray support must be installed at regular intervals not exceeding the manufacturer's recommendations such that the weight of the cable is carried without deflection.
Welding to main structural steel work or drilling into concrete members is only permitted with the Environment Agency's approval.
Cables with an overall diameter of 40 mm and above must be fixed to the tray by cable cleats.
Single core cables making up three-phase circuits must normally be run in three-phase trefoil groups, securely clamped together to withstand the mechanical force produced by a short circuit fault. The manufacturer's recommended spacing must be used, supported by evidence of type tests having been performed under short circuit conditions.

All other cables with an overall diameter below 40 mm must be securely fastened to trays and ladders by nylon cable ties. Where cables are secured in fire evacuation routes they must be fixed with fire resistant metal cable clips.

Trunking

Trunking must be installed as a complete system including all necessary parts and accessories. Trunking must be sized to provide a spare capacity of 25%. Trunking ends must be fitted with removable end caps.
Steel trunking must be heavy duty, galvanised with minimum dimensions of 50 mm × 50 mm complying with BS EN 50085. Plastic trunking must be of high impact, self-extinguishing unplasticised PVC (uPVC).
The minimum gauge of steel trunking must be 2 mm. Trunking must be fitted with cable-retaining clips.
For vertical runs, cables must be supported with pin racks.
Trunking must be fixed with round-headed fixing screws or bolts.
Trunking must be kept clear of gas, water and process pipes by a minimum distance of 150 mm.
Appropriate bushes, couplings and flanges must be used for connections to conduit and junction boxes.

Support steelwork and fixings

The Supplier must provide supports necessary for mounting cable trays and cable ladders. These must be of a pre-fabricated construction supplied by the tray or ladder manufacturer to avoid on-site fabrication.

In addition, the Supplier must provide supports for the bus duct, control push button stations, socket outlets, lighting fittings, small power distributions boards, etc. These must also be of proprietary manufacture.
Unless otherwise specified, supports must be made from hot dipped galvanised steel in accordance with MEICA - Specification - Painting and Protection Systems.
Bolts, nuts and washers, etc. must be stainless steel. Shake-proof spring washers must be installed at all bolted connections.
Structural steel or pre-cast concrete members must not be drilled unless specifically approved by the Environment Agency. Fixing must be by means of clamping brackets.
Under no circumstances must welding or fixing operations be carried out on any process plant equipment, vessels, pipelines or structures unless specifically indicated on contract drawings and agreed in advance with the Environment Agency.

Conduit installations

Conduit fittings must be manufactured from hot dipped galvanised steel or super high impact heavy gauge PVC, with a minimum diameter of 20 mm complying with BS EN 61386-1 and BS 4607 respectively.
Conduit must be sized to accommodate the total number of circuits involved without exceeding the conduit fill limitation specified in IEC 60364-5-52.
Conduit systems must be electrically and mechanically continuous throughout and rigidly secured before wiring is commenced.
An adequate number of pull-boxes must be installed to facilitate wiring without strain or damage to cable.
Conduit must not be installed in the ground or in sand-filled trenches.
All conduit branches must be taken off at right angles. Diagonal runs are not permitted.
Conduits fixed to structural steel work must be secured by girder clips.
All concealed conduits must be installed to have full thickness cover of plaster.
Conduits must be provided with draw in boxes at suitable interval.
The spacing for fixing saddles must be not more than 900 mm for PVC conduit and not more than 1500 mm for steel conduit. Saddles must be fixed on either side of joint, bends, etc.
At expansion joints of structure, either flexible conduits must be used or expansion couplers must be provided across the joints.
Conduit threads must be cleanly cut to a finished length which leaves the minimum exposed length of thread when installed. Threads must be checked for correct size using an appropriate gauge. The leading edge and bore must be made smooth.
Exposed bare metal must be cleaned and protected against corrosion using materials compatible with the original protective coating.
Locknuts must be used at all entries and be fully tight.
Wiring in conduit must be looped from point to point and, where joints are unavoidable, they must be made in junction boxes. Junction boxes must be adequately sized and fitted with fixed connector blocks rated for the circuit requirement.
For steel conduit, the whole system must be electrically and mechanically continuous. A test for earth continuity must be carried out before it is concealed by plaster.
Conduit for installations in hazardous areas must be solid drawn screwed galvanised steel complying with BS EN 60079, and fitted with stopper boxes as required. In straight runs, special long couplers allowing each conduit to enter for at least 25 mm must be used.

Flexible conduit must only be used for equipment that are withdrawable, are subject to vibration or at building expansion joints. Flexible conduits must terminate in suitable adaptors and be connected to rigid conduit via a conduit box.

Cable transits

Cables passing through a firewall leading from a safe area into a hazardous area must be fitted with approved proprietary cable transits gland plates. All penetrations through partitions, ceilings and walls must be fire-stopped. Where the fire stopping has not been installed and certified by a third party specialising in fire stopping, the fire stop solution must be proposed to the Environment Agency before use.

Cable identification

Each cable must be fitted with durable identification bands:

- at each end;
- at all points where it enters or leaves ducts and buildings; and
- at each change in direction.

Cables must be identified at each gland termination by their allocated number as indicated on the cable schedules by non-corrodible identification tags.
Similar tags must be attached to cables at either side of a transit unit or cable duct and at specified intervals over the entire length of cable.
Tags must be fixed with PVC coated stainless steel ties.
Cable cores must be identified at each terminal with individual number/letter combinations using non-split cylindrical ferrules.
Identification for multi-core cables, other than power cables, must be made up of three parts:

- terminal number;
- core number;
- cable number.

Cable jointing and termination

Cable joints and terminations must be carried out in accordance with the cable manufacturer’s recommendations, with particular regard to the jointing or termination materials and the procedure proposed.
Jointing and termination of power cables must be carried out by trained and competent tradespeople who have passed an approved course of instruction and trained on the operating voltage levels involved.
Jointing and termination of high voltage cables must be carried out and supervised by specialists, preferably from cable manufacturers.
Prior to insulation of jointed conductors and earth/ground continuity bonds, joints must be proved by resistance measurement to maintain the electrical ratings of the cable conductor, metal sheath (if applicable) and armouring.
Cable glands must comply with BS 6121 and BS EN 62444. They must be fitted with weatherproof shrouds of PVC or another plastic material suitable for the environment.
Flameproof glands must be used on flameproof installations.
Spare cores of control and instrumentation cables must be terminated at both ends, in spare terminal ways or at earth/ground terminals.

Individual cores of cables up to and including 10 mm^2 must be terminated on screw clamp/pressure plate type equipment terminals.
Cable-core termination must be by either crimped palm lugs or sleeves to match either post terminals or bolted-clamp terminals. Aluminium cores of power cables must be terminated using approved bimetallic connectors. Cable lugs and sockets must be of the correct size for the conductor.
Raised insulated barriers must be inserted between groups of terminals intended for wiring at different voltages and between individual phases of a three-phase supply.
No more than two conductors must be connected to one terminal (that is, one incoming and one outgoing conductor).
Terminals in marshalling boxes must be arranged so that 10% spare positions are furnished to allow for future modifications or additions.
Terminations must be neatly arranged, leaving length for one re-termination.
An adequate length of core tail must be provided to allow for generous spreading and laying of cores to their appropriate terminals.
Removable rail-mounted clamp type terminals must be provided for all mains wiring up to 35 mm^2.
Terminal numbers, voltage grouping and terminal block layout must correspond precisely with wiring diagrams so that quick and accurate identification of wiring can be made. All terminals must show the circuit wire number reference.
All telemetry terminals must be located on a single separated common rail.

Cable records

The Supplier must prepare a cable drumming schedule in order to minimise cable wastage and then keep this up-to-date.
The Supplier must maintain an up-to-date record of cables installed by marking up a copy of the cable schedule to indicate where variations in length, size, number of conductors and destinations occur.
The Supplier must also institute a recording system to record actual lengths of cable removed from the drum, the drum reference and the purpose for which each length is used.

Lighting and small power installations

General

The design and installation of indoor and outdoor lighting must comply with BS EN 12464. Road lighting must comply with BS 5489.
All luminaires and accessories must have an appropriate ingress protection (IP) rating and corrosion resistance suitable for the operating environment.
Luminaires must be supplied complete with:

- suitable lamp ballasts;
- installation accessories such as clamps, brackets, suspension chains, pendants, etc.

In areas housing rotating machinery, lighting must be arranged on multiple-phase circuits to prevent stroboscopic effects.
Where adjacent luminaires are connected to different phases of the supply, labels must be fitted internally, warning of the presence of the phase-to-phase voltage.

After installation, luminaires must be readily accessible for inspection, cleaning, maintenance and replacement without need of scaffolding. Where this is not possible, the Supplier must obtain approval from the Environment Agency.
Following installation of the lighting systems, the Supplier must, under night-time conditions:

- take readings of illumination levels throughout the plant or platform with the normal lighting system energised;
- energise the emergency lighting system only to prove adequacy;
- adjust the orientation of floodlight fixtures for maximum efficient use.

Levels of illumination

Levels of illumination must be in accordance with the Chartered Institution of Building Services Engineers (CIBSE) *Code for lighting*.

In general and unless otherwise specified, the lighting design and installation must achieve the average maintained luminance as per the table below.

Type of location	Average maintained luminance
Control rooms, motor control centre (MCC) rooms and switchrooms	300 lux
General offices	300 lux
Pump house	200 lux
Internal plant areas	150 lux
Stores	100 lux
External plant areas	50 lux
Major roads and car parks	20 lux
Outdoor substations	30 lux
Walkways and platforms	50 lux

Indoor Lighting

General-purpose luminaires

Luminaires must be of the light emitting diode (LED), fluorescent, tungsten or gas-discharge type as specified, and must comply with BS EN 60598.
General-purpose fluorescent luminaires must be manufactured from zinc-coated sheet steel of minimum thickness 0.7 mm with white epoxy polyester powder or equivalent finish. Luminaires must be fitted with a trough reflector or prismatic diffuser as specified.
Fluorescent luminaires must be of the switch-start type unless otherwise specified and must be complete with power factor correction capacitors sized to give an overall circuit power factor of 0.9.
Luminaires for installation in clean and dry areas must have a minimum degree of protection IP20 (without a diffuser) and IP40 (with a diffuser) to BS EN 60529.
Luminaires for use in a corrosive environment must have a GRP body with a prismatic acrylic or polycarbonate diffuser. The degree of protection must be IP65 to BS EN 60529. Covers must be sealed to the body with a neoprene gasket and must be secured using stainless steel fixing catches. The catches must be hinged to the body.
Recess-mounted luminaires must be arranged for mounting independent of the suspended ceiling into which they are fitted.
Bulkhead luminaires must be of the heavy-duty type and must have a diecast corrosion-resistant aluminium body and front frame with epoxy polyester powder or equivalent finish, and prismatic cover.
Covers fitted to luminaires located outdoors must be impact-resistant polycarbonate. The cover must be sealed to the body with a silicon rubber gasket and must be secured using stainless steel captive screws. Retaining hinges must be stainless steel.

Bulkhead luminaires for indoor location must have a minimum degree of protection IP54 and for outdoor location IPW55 to BS EN 60529.
Indoor lighting must be controlled by individual wall switches and/or occupancy sensors in each room or area.
Lighting switches must, in general, be placed 1.2–1.8 m above the finished floor or grade.
Indoor lighting circuits must be separate from outdoor lighting circuits.

Luminaires for hazardous areas

Luminaires for location in Zone 1 and Zone 2 hazardous areas must comply with BS EN 60079. The apparatus group and temperature class must be as specified.

LED lamps

LED lamps must comply with IEC 62560 and IEC 62031.
Currently there are many developments in lighting using LEDs. Where commercially available, LED lamps must be the preferred choice of lamp. The Supplier must submit technical details with their tender for any LED light products for approval by the Environment Agency.
As a minimum, LED lamps must comply with the following.

- LEDs must have a correlated colour temperature of 4,000–4,500K range (warm white). The colour rendering index (CRI) of the light produced by the light-emitting diodes of the lamps must be above 75.
- The individual LEDs must have rated life of 30,000–50,000 hours.
- The replacement LED lamps must have compatible fittings so they can be direct retrofit to incandescent, fluorescent and halogen lamps.
- LED lighting products must not contain mercury gases.
- Where specified, dimmable LED lights must be compatible with local dimmers on the market. The dimming range must provide effective
- dimming without flickering from 40% to 100% light output.
- LEDs must have a power supply efficiency of not less than 85% and an LED efficiency of not less than 90 lumens per watt (lm/W).

