MEICA – Specification - Materials and Mechanical Installations

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Audience: Environment Agency

What's this document about?

This document sets out the MEICA specification to be followed by all Environment Agency staff and suppliers when specifying materials and mechanical 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 supplementary document applies to:

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

Contact for queries and feedback

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

Contents

Introduction

Scope of the specification

This supplementary document covers general requirements for materials and mechanical installation works and must be read in conjunction with any project specification. It does not cover any special requirements for materials and mechanical installation works that are specific to the plant, component, or project.

Other requirements

Materials and mechanical installation works must also comply with:

- MEICA - Specification - General
- this specification;

- the project specification;
- any other documentation issued by the Environment Agency.

General requirements

Quality of works

Materials and mechanical installation works must be of sound quality in accordance with:

- good engineering practice;
- first-class commercial quality;
- best workshop practice.

Qualification of tradespeople

The work must be performed by competent and qualified persons with the appropriate skills knowledge and experience.

Rating of designs

Designs must be rated for the appropriate duty under the prevailing operational site conditions and in accordance with the design life and resilience requirements.

Use of British standards

Unless otherwise specified, all materials and installations must comply with British Standards. Other national standards can be considered provided they are at least equivalent to, or more stringent than, the stated standards.

When alternative standards are to be used, the supplier may be asked to supply the Environment Agency with copies of the relevant standard as part of the submission of technical data for review and comment.

Documentation required before work begins

Before mechanical installation work begins, the installation supplier must prepare the following documents for submission to the Environment Agency for review and comment:

- risk assessments;
- method statements;
- health & safety plan;
- all applicable environment assessments.

Minimum design requirements

Health and safety and other regulations

Where the choice of design or of plant is affected by health and safety or other regulations, it must comply with the relevant sections of these regulations even though reference is not made to them in this specification.

HAZOP analysis

All designs must be assessed to determine whether it is necessary to undertake a hazard and operability (HAZOP) analysis study to identify areas of the system that have an effect on safety or operability. Work at Category A assets should be assessed by carrying out a HAZOP study. Installations of a proven design will not generally require a HAZOP unless specified in the project specification or user requirements specification (URS). Where a HAZOP is undertaken, the study complying with BS IEC 61882 must be agreed with the Environment Agency.

Use in classified areas

Equipment used in classified areas must be selected in accordance with:

- The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)

Access, lifting and maintainability (ALM) risk assessment

An ALM risk assessment must be undertaken for all work that is not of a proven detailed design. As a minimum, the detailed requirements of this assessment must be applied during installation in relation to:

- safe positioning of plant;
- arrangements to access equipment;
- provision of lifting facilities;
- amenities such as power sockets and lighting.

The ALM must be undertaken at the stage where general arrangement drawings (including pipe runs, cable runs, lifting arrangements, hand railing, walkways/platforms, wash down facilities and lighting) are available for review.

The methodology of the ALM must be agreed with the Environment Agency.

Plant layout

Plant must be designed for safety, ease of operation and maintenance for both continuous and intermittent duty.

Plant must be designed and positioned to permit operation, maintenance and removal of equipment without disturbing adjacent equipment.

The plant layout must allow either adequate free space of a minimum of one metre around all equipment or adequate space to perform all operational and maintenance activities recommended by the supplier in a safe manner whichever is the greater.

The plant layout must be reviewed by the Environment Agency.

Health, safety and the environment

VOC Emissions

The supplier must comply with legislation relating to paints and varnishes (Directive on limitation of emissions of volatile organic compounds (2004/42/EC)) to limit the amount of volatile organic compound (VOC) emissions emanating from painting and protection products.

Exposure to hazardous agents

Exposure to hazardous agents such as dust, fumes, noise, vibration, radiation or harmful micro-organisms must be eliminated or adequately controlled in accordance with the requirements (as appropriate) of:

- Health and Safety at Work etc Act 1974 (HSWA);
- The Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended);
- The Control of Noise at Work Regulations 2005 (NAWR);
- The Ionising Radiations Regulations 1999 (IRR).

The requirements of product datasheets must be met in full.

Disposal of paint and protection products

Painting and protection products must be disposed of in accordance with the manufacturer's recommendation and the requirements of the Environment Agency and local authority.