Other lamps

Energy-saving fluorescent lamps used as a direct replacement for tungsten filament lamps must have integral control gear and a minimum rated average life of 8,000 hours.
Tungsten filament lamps must comply with BS EN 60064 and BS EN 60432, and have a minimum rated average life of 2,000 hours.
Tungsten lamps must have a reinforced internal construction to provide increased resistance to filament breakage caused by jolts and vibration. Lamps for special applications must be as specified.
Tungsten lamps rated up to and including 150 W must be fitted with a bayonet-type lamp cap.
For lamp wattage above 150 W, the lamp cap must be of the Edison screw type. Lamp caps must comply with BS EN 60061.
Tubular fluorescent lamps must be of T5 (krypton filled, 16 mm diameter) or T8 (26 mm diameter), and must incorporate tri-phosphor internal coatings.
Fluorescent lamps must comply with BS 1853-2 and have caps of the bi-pin type.
Unless otherwise specified, lamps for installation in industrial areas must have a correlated colour temperature of 3500K (white appearance) and for other areas must

have a correlated colour temperature of 3000K (warm appearance). The minimum rated average lamp life must be 3,000 hours.
Mercury discharge lamps must comply with IEC 60188.

Emergency lighting

Emergency lighting must comply with BS 5266 and be designed to provide illumination for safe exit from operating areas in the event of power failure.
Emergency lighting must be provided for:

- critical rooms;
- control rooms;
- large electrical substations;
- critical instruments;
- safety eye wash/showers;
- safety equipment locations;
- laboratories;
- clinics;
- other areas where lighting failure might create safety hazards or may disrupt operations.

Emergency lighting must either have self-contained battery powered lamps to provide transitional emergency lighting or be powered from a central emergency battery bank supply.
For self-contained battery powered luminaires, a local key-operated test switch must be installed adjacent to normal lighting switches. The front plate of the switch must be engraved ‘Emergency Lighting – Test Switch’. Key switches must be grid type with a secret key. Such luminaires must have a permanent neon indication light indicating battery charge ‘healthy’.
Emergency exit lights must be provided for all emergency exits.

Outdoor lighting

Roadway lighting

The installation must be designed to avoid light pollution beyond the site boundary and upward into surrounding area.
The control system incorporating photoelectric cells must be provided with a 24-hour time switch to allow the user to override the automatic control system and to pre-set any periods when no lighting is required.
Roadway lighting columns must be constructed and installed in accordance with appropriate parts of BS EN 40. The base compartment door/cover must be fitted with a tamper-proof fastening.
Columns must have bolted base mounting plates for installation on concrete foundation blocks, which must incorporate bottom-entry cable ducts. Columns must be complete with baseboard, fuse unit and wiring between the fuse unit and luminaires.
The fuse unit must have:

- a non-hygroscopic plastic case designed to prevent the ingress of moisture and condensation;
- integral double-entry cable termination chamber with detachable front cover;
- enclosed-type fuse complying with IEC 60269-1.

Flood lighting

Floodlighting must be general-purpose LED or metal halide fixtures.
Floodlighting luminaires must be complete with a high-purity anodised aluminium reflector and a galvanised steel mounting bracket. Reflector characteristics must be selected to suit the floodlight application. The final position and angles of floodlights must be determined during construction.
Floodlights must be mounted on stirrups.
Cable for connections to floodlights must be of adequate length to permit floodlights to be adjusted to the full range of their mountings.
Control boxes must be mounted adjacent to the fittings in a position easily accessible for maintenance and repair.

Electrical outlets

Electrical outlets

Electrical outlets/switches must be installed in accordance with the following.

- Industrial socket outlets must be used for process areas, switch rooms, workshop and garages.
- Electrical outlets/switches located in wash down areas or in other wet areas must be equipped with IP65 weatherproof covers and boxes.
- Electrical outlets/switches must be centrally located to provide ease of use for maintenance and operations.
- A branch circuit supplying welding plug outlets must serve no other equipment. Electrical outlets must be arranged in groups of not more than four outlets per circuit. The number of outlets on a circuit will determine the minimum cable size to be used.
- Welding outlets must be located within 30 m of any structure or area in which welding is to be performed.
- Outlet and switch boxes located outdoors must be IP65 enclosures in accordance with BS EN 60529 made of a corrosion-resistant material such as fibreglass, copper-free aluminium, or stainless steel.
- In office and control room areas, socket outlets must be installed 0.5 m above floor level. In plant areas, socket outlets must be installed 1.2 m above floor level. For critical assets, socket location must be above the assessed exceedance level. The height of socket outlets must only be changed with the approval of the Environment Agency.
- Residual current circuit breakers fitted to socket outlets must comply with BS EN 61008. They must have a tripping sensitivity of 30 mA with an operating time not exceeding 30 milliseconds.

Earthing and bonding

Compliance with standards

All earthing and equipotential bonding must be installed and tested in accordance with BS 7671 and BS 7430.

Earthing system design

An effective and safe earthing system for all plant, equipment, extraneous metalwork and electrical services installations within the complete site installation shall be designed and provided.
The earthing system must be designed and installed in accordance with BS 7430 and BS 7671.
Earthing grid systems for main power plant and electrical substation installations, including limits for ground potential rise step and touch potentials, must comply with the requirements of IEEE 80 *Guide for safety in AC sub-station grounding*.
The Supplier is responsible for the design of the earthing system and for the design co-ordination of the earthing system with the earthing of the main incoming power supply system.
The Supplier must supply all required design and also test documentation to the distribution network operator (DNO) when the installation is complete. A copy of these documents must be sent to the Environment Agency.
The earthing systems for instrumentation and control systems must be as specified in ICA earthing.

Selection and installation of earthing components

Components

Earth electrodes

Earth electrodes must consist of earth rods or earth plates or tapes bonded together in a grid. Buried metallic pipes and building steel structures must not be considered as a sole means of earthing and must be bonded to earth grid.

- Earth rods must be able to be extended, being each 1.2 m long and 16 mm diameter made up of copper-clad, high tensile steel. The rods must have hardened steel tips and driving caps. The extensible rods must be threaded for screwed joints and applied with corrosion inhibiting paste at the joint. The separation distance between two adjacent installed rods must not be less than 1.25 times the length of the rod.
- Earth plates must be manufactured from 600 mm × 600 mm × 3 mm thick material and buried vertically in ground. Plates must be installed such that the top edge of the plate is a minimum of 1 m below ground and the separation distance between adjacent plates is not less than 2.5 m.
- Where earth tapes are used as earth electrode, the tapes must be bare annealed copper of minimum 20 mm × 3 mm size. They must be installed as a minimum 1 m below ground.
- The earth electrodes must be installed in soil of low resistivity, below the frost line. If necessary approved soil conditioning agents must be used. All earth electrodes must be provided with labelled earth pits. The earth pits with removable lids must be flush with finished ground level.

Earthing conductor

The earthing conductor must be sized according to the anticipated fault current. The earth electrodes must be joined in a grid by a bare copper earthing conductor of

appropriate size. The sizing calculation must take into account corrosion factor for high resistivity soils.
When buried underground, the minimum cross-sectional area of earthing conductor must be:

- 2.5 mm^2 copper equivalent when protected against mechanical damage and corrosion;
- 16 mm^2 when not protected against mechanical damage;
- 25 mm^2 when not protected against corrosion.

All joints below ground must be made by exothermic welding.
All above ground joints at earthing pits must be made by copper clamps and phosphor bronze bolts.
All earthing cable terminations must be by lugs.
All contact surfaces to be joined must be cleaned and be free from paint.
All exposed joints and connections must be covered with a protective coating such as petroleum wax, heat-shrink sheathing, etc.

Circuit protective conductor

All exposed conductive parts of electrical equipment liable to become live under fault conditions must be connected to an earthing system by a circuit protective conductor (CPC).
The CPC must be run to and be terminated at each point in the wiring and at each accessory, apart from suspended lamp holders having no exposed conductive part.
Metallic trunking and conduits must be bonded but not used as the circuit protective conductor.
The protective conductor must be selected and sized in accordance with BS 7671. All calculations must be submitted to the Environment Agency for approval.

Equipotential bonding conductor

All metallic pipes of incoming services (water, gas, heating, etc.) and all structural steelwork must be bonded to the main earthing terminal at the point of entry of these services by the main equipotential bonding conductor.

- The main protective bonding conductor must be designed in accordance with BS 7671.

Main earth bar

All system earths must be connected to a copper main earth bar mounted on an insulating stud.
The earth bar must be 50 mm × 6 mm and a minimum of 600 mm long with 10 mm diameter holes drilled at intervals of 50 mm.
The earth bar must be identified with a permanently engraved legend and label ‘Safety Earth. Do Not Remove.’

ICA earthing

The ICA system must have single point earth to prevent creation of earth loops.
The ICA earth must be connected to the main earth at one point only. ICA cable shields must be earthed at one point only.
The ICA earth conductors must be insulated.
The equipment chassis, panel frames, instrument AC power supply and transformer laminations must be connected to the electrical power earth.

A separate ICA copper earth bar of 75 mm^2 cross-sectional area must be mounted on insulators.
The ICA earth bar must be connected to the main earth bar by 16 mm^2 insulated copper wire having a resistance less than 0.2 Ω.
The cable screen must remain insulated from earthed conducting surfaces throughout its length.
All equipment in field-mounted ICA enclosures must be connected to the nearest earth bar by insulated earth wire.
Diode shunt barrier devices in intrinsically safe circuits must be bolted directly to an intrinsically safe earth reference bar.

Lightning protection

General

Lightning protection must be installed and tested for all buildings and/or plant structures in accordance with BS EN 62305. All new structures must be assessed for the need for lightning protection as detailed in BS EN 62305-2 and, if required, must be provided with lightning protection.

System design

The system shall be designed in accordance with BS EN 62305. The system must be designed to appear as part of the structure.
Exposed roof conductors must be placed so as to require a minimum displacement for future repair and maintenance of roofing.
Buildings with brown roofs and handrails may utilise the handrail as an air termination network provided this is:

- assessed as being suitable;
- connected to down-conductors or the building structural steel columns.

Earthing system

The lightning protection system must have an independent earthing system that must be interconnected to the power system earth grid.
The connection between the down-conductor and earth electrode must be accessible and contained within an inspection box.
Each down-conductor must be connected to an earth electrode through a screw-type test clamp mounted at a height not exceeding 1800 mm above ground level.
The lightning protection earth grid resistance must not be more than 10 Ω when not bonded with other services.

Air terminals

Air terminals must have base supports designed for the surface on which they are used and must be securely anchored.
All exposed metal eave troughs, roof vents, guy wires, antennas and air handling equipment must be bonded to the lightning protection (LPS) system in such a way that if struck a clear path to ground through the LPS is provided. Dissimilar metal components

must not be connected together except by means of an approved bimetal transition fitting.

Bonding

The LPS must be bonded to structure/building electrical ground grids wherever these are available.

Inspection, testing and commissioning

General

The electrical installation must be inspected and tested in accordance with BS 7671.

Labels and safety signs

Design and fixing

All equipment must be clearly identified by individual labels.
The labels mounted on outside of an enclosure must be manufactured from laminated plastics and engraved so as to produce black letters 3 mm in height on a white background.
Lettering, colour and layout of safety signs must comply with the relevant parts of BS 5499 and BS ISO 3864 and the Health and Safety (Safety Signs and Signals) Regulations 1996.
Labels and safety signs must be written in English and be unambiguous, durable and legible.
Labels and safety signs must be attached using corrosion-resistant mechanical fixings. They must not be attached to covers or removable items.

Related Documents

Regulations

- Health and Safety (Safety Signs and Signals) Regulations 1996
- Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016
- The Waste Electrical and Electronic Equipment Regulations 2006 (as amended)

Code of Practice

- Guide for safety in AC sub-station grounding, IEEE 80, Institute of Electrical and Electronics Engineers, 2000.

- Code for lighting, CIBSE, 2002.
- Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators, Engineering Recommendation ER G59/2-1, Energy Networks Association, 2011.
- Specification for underground armoured cable protected against solvent penetration and corrosive attack, Publication 133, 2nd edition, EEMUA, 2011.

BS series

- BS 67 Specification for ceiling roses
- BS 1362 Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)
- BS 1363 13A plugs, socket-outlets, adaptors and connection units
- BS 1853-2 Tubular fluorescent lamps for general lighting service. Specification for lamps used in the United Kingdom not included in BS EN 60081, BS EN 60901, BS EN 61195 and BS EN 61199
- BS 4607 Non-metallic conduits and fittings for electrical installations
- BS 4660 Thermoplastics ancillary fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage
- BS 4662 Boxes for flush mounting of electrical accessories. Requirements, test methods and dimensions
- BS 4678 Cable trunking
- BS 5266 Emergency lighting
- BS 5489 Code of practice for the design of road lighting
- BS 5499 Graphical symbols and signs. Safety signs including fire safety signs
- BS 6004 Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500V, for electric power and lighting
- BS 6121 Mechanical cable glands
- BS 6972 Specification for general requirements for luminaire supporting couplers for domestic, light industrial and commercial use
- BS 7430 Code of practice for protective earthing of electrical installations
- BS 7671 Requirements for electrical installations. IET Wiring Regulations

BS EN series

- BS EN 40 Lighting columns
- BS EN 12464 Lighting of work places
- BS EN 13598 Plastics piping systems for non-pressure underground drainage and sewage
- BS EN 13602 Copper and copper alloys. Drawn, round copper wire for the manufacture of electrical conductors
- BS EN 17037 Daylight in buildings
- BS EN 62444 Cable glands for electrical installations
- BS EN 50085-2-1 Cable trunking systems and cable ducting systems for electrical installations. Cable trunking systems and cable ducting
- BS EN 50288 Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for instrumentation and control cables
- BS EN 60061 Lamp caps and holders together with gauges for control of interchangeability and safety
- BS EN 60064 Tungsten filament lamps for domestic and similar general lighting purposes. Performance requirements

- BS EN 60079 Code of practice for selection, installation of electrical apparatus in potentially explosive atmospheres
- BS EN 60309 Plugs, socket outlets and couplers for industrial purposes
- BS EN 60432 Incandescent lamps. Safety specification
- BS EN 61439-3 Low-voltage switchgear and controlgear assemblies. Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access to their use. Distribution boards
- BS EN 60529 Specification for degrees of protection provided by enclosures (IP Code)
- BS EN 60598 Luminaires
- BS EN 60669 Switches for household and similar fixed electrical installations
- BS EN 60702-1 Mineral insulated cables and their terminations with a rated voltage not exceeding 750V. Cables
- BS EN 60793 Optical Fibres
- BS EN 60874-1 Fibre optic interconnecting devices and passive components. Connectors for optical fibres and cables. Generic specification
- BS EN 60947-1 Low-voltage switchgear and controlgear. General rules
- BS EN 61008 Residual current operated circuit-breakers without integral overcurrent protection for households and similar uses
- BS EN 61558-2-5 Safety of transformers, reactors, power supply units and combinations thereof. Particular requirements and tests for transformer for shavers, power supply units for shavers and shaver supply units
- BS EN 61386-1 Conduit systems for cable management. General requirements
- BS EN 62305 Protection against lightning
- BS EN 62444 Cable glands for electrical installations

BS EN ISO Series

- BS ISO 3864 Graphical symbols. Safety colours and safety signs

IEC standards

- IEC 60055 Paper insulated metal sheathed cables for rated voltages up to 18/30kV
- IEC 60188 High-pressure mercury vapour lamps. Performance specifications
- IEC 60227 PVC insulated cables for voltages up to and including 450/750V
- IEC 60269 Low voltage fuses
- IEC 60287 Electric cables. Calculation of the current rating
- IEC 60309-2. Plugs, socket-outlets and couplers for industrial purposes.
- IEC 60364 Low voltage electrical installations
- IEC 60502 Power cables with extruded insulation and their accessories for rated voltages from 1kV up to 30kV
- IEC 60529 Degree of protection provided by enclosures (IP code)
- IEC 60793 Optical Fibres
- IEC 60947 Low-voltage switchgear and controlgear
- IEC 62031 LED modules for general lighting. Safety specifications
- IEC 62560 Self-ballasted LED-lamps for general lighting services by voltage >50V. Safety specification

Guidance note

- IET Guidance Note 1: Selection and Erection
- IET Guidance Note 3: Inspection and Testing
- IET Guidance Note 4: Protection Against Fire
- IET Guidance Note 5: Protection Against Electric Shock
- IET Guidance Note 7: Special Locations
- IET Guidance Note 8: Earthing and Bonding

Standard specifications

All MEICA specifications are listed in:

- MEICA - Specification - General

Appendix 4.4 - MEICA - Specification - Electric motors

What's this document about?

This document sets out the MEICA specification to be followed by all Environment Agency staff and suppliers when specifying electric motors. Any variation to this standard must be applied for through the concession process.
! Users must read MEICA – Specification - General prior to using MEICA any Specifications.

Who does this apply to?

This specification applies to:

- Environment Agency Staff;
- External suppliers working on MEICA projects.

Contact for queries and feedback

- MEICA.Directorate@environment-agency.gov.uk
- Please give anonymous feedback for this document.

Contents

Electric motor selection and design

Correct selection

The electric motor must be suitably sized and selected for the duty and conditions of service.
The performance, design, construction and testing of the electric motor must comply with:

- all relevant and latest British and international standards and codes of practices;
- statutory requirements such as but not limited to the supply of machinery (safety) regulations, electromagnetic compatibility regulations and the LV directive.

Other requirements

Electric motors must also comply with:

- MEICA – Specification - General
- this specification;
- project datasheets;
- any other documentation issued by the Environment Agency.

Note Where such documentation imposes additional requirements to the standards listed in Related documents, the requirements of the specific project documentation take preference.

Critical Assets

- Electric motors installed as part of a Critical Asset must be assessed under OI 17_17 and the associated MEICA specifications.

Whole life costs

In addition to the documentation requirements in MEICA - Specification - General the following must be submitted as part of the tender:

- power output;
- specific fuel consumption;
- specific lube oil consumption of the electric motor.

Design life

The table below sets out the minimum design life of the electric motor at the rated conditions.

Equipment Type	Design Life
Single phase motors	20 years
Three phase motors	30 years

Equivalent standards

Equivalent standards issued by internationally recognised engineering institutions or organisations that are equivalent to those listed in Related documents may also be accepted subject to the approval by the Environment Agency.
Manufacturers offering equipment complying with other standards must supply duplicate copies of such standards in English together with the tender.

Service conditions and application

Standard conditions

Unless otherwise specified, the motors provided must be capable of satisfactory operation:

- at an altitude not exceeding 1,000 metres above sea level;
- within the temperature range of –15˚C to 40˚C (with a maximum average in any 24-hour period of not more than 35˚C); and
- relative humidity up to 95%.

Special service conditions

Particular requirements to meet special service conditions in terms of temperature, altitude, degree of pollution, vibration, shocks and hazard must be complied with or special agreements made between the Environment Agency and the Supplier. For information on locations with special service conditions, see MEICA – Specifications - Electrical Installations

Electrical supply characteristics

General requirements

Unless otherwise specified, the electric motor must be suitable for operation with the specified electrical supply voltage, phases, efficiency and frequency.

Tolerance

Tolerance on the supply must be within the range of ±10% of the supply voltage and ±1 Hertz (Hz) of the supply frequency.

Operation under three phase supply

The motor must be capable of operating under three phase supply imbalance, where the negative and zero phase sequence components of the voltage do not individually exceed 2% of the positive phase sequence components.

Direction of rotation of motor

When viewed from drive end and motor phases brown–black–grey are connected to the L1–L2–L3 terminals respectively, the direction of rotation of electric motor must be clockwise.

Information for the manufacturer

The manufacturer must be supplied with information in writing such as plant duty, number of starts per hour, voltage, frequency and rotational speed.

Performance requirements

Duty and rating

The electric motor must have a maximum continuous rating (rated output), based on duty type (as defined in BS EN 60034-1), equal to 110% of the maximum power input of the driven equipment.
For fixed speed motors, the duty power input must not be less than 75% of the maximum continuous rating of the motor.

The motor efficiency for all motors at the continuous rating must conform to the 'IE' efficiency class, defined within BS EN 60034-30 and motor must have maximum ranges of efficiency between half and full rated output. Regulations (EC) 640/2009 and 04/2014 require motors with an efficiency class of IE3 or above for motors rated 0.75 to 375 kW; motors with an efficiency class of IE2 can still be installed as long as they are driven by variable frequency drives.
The electric motor and all its components must be rated to withstand the maximum prospective fault current at the point of installation and an insulation class capable of withstanding voltage spiking from variable frequency drives.

Starting

The method of starting must be specified in the project specification, using MEICA - Specification - Motor Starters, for details on starting methods.

Speed

Unless otherwise specified in the project specification, the output speed requirements of the electric motor must have a maximum synchronous speed of 1,500 rotations per minute, corresponding to four-pole construction at 50 Hz.
Electric motors must have a rated output speed to meet the requirements of the plant or machinery. Unless otherwise specified, this speed must be determined by the plant or machinery supplier.

Transient recovery

The motor must be capable of recovering normal operation in the event of a system disturbance causing temporary loss of supply voltage for periods of up to 0.2 seconds (fault clearance time) followed by a sudden restoration initially to 80% rated voltage. At this voltage, the motor must be capable of accelerating to ultimate recovery under the most arduous load conditions (for example, open fan vane, open pump discharge valve, speed controller in maximum speed position, etc.).

Noise levels

The noise level of the electric motor when running at rated speed and output must be considered.
The noise levels of the motor must be in accordance with BS EN 60034-9.

Vibration levels

At the rated speed and output, the maximum level of vibration of the electric motor must comply with Grade A in accordance with BS EN IEC 60034-14.

Design requirements

Insulation

The insulation of the motor windings must be to Class F of BS EN 60085 with the temperature rise limited to Class B.
Temperature rise must be measured by the resistance of the windings during full load condition, in accordance with BS EN 60034-1.
Windings must be supported, braced, wedged and blocked to provide adequate rigidity under all conditions of service.
Special attention must be given to the windings of direct-on-line started motors and the support of windings of vertical motors to prevent any permanent displacement during the service life.
The coil overhang of rotor windings must be tension banded.
The stator windings must be designed for a minimum life of 25 years of service at rated load and voltage.

High Torque (HT) motors

For HT motors, details of insulation system type tests and the manufacturing quality assurance scheme must be submitted to the Environment Agency for approval.
The motor winding insulation must withstand the voltage stress caused by switching of an oil circuit-breaker, SF_6 circuit-breaker, vacuum circuit-breaker or vacuum contactor as motor starter.
Vacuum interrupters must have a level of current chopping of 5A or less, a rate of rise of re-striking voltage up to 0.2 kV/m/s (kilovolts per metre per second) and a peak re-striking voltage of 229% of its rated line voltage.
If the motor has a graded insulation system such that different test voltages are recommended other than the standard voltage specified in BS EN 60034-1, this should be stated in the tender.
For HT motors, semi-resin mica tape and hyper-sealing tape must be used for insulation of winding overhang and jumpers. Heat shrinkable insulating material must not be used as Class F motor insulation. The winding overhang must be accessible for cleaning.
For HT motors, windings coils must be of preformed type. Stator slots must be of open type to facilitate easy insertion of replacement windings.
Laminated type magnetic slot wedges must not be used. If the manufacturer proposes to use other type of magnetic wedges, the resulting change in performance must be better as compared with non-magnetic slot wedges.

Cage type rotors

Cage type rotors must be designed to provide an adequate factor of safety against mechanical failure due to fatigue during the service life of the motor.
Special attention must be given to the design of cage rotors fitted to motors that are subject to operation at speeds in excess of rated speed and where flywheels or large inertia loads are involved.

Joints and connections

Electrical joints and connections must withstand the mechanical and thermal stresses under normal and abnormal operating conditions.

Stator end windings must be blocked and braced to provide high rigidity.

Use of vacuum impregnation

Completed windings, including connections, must be subjected to a minimum of two cycles of vacuum impregnation with solvent-free resin varnish followed by curing to:

- fill gaps between individual conductors effectively;
- enhance mechanical strength;
- provide a high resistance to moisture, oil and chemical contamination.

Where an alternative insulation process is proposed by the manufacturer, full details must be provided to the Environment Agency with the offer with test data given to verify the service life of the windings to 25 years.

Resistance to flame propagation

The winding insulation materials and cable insulation must be resistant to flame propagation.

Cables

The insulation of flexible cables connecting stator windings to terminal boxes must be of the chlorosulphonated polyethylene (CPS) or ethylene propylene rubber (EPR). Natural rubber insulated cables must not be used.
Cables must be securely fixed to the stator frame. The stator winding cable leads must be terminated with tinned copper cable lugs securely held by steel bolts supported on strong insulation material.