Signs and signals

Safety signs and signals must meet the requirements specified in the Health and Safety (Safety Signs and Signals) Regulations 1996.

Materials

Prevention of corrosion and erosion

Provision must be made for the prevention of corrosion and erosion in any part of the equipment supplied. Such provision must include:

- use of suitable materials;
- choice of operating speeds;
- design of components;
- type of protective coatings and finishes.

Painting and protection requirements must be carried out in accordance with MEICA – Specification - Painting and protection systems

Attention must be paid to prevention of corrosion due to dissimilar metals in contact or in close proximity, or in all environments where there is any possibility of the presence of moisture. This must include all wetted, submerged or unprotected outdoor environments. Special precautions must be taken to prevent corrosion due to humidity, rainfall and moisture.

All wall-mounted equipment must be fitted with spacers to provide a minimum gap of 5 mm. All holes must be sealed against ingress of water.

All items exposed to weather or water must be free of water traps. Where necessary, drain holes must be provided to prevent accumulation of water.

Dissimilar metals in contact

When it is necessary to use dissimilar metals in contact, you must select metals such that the potential difference between them in the electrochemical series is less than 0.5 mV. If this is not possible, the contact surfaces of one or both of the metals must be electroplated or finished in such a manner that the potential difference is reduced to within the required limits. Alternatively, the two metals must be insulated from each other by an approved method such as insulation gaskets, washers and sleeves. Where these methods are not selected, cathodic protection must be applied by sacrificial anodes or impressed current (suitably specified for the installation).

Stainless steel

Stainless steel must have a resistance to atmospheric corrosion not less than that provided by BS EN 10088.

Aluminium

Where use of aluminium is proposed, it must be marine grade.

Aluminium structural supporting members must be:

- fabricated from aluminium alloy;
- comply as appropriate for the sections, plate, sheet and other forms employed with BS EN 754, BS EN 755, BS 1473, BS EN 485, BS EN 515, BS EN 573 Parts 1–4 and BS EN 1301 sections 2 and 3.

Asbestos

Asbestos materials **must not** be used in any form or for any purpose associated with equipment to be supplied, installed or repaired.

Fixings

All items of equipment must be fixed securely and aligned on a common base plate or frame. If equipment is mounted on anti-vibration mounts or where special arrangements need to be made to ensure water tightness, those cases can be treated as an exception. The base plate or frame must be levelled, aligned and secured before final grouting in.

All fixings, fastenings and spacers that may be submerged in a corrosive liquid must be galvanised or stainless steel unless otherwise specified. Sheradised or cadmium plated fasteners must not be used in damp or corrosive environments

Nuts, screws, washers, bolts and anchors must comply with the relevant requirements of the appropriate specification as indicated below.

Bolting for pipes and fittings must comply with BS EN 1092, except for spheroidal graphite iron bolts for use with ductile iron pipes and fittings. These must be manufactured from metal complying with the requirements of BS EN 1563.

Anchors for fixing metalwork to concrete must be mild or high tensile steel proprietary fixings; rag or indented bolts are not permitted.

Bolt lengths must be sufficient to ensure that nuts are full threaded when tightened in their final position, with one or two threads protruding clear of the nut. One washer must be provided under each bolt head and nut. Bolt clearance holes must be drilled and not flame cut.

Self-locking nuts, spring washers, star washers or castle nuts with split pins must be used where nuts and bolts are subject to vibration or are in inaccessible positions.

The provision of washers is mandatory for flange bolting of pipes with a corrosion protection finish such as epoxy/polyurethane paint or fusion bonded epoxy.

All components, except for bolting for pipes and fittings, must be galvanised in accordance with BS EN ISO 1461.

Fastening to concrete or masonry must be:

- complete in all respects;
- recommended by the manufacturer for the particular application;
- reviewed by the Environment Agency before use.

Component Type	Relevant standards
Black hexagon bolts, screws and nuts	ISO 272, ISO 885, ISO 888, BS EN ISO 4759-1
Metal washers for general purposes	BS 4320

High strength friction grip bolts, nuts and washers	BS EN 14399
Black cup and countersunk head bolts and screws with hexagon nuts	BS EN ISO 225

Threads

All threads must be metric with the standard coarse form of medium fit to BS 3643 except for special applications, for which the metric fine thread or other thread forms may be utilised subject to review by the Environment Agency.