High voltage testing

Motors must be designed to permit high voltage tests conducted after erection on site in accordance with BS EN 60034-1.

Degree of protection for motor enclosures

The degree of protection for motor enclosures must be in accordance with BS EN IEC 60034-5. Unless otherwise specified, the following minimum degrees of enclosure protection must apply:

- all motors installed in dusty, damp or wet areas (IP55);
- all motors installed outdoor or exposed to water jet (IP56).

Guards must be used to protect fans and blades external to the enclosure against contact. The degree of protection offered by guards must comply with BS EN IEC 60034-5.
Totally enclosed motors must be provided with a suitable means for breathing and for drainage to prevent the accumulation of water.
Stator frames must be cast iron and foot- and flange-mounted as required by the contract. Aluminium frames are only permitted for 2.2 kW motors or smaller.

For submersible applications, the enclosure must be to IP68 and be capable of being continuously submersed to a depth of at least 2 m greater than the maximum immersion depth of the application.
All fans, end covers, terminal boxes, etc. must be constructed from metal. Fans must be designed to allow the motor to be run in either direction
If the motor is to be vertically mounted with a shaft-down configuration, it must be fitted with a drip-proof, top-end cowl.

Structural requirements

General

Motor dimensions and frame number must be in accordance with BS EN 50347.
Motor frames must be cast iron, fabricated from steel plate or aluminium as appropriate. Frames must incorporate substantial internal ribbing to provide high structural strength.
The shaft-end must be machined in accordance with BS 4999-141, with a tapped hole to facilitate fitting of half couplings and pulleys.
Type of mounting for standard motors must be either IM B3 (IM 1001), IM B5 (IM 3001), IM V1 (IM 3011) or IM V6 (IM 1031) in accordance with BS EN 60034-7.
End covers, end shields, external fan cowls and other external components must be of adequate strength and robustness. They must be constructed of metal and treated with a corrosion-resistant coating unless otherwise approved by the Environment Agency.
Plastic components must be designed to take into account the environmental conditions and the long-term effects of operating temperature, ageing and the thermal stability of the material. Where used for external components, the material must be resistant to flame propagation. Where plastic covers enclose live parts, the design must eliminate the risk of electrical shock to personnel during operation of the motor.
Motors for driving pump sets of the same capacity and supplied under the same contract must be interchangeable.
An acoustic enclosure must not be used unless specified. Where specified for use, acoustic chambers must be detachable and fitted with lifting bolts for easy removal. The position and the mounting of the chamber must not cause undue vibration to the motor.
The frame design of the motor must facilitate easy removal of the rotor assembly and allow motor stator winding repair/cleaning to be carried out.
The colour of the final coat of the motor must be same as that of the pump.
A motor bedplate/foundation block must be provided unless the motor is to be mounted on the soleplate of the pump. Provision must be made for fitting jacking screws to facilitate alignment of the coupling.
Vertical motors must be designed for flange mounting on a detachable motor stool and soleplate to be supplied with the motor.

Cooling

Motors must be designed for method of cooling IC411 to BS EN 60034-6. For HT motors, unless otherwise specified, motors of size 1000 kW and above must be fitted with individual outlet air ducts to BS EN 60034-6(method of cooling IC2A1), with self-circulation air as coolant.

The motor air inlet must normally be arranged to draw ventilating air directly from the surroundings.

Fans

The motor ventilating fan at the non-drive end (NDE) must be directly driven by the motor (that is, with no auxiliary power supply required).
The motor fan for outlet air must be designed such that, at the worst operating condition and rated output, the maximum operating temperature of the stator windings does not exceed the value specified for Class B insulation and the casing temperature is less than 75°C at 40°C ambient.
The fan must be designed to take into account the air resistance of the air ducting and the back pressure at the discharge outlet equivalent to a wind velocity of 10 m/s blowing directly against the exhaust air outlet grille.
The design calculation of the air ducts must be submitted for assessment.
For HT motors, a temperature detector must be installed for the motor exhaust air for high temperature alarm and trip.

Inlet and exhaust air grilles

The inlet and exhaust air grilles must be designed such that there will be no recirculation of exhaust air on individual motors or between adjacent motors.
To avoid water condensation, the exhaust air grille must be so positioned that it does not direct air on to the pump casing, its inlet or discharge pipes.

Ducts

Ducts must be fabricated with hot dip galvanised steel sheet to BS EN 10143 Grade 22 and be not less than 1.5 mm thick. The ducts must be constructed such that:

- the pressure losses due to eddies or vortices are minimised;
- no noise or vibration is created or transmitted.

Face panels must be stiffened and creased to prevent “drumming”.
All ductwork must be secured by hangers, brackets or other appropriate means of support. All mild steel components must be hot dip galvanised.
Provision must be made in the design to prevent water or condensate getting into the winding through the ventilation ducts. A flexible coupling must be provided between the motor and the ducting.
Access/maintenance openings must be provided at suitable positions to facilitate inspection and cleaning of the interior

Lubrication

Unless ‘lubricated for life’ bearings are included, bearings must be lubricated with grease in line with manufacturer’s instructions.
Grease nipples must be located such that there is no danger from moving parts while the motor is being greased.

Bearings - general

Full details of all bearings must be given on the nameplate of the motor and on the parts list supplied as part of the service manual.
Bearings must be capable of accepting:

- the mechanical and electrical forces imposed on them by the rotor;

- the forces imposed by the motor altitude;
- external forces due to the drive method.

Bearings must be of the rolling or plain type as determined by consideration of motor rating and speed, shaft system, duty, method of drive and the type of bearing of the driven equipment. Motors rated below 40 kW must be fitted with a “sealed for life” type of bearing.
Unless otherwise specified or approved by the Environment Agency, motors rated from 40 kW up to 140 kW must be fitted with rolling type bearings.
The motor manufacturer must examine the external axial and radial load imposed from the shaft and the driven device when selecting the type of bearings to be provided for HT motors. Where damage is likely to occur to rolling bearings due to thrust load or stationary vibration, a plain type bearing must be preferred.
Variable frequency drives (VFD) can cause premature motor bearing failure due to shaft currents passing through the bearing. The motor, therefore, must be designed to prevent this occurring by the use of an alternative discharge path. Insulated bearings may be used where this is not practicable.
Motors marketed as “inverter-rated,” “inverter-duty” or “inverter-ready” models must, in addition to inverter rated windings, have bearings designed to prevent damage from shaft induced currents. Insulated bearings or insulated end shields shall be fitted to the non-drive end of these motor(s).
Where bearings are insulated from the main frame to suppress shaft circulating currents, they must be connected to earth at one point via a link. The link must be removable to permit testing of the bearing insulation.
Oil and water pipes, direct driven oil pumps and any other ancillary equipment must be insulated as necessary to maintain the integrity of the bearing insulation. The insulation must not be short-circuited by the application of electrically conducting paint.
For HT motors of 750 kW and above or where the induced shaft voltage exceeds 0.15 V, an insulated bearing arrangement must be provided.
For motors above 140 kW and inclusive, thermometer pockets must be provided on each bearing to enable insertion of a test thermometer. A resistance temperature detector (RTD) complying with BS EN 60751 Grade 2 must be provided to monitor the temperature of each motor bearing.
The RTD must be supplied with a 110 V AC powered monitoring unit and provided with independent alarm and trip volt-free contacts. The alarm and trip setting must be adjustable. The monitoring unit must be installed in the pump set instrument panel and must provide a suitable output for the temperature indication.
Where water-cooled bearings are used, a flow failure detector and associated strainer, if required, must be provided.
Suitable timers and relays must be provided to obviate any false alarm during start-up of the pump set and on flow surges.
At least two vibration detectors must be installed for HT motors of 750 kW and above to initiate alarm and tripping of pump sets when a pre-set vibration level is exceeded.

Bearings – rolling type

Rolling bearings must comply with the relevant British and international standards and the assembly must be designed to exclude the ingress of dirt and water.
Where the shaft speed exceeds that permitted by the standards, the bearings must be grease-lubricated or oil-lubricated.

The bearing assembly must be sealed to prevent leakage of the lubricant along the shaft and designed to permit the easy removal of bearings. Oil-lubricated bearings must be fitted with a breather.
Approved type thrust and guide bearings must be provided for vertical-shaft motors.
Rolling type bearings must be selected to meet the following requirements:

- the life associated with 90% reliability (L10 life) of the bearing must be not less than 50,000 hours under the most onerous conditions.
- a re-lubrication interval of preferably 8,000 hours but not less than 4,000 hours;
- a maximum outer race temperature of 80°C.

Rolling bearings of the “sealed for life" type must operate for a minimum of 18,000 running hours or a period of five years if the latter occurs sooner.
Grease-lubricated bearings must be packed with lithium-based grease at the time of assembly.
A separate grease nipple must be provided for each lubricating point. Grease nipples must be manufactured from steel. Bearings must be provided with facilities to eject surplus grease.
Oil-lubricated bearings must be provided with an oil reservoir, a breather and, if appropriate, an external make-up reservoir. The reservoir must have a filler plug and an oil level indicator. Use of oil-lubricated bearings must be approved by the Environment Agency.
Where there is a danger of vibration from other plant being transmitted to a stationary motor, provision must be made to prevent fretting damage to bearings.
! Important
It must be possible for lubrication to be carried out with the motor stationary or running, and without the need to remove guards.

Bearings – plain type

Plain bearings must:

- be self-lubricated by oil rings or discs, or alternatively, must be forced lubricated.
- be designed to exclude the ingress of dust and water;
- have provision for breathing;
- be sealed to prevent leakage of oil;
- be fitted with an accessible drain plug;
- have provision to permit the cleaning of the oil sump;
- have a transparent window or other approved facility for observing the oil feed.

The two bearing shell parts must have white metal linings and be self-aligning. The two bearing shells must be located to each other by dowels.
The temperature of the oil leaving the bearing must not exceed 70°C. Bearings must incorporate thermometer pockets or must be fitted with a dial type thermometer as specified. Dial type thermometers must incorporate two sets of adjustable contacts for alarm and motor trip initiation. The contacts must be wired to a terminal box.
The oil rings or discs of self-lubricating bearings must run in an oil bath. Bearings must have provision for filling and a clearly visible oil level indicator. The oil level indicator may be fitted externally to the bearing.
Forced lubricated bearings must be supplied from a self-priming oil pump driven from the main shaft system or from a separate pump.

An oil flow indicator must be provided for each bearing together with oil cooler, oil tank filter valves and all interconnecting pipework. Unless otherwise specified, the oil feed system must be fitted with a pressure gauge and flow switch. The pressure gauge must incorporate two sets of adjustable contacts for alarm and motor trip initiation. The contacts must be wired to a terminal box.

Balancing

Rotors must be dynamically balanced with full key. The rotor of a motor fitted with an external fan must be initially balanced without the fan and then with the previously statically balanced fan fitted. Any additional weights must be fitted to the fan balance rings.
For HT motors, means and access for fixing balancing weights in situ must be provided at both ends of the rotor without the need to dismantle the motor for balancing on-site.

External corrosion protection

If specified, the motor must be provided with a paint finish suitable for corrosion protection in a polluted/aggressive environment. Details of the paint finish must be provided with the tender.
The paint finish must be compatible with the environment to which the motors will be subjected. The finish must consist of an anti-corrosion primer/undercoat with a two-part, heavy-duty epoxy resin paint or such other paint finish determined by the application and as detailed in the project specification for corrosion protection.

Additional requirements for submersible motors

In addition to the requirements above, submersible motors must comply with the following additional requirements:

- the maximum synchronous speed of the motors must be 1500 rpm;
- the water temperature range operating condition must be 2–15˚C

The motor must be suitable for two starts in succession followed by a cooling period of 30 minutes before attempting another starting sequence.
For motors rated 40 kW and above, the motor must also be capable of at least four starts per hour, equally spaced, during normal operating conditions.
For motors rated below 40kW, the motor must be capable of at least 15 starts per hour equally spaced, during normal running conditions.
The motor power output must be not less than 120% of the maximum power absorbed by the driven unit (for example, a pump set operates at any point between the specified duty points under the most arduous operating conditions).
Submersible motors must be supplied complete with submersible power and control cables, factory terminated to the motor terminals with an approved weatherproof termination. The length of the power supply and control must be specified to ensure it is suitable for the application and which allow a sufficient length of cable for glanding the cables in a junction box and termination. The voltage drop on cable at full load must not be greater than 2%.
The power supply cable must be:

- waterproof;

- flexible;
- resistant to abrasion and impact;
- of adequate current rating;
- complete with an integral earth continuity conductor.