Castings

Only sound castings must be incorporated in equipment. The method of casting will need to be suitable for the application and the strength required from the casting, e.g. may need to consider centrifugal casting for high-strength applications

Welding, building up, filling or any other processes to recover castings are not permitted in any casting associated with engines, pumps, gearboxes, compressors or other equipment subjected to pressure or vibration.

Castings subject to hydraulic pressure must be tested to 1.5 times maximum working pressure. Certified copies of test reports must be provided.

Forgings

All major stress-bearing forgings must be subject to internal examination and non-destructive tests. They must be heat-treated to relieve residual stresses. The name of the maker and particulars of the heat treatment proposed for each major forging must be submitted to the Environment Agency.

Welding

Structural steel and aluminium welding work shall be carried out in accordance with BS EN 1090 or BS EN ISO 5817.

All welds must be carried out by competent and qualified welders and under proper supervision. Carbon steel welding must meet BS EN 1011.

The works must be prepared properly for welding and the correct sequence adhered to. Copies of approved welding procedures must be provided.

The welder’s capabilities may be called for test in accordance with BS EN 287-1, BS EN ISO 9606-2 or BS 4872-1 where applicable.

Wherever possible, all welding must be done in the flat and / or horizontal or vertical positions. Overhead is non preferred. After assembly and before general welding begins, the parts are to be tack welded. This must be strong enough to hold the parts together but small enough to be covered by the general welding.

All parts to be welded must be prepared accurately so that, on assembly, they will fit together closely.

Wherever possible, all welds (either at the factory or the site) must be continuous and returned around any meeting face or corner to ensure the joint is completely sealed against corrosion.

All welds must be chipped and dressed to remove weld splatter.

Radiographic examinations, which may be required for highly stressed fusion welds, must comply with BS EN ISO 17636-2 unless specified otherwise.

Mechanical and other non-radiographic tests, if required, must be carried out in the presence of the Environment Agency.

Electrodes for manual arc welding must meet BS EN ISO 2560.

Access and safety provision

Health and safety

All access equipment, including handrails, infill panels, ladders, stairs, safety chains, platforms and walkways, must meet all current health and safety requirements including:

- The Construction (Design and Management) Regulations 2015 (CDM);
- The Work at Height Regulations 2005 (as amended)
- as specified in the project specification.

Adequate access and egress routes and working areas must be provided to all instruments, sight glasses, lubrication points, and mechanical and electrical equipment so that they can be accessed safely for calibration, routine operation and maintenance, and replacement.

Access floorings, ladders, stairs, handrails, balusters and chains must be provided as required by the Workplace (Health, Safety and Welfare Regulations) 1992 and other applicable legislation.

Handrails and balusters

Handrails and balusters must be manufactured from material complying with the British standard as set out in the table below.

Protective barriers must comply with the provisions of BS 4592.

Relevant standards for handrails and balusters

Note: The grade of material must be the most cost-effective and suitable for the application. The grade of material to be used/proposed must be reviewed by the Environment Agency.

Material	Handrails		Balusters	
	Solid	Tubular	Solid	Tubular
Mild Steel	BS 7668 BS EN 10025 BS EN 10210-1	BS EN 10255 or BS EN 10296-1	BS 7668 BS EN 10025 BS EN 10210-1	BS EN 10255
Stainless steel	BS EN 10088	BS EN 10296-2	BS EN 10088	BS EN 10296-2
Aluminium	BS EN 573 BS EN 755	BS EN 754 BS EN 755	BS EN 573 BS EN 755	BS EN 754 BS EN 755

Infill panels

Where infill panels may be required for additional protection, panels shall comply with BS 4592-0.

The extent of infill panels must normally be between the kicker plate and the lower handrail, or as agreed with the Environment Agency.

Ladders

Ladders must only be installed where it is not possible to install stairways.

Ladders for permanent access must comply with BS 4211. Where fixed ladders are to be used for access to machinery, they will comply with BS 14122-4.