The earth continuity conductor must have the same current carrying capacity as the line conductors and terminate at an earthing terminal inside the casing.
Cable cores must be identified by colour codes or lettering. The cable must be synthetic rubber insulated and oversheathed, and have a voltage rating suitable for the motor rated voltage with a maximum conductor temperature of 85˚C.
The cables and termination at the motor end must be suitable for continuous operation under water and must have the same degree of protection as for the motor. The other end of the cables must be suitably sealed to keep out of moisture.
Terminal boxes must be factory sealed and rated for continuous submersion.
Submersible motors must be closely-coupled to the pump to form an integral unit. Such enclosures must be corrosion resistant water-tight housing, rated for continuous submergence. Enclosures for submersible motors must include a suitable oil seal between pump and motor.

Additional requirements for submersible motors (continued)

Submersible motors of 30 kW and above must be provided with a set of positive temperature coefficient (PTC) type thermistors to monitor the temperature of the stator winding and to afford protection against over-heating on load and stalling as detailed in BS EN 60034-11. The thermistors must be set to operate at the appropriate temperature subject to the insulation class of the motor. Cable chamber leakage sensors must also be provided.
For motors rated at 3.5–70 kW, a winding embedded thermostat switch must be used. Cable chamber leakage sensors must also be provided. A simplified monitoring unit with a dry contact for each functional protection must be provided.
The degree of protection for the submersible motor must be rated at IP 68 to BS EN IEC 60034-5 for continuous submersion in water. The motor must be provided with lifting facilities for easy handling during erection or maintenance.
A water-sealing type motor must have self-circulation cooling to BS EN 60034-6, characteristic code IC 4WI WO (that is, motor cooled by water in an internal closed circuit and immersed in water externally).
A dry-type motor must have self-circulation cooling to BS EN 60034-6, characteristic code IC 4AI WO (that is, motor cooled by air in an internal closed circuit and immersed in water externally).
Motor bearings must be of a rolling type and in metric sizes.
Approved type thrust and guide bearings must be provided for vertical-shaft motors. The life of bearing must be not less than 50,000 hours under the most onerous conditions.

Anti-condensation heaters

Anti-condensation heaters must be fitted to all motors located outside. Heaters are not required in motors with totally encapsulated winding. The additional requirement for anti-condensation heaters must be detailed in the project specification.

The rating per unit length of the heaters must be such that the surface temperature at the motor casing at any point must be several degrees above the dew point temperature. The heater voltage must be 230 V AC, single phase, 50 Hz, unless otherwise specified.
Heaters must be designed to provide even heating to the motor windings with due consideration given to energy efficiency schemes such as on/off cycling of motor heaters.
Heaters must be connected to an insulated terminal strip within a dedicated terminal box by means of flexible butyl rubber insulated leads. The terminal box cover must be fitted with a warning label advising of the need to isolate the supply before removing. A separate totally enclosed (IP 55) terminal box must be provided for motors above 16 kW for the anti-condensation heaters.

Motor winding temperature detectors

For motors driven by a variable frequency drive (VFD) or rated at 30 kW or above or where called for in the project specification, the motor windings must be protected by means of a set of three thermistors selected for the class of insulation of the motor. The thermistor wiring must be terminated properly in the main connection box, but segregated from the main connections and labelled ‘thermistor protection’.
The thermistors must be selected so as to ensure tripping of the motor control equipment at a temperature appropriate to the insulation class of the motor (typically 155–160˚C for class F insulation).
When specified, a second set of three thermistors must be provided to give an alarm in the event of rising temperatures in the motor windings. This set of thermistors must operate at a temperature 10˚C below the insulation temperature rating of the motor. The alarm wiring, when specified, must be terminated in the main connection box, segregated from the main connections and labelled ‘thermistor alarms’.
Submersible pump motors must be fitted with seal leakage and moisture protection devices.

Monitoring bearing temperature

When indicated, temperature detectors (either RTD or thermocouple) must be provided to measure the bearing temperature.
Care must be taken to ensure the temperature-measuring element does not violate the integrity of bearing insulation.
Temperature detectors must be wired to a separate terminal box on the motor frame.

Hazardous area requirements

All equipment selected for use in a hazardous area must have undergone an appropriate conformity assessment procedure (CAP) to demonstrate compliance with the essential health and safety requirements of EC Directive 2014/34/EU (A TEX) as enacted in the UK by:
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016

The type of motor protection, gas group (if applicable) and temperature classification must be appropriate to the hazardous area classification, gas group (if applicable) and temperature class specified, and must be as specified.
The motor construction, testing and marking must comply with BS EN IEC 60079 as modified by the specific British and/or harmonised European standard(s) relating to the chosen type of motor protection.
All relevant hazardous area certification must be provided with the tender, including where appropriate, certification relating to operation with inverters.

Motor windings and wiring

Insulation

High temperature insulation must be provided on all wiring where contact with heated parts of the motor is anticipated.

Length allowance

An allowance must be made on the length of each wire at the point of connection to the terminal to permit the cutting off and re-marking of the wire terminations without disturbing the main run of the wiring.
Long cables between the motor and the drive should be avoided, where practicable, to mitigate capacitive cable charging currents.

Colour of wires

Wires must be coloured:

- brown for AC connections;
- grey for DC connections;
- green and yellow for earth connections.

Ferrules

Ferrules must be fitted for each wire core such that they would not be detached unintentionally when the wire is removed from the terminal.

Terminations

Terminal boxes

Terminal boxes must be provided and have sufficient internal space for connecting cables as specified.
Terminal boxes must be metallic and be able to accommodate alternative cable connection positions.
Terminal markings and direction of rotation must be in accordance with BS EN 60034-8.

The terminal assembly must comprise anti-tracking mountings with non-ferrous, stud-type connectors and electroplated/tinned connection hardware. Electrical creepage and clearance details must comply with BS 4999-145.
External to the terminal box, an earthing clamp or bolt of adequate dimensions must be provided for connection of cable earthing.
Terminal boxes must be threaded for cable entry. Separate entries must be provided for motor heater and thermistor cables (20 mm diameter minimum).
Connections must be secured against loosening and be such that contact pressure is maintained over the life of the motor.

Earthing

Bonding

The terminal box and gland plate (where provided) must be bonded to the motor frame.

Nameplate

Material location

Rating plate information, as detailed in BS EN 60034-1 or equivalent, must be embossed on a metallic, corrosion-resistant rating plate fixed to the motor casing.

Information to be provided

The motor must carry a plate clearly marked with:

- manufacturer's name;
- date of manufacture
- weight
- serial number;
- output in kW;
- voltage;
- frequency;
- current;
- speed;
- insulation class;
- relevant British standards;
- full bearing details.

The motor serial number must be stamped with metal dies on the driving-end shaft face of the motor in addition to being stamped on the stator.

Other labels

Labels other than danger and warning labels must be engraved ‘Traffolyte’ laminate or equivalent, with black letters on a white background.

Testing, inspection and certification

General

Before leaving the manufacturer's works, each motor must be inspected and tested, and results must be recorded in test reports.
Motors offered for final inspection must be complete and ready for shipment, with possible exception of final paint finish.
Tests must be carried out in accordance with any testing and commissioning and referenced external standards.
Manufacturers must state in the tender if normal test arrangements are not adequate or if they are not capable of carrying out specified tests.

Performance test

A performance test must be made on at least one motor of each group of identical motors being supplied.
The performance test must include but not be limited to the following tests and measurements:

- winding resistance (cold);
- full load heat run;
- winding resistance (hot);
- calculated winding temperature rise;
- bearing temperature rise;
- direction of rotation and phase sequence;
- slip at full load;
- efficiency at full, three-quarters and half load;
- power factor at full, three-quarters and half load;
- measurement to allow calculation of pull-out torque;
- momentary overload capability;
- locked rotor torque and current at the rated voltage of the motor or as near to it as the test plant allow (if rated voltage cannot be achieved, the method of extrapolation used to obtain the full voltage values must be detailed);
- no-load current;
- no-load losses;
- vibration severity;
- insulation resistance test on:

- motor windings before heat run and after heat run and dielectric test
- heater(s);
- built-in temperature detectors;
- bearing insulation;

- shaft voltage at no-load;
- noise test;
- measurement to allow calculation of starting (run-up) torque characteristic;
- inspection (at full load) of bearings and mechanical operation of the motor;
- physical inspection for compliance with this specification

Routine test

A routine test must be carried out on every motor not subjected to a performance test. The manufacturer must certify that each motor is identical to one that was subjected to performance or type test.
The routine test must comprise but not be limited to the following:

- winding resistance (cold);
- direction of rotation and phase sequence checks;
- no-load current;
- no-load losses;
- vibration severity;
- insulation resistance test on motor windings, heaters, built-in temperature detectors and bearing insulation;
- inspection (at no-load) of bearings and mechanical operation of the motor;
- physical inspection for compliance with this specification

Type tests and measurements

A manufacturer's type test is acceptable for:

- winding temperature rise measurements on identical motors;
- locked rotor current and torque tests on identical motors;
- heat run (temperature rise) tests (conducted with the motor operating at rated voltage, load and speed).

Testing of motors for special duties or equipped with special protection equipment must be detailed in the project specification or agreed between the Supplier and the Environment Agency.
Vibration measurement tests must be conducted with the motor operating at its rated voltage and speed and mounted in a manner reasonably representative of site mounting conditions.

Lifting

All lifting accessories/equipment necessary for the motor must be provided to comply with The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER).
If the motor weighs over 25 kg, it must be fitted with eye-bolts, lugs or extension pieces for hoisting. Eye-bolts must be of the shouldered pattern and must be properly fitted to pull down securely onto the shoulder.
The complete motor must be capable of being dismantled or reassembled by the use of one electric overhead crane. Parts above 25 kg must be provided with facilities for lifting and handling during erection and overhaul. Details of the arrangements must be included in the instruction manual

Technical submissions

General

In addition to the requirements in MEICA - Specification - General , the following must be supplied for all electric motors:

- test reports;
- coil quality and inter-turn tests;
- winding data.

Technical literature

As a minimum, the following technical literature including all system/motor calculation requirements must be provided for review on award of contract:

- rated output (kW) and duty type;
- nominal line voltage (Volts);
- nominal frequency (Hz);
- speed at full load (rpm);
- temperature rise at full load;
- direction of rotation;
- manufacturer's type designation;
- applicable national or international standards;
- connection;
- rated current (Amperes);
- efficiency and power factor at full, three-quarters and half load;
- locked rotor current – as per-unit (p.u.) of full load current;
- speed/torque characteristic at 100 and 80% of rated voltage;
- moment of inertia of motor rotating parts (kilogram square metre);
- bearing details;
- terminal box type mounting arrangement and cable gland details;
- type of drain device fitted, or description of how freedom from effects of condensation is assured;
- dimensional drawings – including shaft details;
- date when certified drawings will be provided;
- coupling or pulley details (where supplied);
- installed weight (kg);
- sound pressure level at no-load;
- noise generation characteristic across eight octave bands expressed as a sound pressure level measured at 1-metre reference radius when the motor is running at full load;
- parts made of non-ferrous or non-metallic materials (excluding electrical conductors and insulation);
- type of protection, apparatus group or sub-group and temperature classification for motors in hazardous areas;
- copy of certificate from certifying authority for motors in hazardous areas;
- confirmation of suitability for switching device specified;
- estimated run-up time of motor at rated voltage – uncoupled and coupled to intended load;
- details and characteristics of built-in temperature detectors (if applicable);
- per-unit values of residual voltage in phase opposition against which the motor can be re-connected immediately after supply disconnection

Test reports

The manufacturer must provide test reports giving the results of tests carried out on the motors supplied. These reports must include the manufacturer's type tests and routine/production tests.

Coil quality and interturn tests

Copies of test certificates covering coil quality assurance procedures and coil interturn tests must be sent to the Environment Agency by the manufacturer at appropriate stages of tender and manufacture.

Winding data

Subsequent to the order and prior to despatch from the manufacturer's works, full winding details must be sent to the Environment Agency by the manufacturer.

Delivery and storage

General

In addition to the requirements in MEICA - Specification - General, electric motors must be supplied with:

- rotor locking device;
- slings and spreaders.

Rotor locking device

A rotor locking device must be fitted in the motor prior to shipment to protect the bearings against damage during transport. The device must be of robust design and be reusable for future maintenance.

Slings and spreaders

Any necessary slings and spreaders for transport of the motor and its components must be supplied.

Related Documents

Regulations

- EC Directive 2006/66/EC on batteries and accumulators containing certain dangerous substances
- The Waste Electrical and Electronic Equipment Regulations 2006 (as amended)

Codes of practice

- Guidance note INDG139 Using electric storage batteries safely, HSE, 2006.
- MCS publication; Guide to the Installation of Photovoltaic Systems

BS Series

- BS 4999: General requirements for rotating electrical machines.
- BS 6290-2: Lead–acid stationary cells and batteries. Specification for the high-performance Plant positive type
- BS 7671: Requirements for electrical installations. IET Wiring Regulations

BS EN series

- BS EN 10143: Continuously hot-dip coated steel sheet and strip
- BS EN 50347: General purpose three-phase induction motors having standard dimensions and outputs. Frame numbers 56 to 315 and flange numbers 65 to 740
- BS EN 60034: Rotating electrical machines. Rating and performance
- BS EN 60085: Electrical insulation. Thermal evaluation and designation
- BS EN 60622: Secondary cells and batteries containing alkaline or other non-acid electrolytes. Sealed nickel-cadmium prismatic rechargeable single cells
- BS EN 60623: Secondary cells and batteries containing alkaline or other non-acid electrolytes. Vented nickel-cadmium prismatic rechargeable single cells
- BS EN 60751 Industrial platinum resistance thermometers and platinum temperature sensors
- BS EN 60896-11: Stationary lead-acid batteries. General requirements and methods of tests. Vented types.
- BS EN 60896-21: Stationary lead-acid batteries. Valve regulated types. Methods of tests
- BS EN 60896-22: Stationary lead-acid batteries. Valve regulated types. Requirements
- BS EN 61400-2 Wind turbines. Design requirements
- BS EN 61400-2 Wind turbines. Design requirements for small wind turbines

BS ISO Series

- BS ISO 7010: Graphical symbols. Safety colours and safety signs. Registered safety signs

BS EN IEC Series

- BS EN IEC 60034-5 Rotating electrical machines. Degrees of protection provided by the integral design of rotating electrical machines (IP code). Classification
- BS EN IEC 60079 Explosive atmospheres
- BS EN IEC 60034-14 Rotating electrical machines. Mechanical vibration of certain machines with shaft heights 56 mm and higher. Measurement, evaluation and limits of vibration severity

Standard specifications

All MEICA Specifications are listed in:

MEICA - Specification - General

Appendix 4.5 - MEICA - Specification - Pump starters

What's this document about?

This document sets out the MEICA specification to be followed by all Environment Agency staff and Suppliers when specifying pump starters. Any variation to this standard must be applied for through the concession process.
! Users must read MEICA – Specification - General prior to using MEICA any Specifications.

Who does this apply to?

This specification applies to:

- Environment Agency Staff;
- External Suppliers working on MEICA projects.

Contact for queries and feedback

- MEICA.Directorate@environment-agency.gov.uk
- Please give anonymous feedback for this document.

Contents

Starter selection and design

Correct selection for pumping equipment

Pumping can be defined in one of the two following categories:

- quadratic torque load (QTL) – a typical QTL is a submersible pump, an axial flow pump or a canister pump;
- high breakaway/constant torque load (HB/CTL) – a typical HB/CTL is a helical screw pump.

The difference in initial loading for these different types of pump puts different strains on the electrical supply and other components.

! Important you must:

- start these types of loads while minimising:
  - inrush currents
  - voltage dips
  - wear and tear;
- use starting methods that lead to better efficiencies.

Other requirements

Starter installations must also comply with:

- MEICA - Specification - General;
- this specification;
- project datasheets;
- any other documentation issued by the Environment Agency.

Note: Where such documentation imposes additional requirements to the standards listed in Related documents, the requirements of the specific project documentation take preference.

Design life

The table below sets out the minimum design life, of the pump starters at the rated conditions.

Equipment Type	Design Life
Low voltage (LV) pump starters (up to 1000 volts (V))	25 years
High voltage (HV) pump starters (up to 11 kilovolts (kV))	25 years

System risks

The ability of a pumping station to perform on demand may be compromised without a reliable and stable power supply. Incorrect starter choice will:

- lead to excess strain on power supply transformers;
- cause network fluctuations;
- cause mechanical and electrical damage due to excessive current draw while the motor and load are ramping to base load torque;
- cause mechanical damage due to heavy load cycling and load shocking

Effective selection of pump starter types

The benefits of effective selection of pump starter types are:

- Reliable pumping equipment will perform to required standards while limiting ongoing expenditure;
- Appropriate selection of new technology can reduce the environmental impact of pumping and save money.

Key factors in starter selection

Starting an induction motor that is driving large water pumps associated with an Environment Agency asset is a dynamic process.
Choosing an incorrect starting mechanism can:

- reduce system life;
- Compromise the electrical system;
- increase required maintenance activity and its associated costs.

Efficient operation of pumping equipment

Correct selection of equipment allows pumps to run more efficiently.
Note: From 1st of January 2017 only motors in the power range from 7.5 to 375 kW complying with Energy Efficiency Class IE3 will be permitted for line operation in the European Economic Area from that date, IE2 rated motor are still acceptable if used in line with a variable frequency drive (VFD). If there are exceptions to this requirement; these must be assessed.
Starting and running ‘quadratic torque loads’ using variable inverter drives can, if set up correctly, yield large reductions in running costs. Incorrect choice of available technology can prove non-viable.
Note: Changing fit-for-purpose starting mechanisms that are working correctly to voltage-limiting starting equipment for energy saving reasons is not recommended, as voltage reductions are only present momentarily during the starting process. The cost of purchase and installation outweigh any savings that would be achieved.

Starting methods

The starting process

Regardless of the load the motor is driving, the starting mechanism must:

- assist the motor in accelerating itself and its load to full speed;
- maintain the load at full speed over a full range of loadings.

To address these issues, different methods of starting motors have been developed in order to mitigate damaging effects:

- direct on line (DOL);
- automatic star delta (ASD);
- automatic transformer (AT);
- rotor resistance (RR);
- electronic soft start (ESS);

- variable frequency drive (VFD).

For information on electric motors, see MEICA - Specification - Electric Motors.

Variable frequency drive (VFD)

VFDs must be of the following type:

- 6-pulse voltage source using pulse-width modulation (PWM) or other equivalent technology; or
- 12-pulse voltage source using PWM or other equivalent technology.

The controller assembly must incorporate on-board protection, control and monitoring features that include the following as a minimum:

- overload;
- current limit;
- overvoltage;
- speed control;
- speed indication.

A dedicated keypad with display must be provided on the exterior of the compartment door.

Indicator lamps, discrete switches and push buttons must be provided as detailed for motor starters as well as the functions on the keypad. This keypad must provide indications of the following:

- drive available;
- output frequency (Hz) or speed (rpm or percentage);
- motor current;
- drive failed (plus code or text to define nature of failure).

The keypad must permit the following control functions:

- selection of ‘auto’ or ‘manual’ (local) control – with the drive running in ‘auto’ it must be possible for the operator to select ‘manual’, whereupon the drive must commence a sequence shutdown unless a start command is given;
- starting and stopping of the drive under manual control;
- adjustment of the output frequency under manual control;
- reset of faults.

If thermistor motor over-temperature protection is provided, this may be integrated with the VFD controls.

Harmonic current and voltage distortion introduced onto the electricity supply at the point of common coupling must comply with Electricity Council Engineering Recommendation G5/4.

Motor starter general

Starting methods for 3 phase motors must be selected from the following:

- up to 7.5 kW direct on line (or larger to a maximum of 15 kW, supply capacity and voltage drop permitting – to be agreed with the Environment Agency);

- above 5 kW assisted start
- above 30 kW electronic assisted/soft start or star delta.
- Variable frequency drives.

Unless specified, motor starters must be suitable for uninterrupted duty.

Motor starters must be fixed or withdrawable pattern as specified.

Motor starter operating and control circuits must be 110 V AC.

Motor starter isolation

Motor starters must:

- be combination-type as defined in and complying with appropriate parts of BS EN 60947;
- comprise combinations of fused switch connector/contactors or circuit breaker/contactors as specified.

The utilisation category must be selected to suit the application of the motor starter, but must be not less than AC–3.

Motor starter protection

Motor starters must have Type 2 short-circuit co-ordination. The protective device, contactor and overload-relay combination must have undergone and passed all the tests specified for full Type 2 co-ordination.

Overload protection must be provided on motors as follows:

- Up to and including 30 kW, thermal overloads
- Above 30 kW and up to and including 110 kW, electronic overloads;
- Above 110 kW, digital overloads; and/or
- Soft start and soft start/soft stop motor starts, on board protection.

Contactor auxiliary switches must comply with the Class 1 requirements of appropriate parts of BS EN 60947. They must be readily accessible and enclosed in a transparent plastic cover. A minimum of four spare auxiliary switches (two normally open and two normally closed) must be provided.

! Important All starters must be provided with an emergency stop circuit utilising twist to release push buttons which **must not** initiate restart of the machine when released.

Motor starter functionality

Details of functionality to be included in this section, this should include the minimum as a following:

- Automatic control
- Manual control
- Back up Control
- Hand/off/auto
- Local/remote/scada
- etc

Push buttons / interface

For information on Push buttons, selector switches, lamp indicators, human-machine interface (HMI), ammeters, multifunction meters and relays, see MEICA- Specification - Switchboards.

Conventional / intelligent starters

Details required for specifying conventional and intelligent starters can be found in MEICA- Specification - Switchboards, (Intelligent MCC).

Motor starter circuitry

For details on circuitry required by motor starters, see MEICA - Specification - Switchboards.

Starter guidance tables

Guidance available

Guidance is given below on:

- motor nameplate data requirements;
- maintenance requirements for the different types of starter;
- electro-mechanical starting characteristics of the different types of starter;

Motor nameplate data

Information on the motor driving the pumping load will be found on the motor nameplate. Appreciation of this data is essential when matching a motor and its load to a starting mechanism.
The National Electrical Manufacturers' Association (NEMA) specifies that every motor nameplate must show:

- manufacturer's name;
- rated volts/full load amps;
- rated frequency/number of phases;
- rated full load speed;
- rated temperature rise or insulation system class;
- time rating;
- rated horsepower;
- rated kilo watts;
- power factor;
- locked rotor indicating code letter;
- service factor;
- efficiency;
- weight;
- frame size; and
- design code.

Additional information will also appear on nameplates.
Detailed information on nameplate data

How much maintenance is necessary?

All starters require maintenance. The table below provides a guide as to how much is required.

Per starter	DOL	ASD	AT	RR	ESS	VFD
Level (1 = low; 3 = medium; 5 = high)	1	3	3	5	1	2
Maintenance (hours per year)	2	3	3	6	1	1
Estimated lifetime (years)	25	25	25	25	15	15

Electro-mechanical starting characteristics

The table summarises problems that **must** be considered in design.

Starter type	DOL	ASD	AT	RR	ESS	VFD
Voltage dip	High	High during switch over from star to delta	Low	Low	Low	Low
Voltage and current harmonics	Low	Low	Low	Low	Moderate	High
Power factor	Low	Low	Low	Moderate	Low	High
No. of starts	Restricted	2–3 times more than DOL	3–4 times more than DOL	2–3 times more than DOL	Limited	High
Available torque	~2.5 x residual torque (RT)	0.2–0.5 RT	~0.5 RT	2 RT	0.5 RT	1.5–2 RT
Thermal stress	Very high	High	Moderate	Moderate	Moderate	Low

Mechanical shock	High	Moderate	Moderate	Low	Moderate	Low

Related documents

Regulations

- Directive 2014/30/EC of the European Parliament and of the Council of 26 February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 2004/108/EC.

Guidance

- Limits of harmonic distortion, Engineering Recommendation G5/4, Electricity Council, 2001.

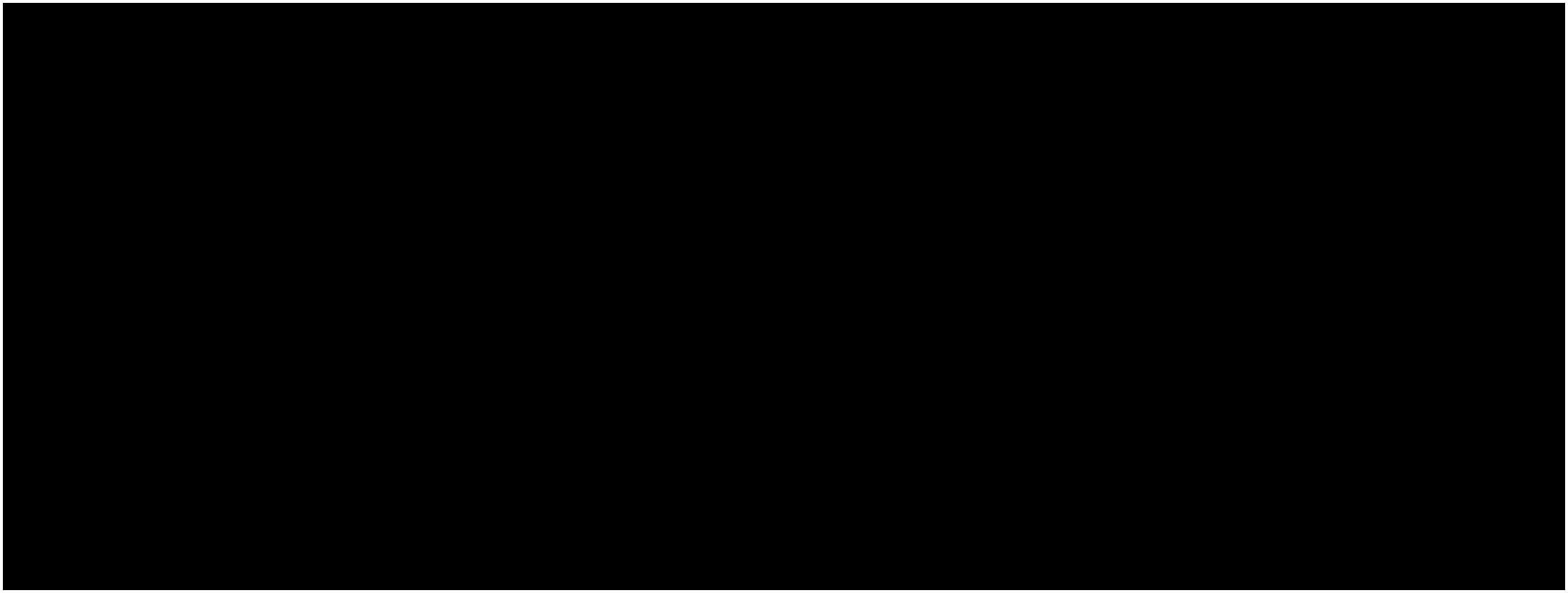
Standard specifications

All MEICA Specifications are listed in:

- MEICA - Specification - General

Annex 3

PRICING SCHEDULE - For the purchase of 24 submersible pumps



Crown Commercial Service

Purchase Order Conditions

(Supply only)

DEFINITIONS AND INTERPRETATION

In these Conditions, unless the context otherwise requires, the words or expressions that begin with capital letters shall have the precise meanings as set out below:

1.1.1 **'Conditions**' means these terms and conditions;

1.1.2 '**Delivery Address**' means the address for the delivery of the Products as identified in the Purchase Order or any other location specified by the Purchaser;

1.1.3 **'Delivery Dates**' means the date(s) for the delivery of the Products as specified by the Purchaser;

1.1.4 '**Insolvent**' means in relation to the Supplier if:

(a) a petition is presented, a notice is given, a resolution is passed, or an order is made, for or on connection with its winding up (being a company) other than for the sole purpose of a scheme for its solvent amalgamation with one or more other companies or its solvent reconstruction

(b) it commences negotiations with all or any class of its creditors with a view to rescheduling any of its debts, or makes a proposal for or enters into any compromise, composition or scheme of arrangement with its creditors or any class of its creditors other than (being a company) for the sole purpose of a scheme for a solvent amalgamation of that party with one or more other companies or the solvent reconstruction of that party; or

(c) any step (whether in or out of court) is taken, an application is made to court, or an order is made, for the appointment of an administrator, or if a notice of intention to appoint an administrator is given or if an administrator is appointed over it (being a company); or

(d) the holder of a qualifying floating charge over its assets (being a company) has become entitled to appoint or has appointed, an administrative receiver; or

(e) a receiver (including an administrative receiver) appointed over the whole or any part of its property, assets or undertaking; or

(f) being an individual, it is the subject of a bankruptcy petition or order or enters into an individual voluntary arrangement, a deed of arrangement or any compromise, composition or scheme of arrangement with its creditors ; or

(g) any distress, execution, sequestration or other such process is levied or applied for in respect of the whole or any part of its property, assets or undertakings; or

(h) any event occurs, or proceeding is taken, in any jurisdiction to which it is subject that has an effect equivalent or similar to any of the events mentioned in paragraphs (a) to (g) above;

1.1.5 '**Framework Agreement**' means [the framework agreement entered into by the Supplier and Crown Commercial Service (with reference number RM6157) which is dated 27 July 2021;

1.1.6 '**Material Breach**' means any breach of the Purchase Contract by the Supplier where the Purchaser has served notice on the Supplier that it has seven (7) days in which to rectify the breach and the Supplier fails to do so;

1.1.7 '**Performance**' means the manufacture, ordering of goods and materials and delivery to and unloading at the Delivery Address;

1.1.8 '**Price**' means all sums payable to the Supplier for Performance and the Products as stated in the Purchase Order;

1.1.9 '**Products**' means all goods, materials and products to be supplied and delivered pursuant to the Purchase Contract whether as expressly described in the Purchase Contract or to be inferred therefrom;

1.1.10 '**Purchase Contract**' means the contract between the Purchaser and the Supplier comprising these Conditions and the Purchase Contract Documents relating to the Products and Performance;

1.1.11 '**Purchase Contract Documents**' means the Purchase Order and any other documents relating to the Products which are listed the Purchase Order;

1.1.12 '**Purchase Order**' means the order from the Purchaser to the Supplier issued pursuant to the Framework Agreement relating to the Performance and the Products;

1.1.13 '**Purchaser**' means the Purchaser named in the Purchase Order;

1.1.14 '**Statutory Requirements**' means any and all law, statute, subordinate legislation within the meaning of section 21(1) of the Interpretation Act 1978, bye-law, enforceable right within the meaning of section 2 of the European Communities Act 1972, regulation, order, mandatory guidance or code of practice, judgment of a relevant court of law, or directives or requirements of any regulatory body with which the Supplier is bound to comply;

1.1.15 '**Supplier**' means the legal entity with whom the Purchaser enters into the Purchase Contract and to whom the Purchase Order is addressed;

1.1.16 '**Variation**' means addition, omission or other alteration (including but not limited to the products or quantity) to the Products; and

1.1.17 '**Working Day**' means any day other than a weekend or public holiday.

In these Conditions, unless the context otherwise requires:

1.1.18 words in the singular shall include the plural and in the plural shall include the singular;

1.1.19 clause headings are inserted for convenience only and shall not affect the

construction of these Conditions;

1.1.20 a reference to a statute or statutory provision is a reference to it as amended, extended or re-enacted from time to time or it is in force as at the date of the Purchase Contract;

1.1.21 a reference to a ‘person’ includes any individual, firm, partnership, company and any other legal entity;

1.1.22 a reference to a party or the parties is a reference to a party or the parties to the Purchase Contract and references to a party shall include its successors in title and permitted assigns;

1.1.23 a reference to writing or written includes email, but not fax;

1.1.24 any words following the terms including, include, includes, in particular, for example or any similar expression shall be construed as illustrative and shall not limit the sense of the words, description, definition, phrase or term preceding those terms and the use of the words 'other' or 'otherwise' shall not be construed as having a limiting effect.

BASIS OF THE PURCHASE CONTRACT

The Purchase Order placed by the Purchaser and any quotation received by the Purchaser from the Supplier in respect of the Products is deemed to have been made subject to the Conditions and the Framework Agreement and the Supplier agrees to supply the Products in accordance with the Conditions and the Framework Agreement. Any terms and conditions of the Supplier are superseded and do not form part of or apply to the Purchase Contract even if included as part of the Purchase Contract Documents.

The terms and conditions of the Purchase Contract may only be amended or varied as specifically set out in the Purchase Order.

Notwithstanding the date the Purchaser and the Supplier enter into the Purchase Contract, any goods supplied or work performed by or on behalf of the Supplier prior to the date of the Purchase Contract in anticipation of the Purchaser entering into the Purchase Contract with the Supplier shall be subject to the terms of the Purchase Contract.

GENERAL OBLIGATIONS AND WARRANTIES

The Supplier warrants to the Purchaser that the Products:

1.1.25 will be of sound and satisfactory quality and fit for all purposes for which the Products are commonly supplied and/or for any special purposes which are notified to the Supplier;

1.1.26 will correspond with any relevant specification or sample provided to the Supplier or where no specification or sample has been provided, will meet all of the Purchaser’s performance criteria which are notified to the Supplier;

1.1.27 will be free from defects in design, material and workmanship;

1.1.28 will comply with all and will not contravene any Statutory Requirements relating to the manufacture and sale of materials and goods, product safety, packaging, labelling and hazardous substances (including the appropriate British Standard and Codes of Practice or equivalent specification unless otherwise agreed);

The Supplier shall ensure that copies of any test certificates or product guarantees or warranties referred to in the Purchase Contract Documents, certificates of analysis, inspection or origin and information relating to the components, parts or raw materials used in the manufacturing of the

Products as may be required by the Purchaser or by law are provided to the Purchaser upon delivery of the Products.

The Supplier shall ensure that all product information relating to the Products provided by the Supplier and all product information provided to the Supplier by its suppliers and sub-contractors complies with the Code for Construction Product Information issued by the Construction Products Association.

The Supplier shall ensure that the Products will be safe and delivered in a safe manner and be accompanied by comprehensive instructions as to the use, handling, maintenance, storage, safety and erection, assembly and/or installation of the Products including all information required for the Purchaser to comply with the Control of Substances Hazardous to Health Regulations 2002 as amended by the Control of Substances Hazardous to Health (Amendment) Regulations 2004.

PRICES AND PAYMENT

In consideration of the satisfactory supply and delivery of the Products, the Purchaser shall pay to the Supplier the Price in accordance with and subject to these Conditions. Subject to payments in respect of Variations pursuant to clause 5, the Price shall be as stated in the Purchase Order and, unless otherwise so stated, shall be:

1.1.29 exclusive of any applicable VAT (which shall be payable by the Purchaser subject to receipt of a VAT invoice); and

1.1.30 inclusive of all charges for packaging, packing, shipping, carriage, insurance and delivery and unloading of the Products to the Delivery Address and any duties, tariffs, imposts or levies other than VAT.

Unless otherwise stated in the Purchase Contract Documents the Supplier may submit an invoice to the Purchaser after delivery of the Products.

The Supplier shall provide a separate invoice for each individual delivery setting out:

1.1.31 the Purchase Contract number;

1.1.32 a breakdown of the amount invoiced clearly showing the amounts charged for Products supplied; and

1.1.33 Value Added Tax shown separately.

The Supplier shall provide with the invoice a copy of the advice note signed by an authorised signatory of the Purchaser upon delivery in accordance with clause 9.

The Purchaser shall be entitled to deduct from the Price:

1.1.34 the unit price for any of the Products which as may be defective and rejected by the Purchaser; and

1.1.35 any amount which is disputed by the Purchaser, pending resolution of such dispute.

The final date for payment of each invoice shall be 30 days after receipt by the Purchaser.

If the Purchaser fails to pay a sum due to the Supplier by the final date for payment, simple interest shall be added to the unpaid sum from the final date for payment until the actual date of payment. This shall be calculated on a daily basis at the annual rate of three per cent (3%) above the Bank of England Base Rate.

4.8 The Supplier must facilitate payment by the Purchaser of the Price under the Purchase Contract under any method agreed with the Purchaser in the Particulars. The Supplier must facilitate a change of payment method during the term of the Purchase Contract. The Supplier shall not charge the Purchaser any fees for the use of any payment method or for a change of payment method during the term of the Purchase Contract.

CHANGES/VARIATIONS

The Purchaser may request Variations by way of an instruction in writing. Variations shall be valued in accordance with the rates and prices in the Purchase Contract Documents or (if no applicable rates and prices exist) such prices as are agreed or as shall be fair and reasonable in the circumstances.

ASSIGNMENT/SUB-CONTRACTING

The Supplier must not sub-let all or any part of the Purchase Contract or assign or charge all or any part of the Purchase Contract or any rights or benefits under it without the Purchaser's prior written consent (such consent not to be unreasonably withheld or delayed).

The Purchaser may assign the benefit of or any rights under the Purchase Contract or novate the Purchase Contract to any department, office or agency of the Crown [Contracting Body as defined in Regulation 5(2) of the Public Contracts (Works, Service and Supply) (Amendment) Regulations 2000 other than the Purchaser.

INSPECTION AND TESTING

The Purchaser and its representatives shall, subject to giving the Supplier reasonable notice, be granted access to any premises (including those of the Supplier's suppliers) and be allowed to inspect and test the Products at any time prior to acceptance of delivery.

Neither inspection, testing nor acceptance of any of the Products nor any waiver of any rights in respect thereof by the Purchaser nor its representative shall release the Supplier in any respect from any of its obligations under the Purchase Contract or otherwise including without limitation its responsibility for any defects subsequently found in materials and/or workmanship.

Where following testing or inspection any Products appear to be defective or otherwise not in accordance with the Purchase Contract the Purchaser shall have the right to reject such Products.

MAKING GOOD DEFECTS AND RIGHT OF REJECTION

If the Purchaser or its representatives reasonably considers any of the Products to be defective in quality of material, workmanship or design and/or to be not in accordance with the Purchase Contract, the Purchaser shall have the option to reject any such Products and require the Supplier at no cost to the Purchaser to replace any such Products in their entirety or to make good such defects by repair or replacement.

The Purchaser's rights under this clause 8 shall apply at any time prior to acceptance of delivery of the Products by the Purchaser in accordance with clause 9 and also following such acceptance in the event of it becoming apparent to the Purchaser that any of the Products are defective or not otherwise in accordance with the Purchase Contract.

Where the Purchaser rejects any Products it shall so notify the Supplier in writing and upon issuing such notification, property and risk in any such rejected Products shall revert to the Supplier. The Purchaser shall be entitled to a refund of the Price relating to such rejected Products if the Purchaser has paid for such Products. If such Products have already been delivered, the Supplier shall make arrangements with the Purchaser for the collection of such Products.

The Purchaser's rights and remedies under these Conditions are in addition to the rights and remedies

available to the Purchaser in respect of the statutory conditions relating to description, quality, fitness for purpose and correspondence with sample incorporated into the Purchase Contract.

DELIVERY AND UNLOADING

The Products shall be delivered to the Delivery Address by the Delivery Date in accordance with these Conditions. The Supplier shall report any delay or anticipated delay to delivery as soon as reasonably practicable and shall keep the Purchaser informed with dates of anticipated actual delivery.

Where the Delivery Date of the Products is to be specified after entering into the Purchase Contract, the Purchaser shall give the Supplier reasonable notice of the specified date.

The Supplier shall be responsible for unloading at the Delivery Address unless otherwise stated in the Purchase Contract Documents.

The Products upon delivery shall be accompanied by an advice note showing the Purchase Contract number, date of delivery, the quantity and full description of the goods delivered. The Supplier shall upon delivery obtain the signature of an authorised signatory of the Purchaser on a duplicate copy of the advice note. The signature of the advice note by the authorised signatory of the Purchaser shall not be construed as confirmation by the Purchaser that the Products delivered are of the correct quality, quantity, specification, materials, design and/or workmanship or are in accordance with the Purchase Contract.

PACKING AND MARKING

Any packaging shall be the property of the Supplier, and the Supplier shall be responsible for recycling all packaging materials where possible, or otherwise disposing of in accordance with current legislation.

SUSPENSION AND TERMINATION

The Purchaser may instruct the Supplier to suspend Performance at any time and for any reason on reasonable notice. Where Performance has been suspended pursuant to this clause the Purchaser may at any time require the Supplier in writing to resume Performance of its obligations under the Purchase Contract in whole or in part and set reasonable new Delivery Dates for delivery of the Products and the Supplier shall as soon as reasonably practicable so resume Performance. Save where such suspension is due to a breach or default by the Supplier, it shall be a Variation.

The Purchaser may terminate the Supplier's engagement under the Purchase Contract for convenience at any time by giving to the Supplier not less than seven (7) days' prior written notice. On expiry of such notice period, the Supplier's engagement under the Purchase Contract will terminate automatically.

In the event of termination pursuant to clause 11.2 the Purchaser shall pay for all Products delivered to Delivery Address up to the date of termination and the reasonable costs of materials, goods and manufacture incurred by the Supplier prior to the notice of termination in relation to Products not yet delivered.

Without prejudice to the Purchaser's rights under clause 11.2, in the event of Material Breach by the Supplier or if the Supplier is Insolvent, the Purchaser may give written notice to the Supplier to terminate the Supplier's engagement under the Purchase Contract and such termination shall take effect from the date of receipt by the Supplier of such notice.

The Purchaser shall not be liable to the Supplier for any losses, costs, damages, claims or expenses suffered or incurred by the Supplier arising from or in connection with such termination under clause 11.4 and the Purchaser shall not be obliged to make any further payment to the Supplier

once the Purchaser has given notice of termination under clause 11.4 until the Supplier has received delivery of equivalent or replacement products to the Product from an alternative supplier or decided that it does not intend to order equivalent products from an alternative supplier. The Purchaser may deduct from any payment to the Supplier which is outstanding and/or to recover from the Supplier all additional costs and expenses which the Purchaser suffers or incurs in ordering and receiving delivery of equivalent or replacement products and any losses and/or damage arising from the termination.

Termination of the Supplier's engagement under the Purchase Contract shall not affect the accrued rights and remedies available to either party as at the date of such termination.

TITLE AND RISK

Title and ownership in the Products shall pass from the Supplier to the Purchaser on the earlier of:

12.1.1 payment by the Purchaser for the Products; and

12.1.2 delivery of the relevant goods forming the whole or part of the Products.

The risk in the Products shall remain with the Supplier until completion of delivery and unloading.

If payment is made for any Products before delivery such Products shall be:

1.1.36 clearly marked by the Supplier as the Purchaser's property and shall be stored separately from the Supplier's property; and

1.1.37 insured in joint names with the Purchaser for their full replacement cost with a reputable insurer carrying on business in the United Kingdom.

INSURANCES

The Supplier shall maintain insurance cover as referred to in this clause 13 and shall provide to the Purchaser if required documentary evidence that such insurance is in place.

The Supplier shall have in force policies of insurance showing adequate cover with such insurers as the Purchaser may approve including:

1.1.38 insurance of the Products for their full replacement cost, such insurance to be maintained up until the point at which the Products have been delivered and unloaded at the Delivery Address;

1.1.39 public liability insurance with a minimum cover of ten million pounds (£10,000,000) for each and every claim; and

1.1.40 product liability insurance with a minimum cover of ten million pounds (£10,000,000) for each and every claim such insurance to be maintained for the period until six (6) years after the date on which the Products have been delivered and unloaded at the Delivery Address; and

1.1.41 if the Supplier is responsible for design, professional indemnity insurance with a minimum cover of one million pounds (£1,000,000) each and every claim such insurance to be maintained for the period until six (6) years after the date on which the Products have been delivered and unloaded at the Delivery Address.

INTELLECTUAL PROPERTY RIGHTS

14.1 The intellectual property rights in all designs, drawings, specifications, software, electronic data, photographs, plans, surveys and reports prepared by or on behalf of the Supplier in relation to the

Purchase Contract, if any, ("**Documents**") remain the property of the Supplier and the Supplier grants to the Purchaser an irrevocable, royalty free, non-exclusive licence to use and reproduce the Documents for any and all purposes connected with the use of the Products. Such licence entitles the Employer to grant sub-licences to third parties in the same terms as this licence provided always that the Supplier shall not be liable to any licencee for any use of the Documents or the intellectual property rights in the Documents for purposes other than those for which the same were originally prepared by or on behalf of the Supplier.

CONFIDENTIALITY

15.1 Each party shall keep confidential any information which relates to the business, affairs, developments, trade secrets, know-how and personnel of the other party and any other information clearly designated as being confidential and not disclose the other party's confidential information to any other person without prior written consent, unless disclosure is a requirement of law, including any requirements for disclosure under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004 or such information was already in the public domain at the time of disclosure otherwise than by a breach of the Purchase Contract.

15.2 Nothing in the Purchase Contract shall prevent the Purchaser from disclosing the Supplier's confidential information to any Crown body or any other Contracting Bodies as defined in Regulation 5(2) of the Public Contracts (Works, Service and Supply) (Amendment) Regulations 2000.

BRIBERY ACT

16.1 The Supplier shall, and shall ensure that any associated person or other person performing services in connection with the Purchase Contract shall, comply with all applicable laws, statutes, regulations and codes relating to anti-bribery and anti-corruption practices including the Bribery Act 2010.

MODERN SLAVERY ACT

17.1 In performing its obligations under the Purchase Contract, the Supplier shall comply and shall ensure that each of its employees, suppliers, sub-contractors, servants and agents shall comply with the Modern Slavery Act 2015.

EQUALITY ACTS

18.1 The Supplier shall perform its obligations under the Purchase Contract in accordance with all applicable equality law (whether in relation to race, sex, gender reassignment, religion or belief, disability, sexual orientation, pregnancy, maternity, age or otherwise).

DATA PROTECTION

19.1 The parties shall comply with all applicable law about the processing of personal data and privacy including without limitation the Data Protection Act 2018 and the General Data Protection Regulation (Regulation (EU) 2016/679) as it forms part of the law of England and Wales, Scotland and Northern Ireland by virtue of section 3 of the European Union (Withdrawal) Act 2018.

SEVERANCE

If any term or condition of the Purchase Contract is for any reason held to be illegal, invalid, ineffective, inoperable or otherwise unenforceable by law it shall be severed and deemed to be deleted from the Purchase Contract and the validity and enforceability of the remainder of the Purchase Contract shall not be affected or impaired in any way and shall remain in full force and effect. If any provision of the Purchase Contract is so found to be invalid or unenforceable but would be valid or enforceable if some part of the provision were deleted or modified, the provision in

question shall apply with such modification as may be necessary to make it valid.

NOTICES

Any notice to be given under or in connection with the Purchase Contract shall be sent to the relevant party's contact details as referred to in the Purchase Contract Documents or such other contact details as may be notified in writing by either party from time to time. Subject to clause 21.2, a notice is deemed to be received:

1.1.42 if delivered personally, on delivery, provided delivery is between 9.00am and 5.00pm on a Working Day (otherwise, delivery will occur at 9.00am on the next Working Day); and

1.1.43 if sent by Royal Mail Signed For™ 1st Class or other prepaid, next Working Day service providing proof of delivery, at the time recorded by the delivery service, provided that delivery is between 9.00am and 5.00pm on a Working Day. Otherwise, delivery will occur at 9.00am on the same Working Day (if delivery before 9.00am) or on the next Working Day (if after 5.00pm); and

1.1.44 if sent by email, at 9.00am on the first Working Day after sending.

WAIVER

No failure or delay by a party to exercise any right or remedy provided under this agreement or by law shall constitute a waiver of that or any other right or remedy, nor shall it prevent or restrict the further exercise of that or any other right or remedy. No single or partial exercise of such right or remedy shall prevent or restrict the further exercise of that or any other right or remedy. Any agreement by the Purchaser or the Supplier to waive any obligation or liability of the Supplier will only be effective if in writing.

Except as expressly set out in clause 22.1, no waiver, forbearance, release, inspection, approval, comment, review or consent or omission to inspect, approve, comment, review or consent by The Purchaser or its employees, servants, suppliers or agents shall in any way derogate, limit or reduce the Supplier's duties and obligations in connection with the Purchase Contract.

LIMITATION PERIOD

Notwithstanding the manner in which the Purchase Contract has been entered into, the statutory contractual limitation period in respect of the Supplier's obligations and liabilities under the Purchase Contract shall extend to the expiration of six (6) years after the date of delivery of all Products to the Purchaser under the Purchase Contract.

2. DISPUTE RESOLUTION

2.1 If any dispute arises out of or in connection with the Purchase Contract it may be referred by either party to its nominated senior representatives who will attempt to resolve it.

2.2 Either of the parties may elect (but will not be obliged) to refer a dispute which arises out of or in connection with the Purchase Contract to mediation.

GOVERNING LAW AND JURISDICTION

The Purchase Contract shall unless otherwise stated in the Purchase Order be governed and construed in accordance with the law of England and Wales, Scotland or Northern Ireland determined by reference to the location of the head office of the Purchaser and the courts of the applicable country shall have exclusive jurisdiction (except for the purposes of enforcement of an English court judgment or order in another jurisdiction) with regard to all matters arising from it.