A suitable and sufficient fall protection system must be provided to comply with the requirements set out in BS4211 and BS14122-4.

Stainless steel ladders for vertical fixing must be fabricated from grade 1.4404, meet BS EN 10088 and any relevant provisions of BS 4211.

Aluminium ladders for vertical fixing must be fabricated and comply with BS EN 754, BS EN 755 and BS EN 573, and with any relevant provisions of BS 4211. After fabrication, aluminium ladders must be anodised in accordance with BS EN ISO 2128.

Industrial flooring and stair treads

Mild steel and aluminium alloy industrial open-type metal flooring and stair treads must comply with BS 4592-0, BS 5395 and BS EN ISO 14122.

Flooring sections must be in panels with maximum mass of 25 kilograms and with appropriate cut-outs to permit their removal without disturbing spindles, supporting brackets, pipework, etc.

Industrial flooring must be lockable. The means of locking must not pose a trip hazard. Cut-outs must be trimmed with a binding bar.

Panels must be manufactured such that, when fitted, the load bearing bars and traverse bars are aligned with adjacent panels.

All fabrications, mild steel flooring and stair treads must be hot dip galvanised in accordance with BS EN ISO 1461.

Glass reinforced plastics flooring will comply with requirements set out in BS 4592 Part 4 – 6.

Where the need for slip resistant flooring has been identified, it shall comply with requirements set out in BS 4592-0 and BS EN ISO 14122-2.

Gates

Safety gates shall be designed to meet the requirements of the following standards, as applicable:

- BS 4211 for permanently fixed ladders
- BS 14122-3 for stairs, stepladders and guard-rails
- BS 14122-4 for fixed ladders

Chains are not permitted as substitutes for safety gates.

Gearboxes

General

Gear Type	Standard
Helical	BS ISO 6336-1
Bevel	ISO 10300 ISO 17485 ISO 23509
Worm	BS 721-1 (imperial units) BS 721-2 (metric units)

Lubrication

The position of the level sight glass and drain plug must be accessible, and should be visible when standing wherever possible.

Provision must be made for suitable lubrication to ensure smooth operation, heat removal and freedom room from undue wear.

Equipment must have minimum lubrication attendance and downtime for lubricant change.

A list of compatible alternative lubricants must be supplied.

The gearbox lubricant must be biodegradable unless the gearbox's lubrication requirements cannot be met by a biodegradable lubricant.

Guards

All moving parts of equipment that may be accessible or hazardous must be fully guarded so that hazards are eliminated and must satisfy:

- current legislation such as PUWER and The Supply of Machinery (Safety) Regulations 2008 (as amended);
- the safety requirements of BS EN ISO 12100 and PD 5304.

Guards must be designed to provide access to bearings and other checkpoints to allow routine maintenance and observations to be made without danger or the need to dismantle any part of the guard.

All fasteners must be M12 unless otherwise stated.

The type of guard fixing must be dependent on the frequency of access.

Coupling guards must generally be manufactured from sheet steel. Open shaft and end guards must be manufactured from expended metal mesh.

All guards and fixings should not be dip galvanised unless otherwise agreed.

All parts and pipelines that are hotter than 60°C must be protected against accidental contact by guarding or lagging. Parts and pipelines colder than 5°C under normal operation must be lagged to reduce energy losses.

Information for use must be provided, including warning signs where appropriate. Appropriate safety labels must comply with BS ISO 3864.

Bearings

General

The supplier must select the most appropriate type of bearing for the plant being supplied.

Equipment with vertical shafts must have thrust and guide bearings.

All bearings must be designed to exclude the ingress of dust and water.

Sealed-for-life units are acceptable subject to a minimum design life of L10 50,000 operation hours at maximum loading, unless otherwise stated in the project specification.

Plant that may be subject to vibration while stationary must be provided with bearings designed to withstand damage from such a cause.

Below water bearings

Below water bearings must be water-lubricated synthetic material, gunmetal, lignum vitea or similar specialist product with journals of steel. Synthetic bearings must be machined with the grain of materials in the correct plane for the load.

Above water bearings

Above water bearings must be plain, ball or roller type.

Single journal plain bearings must have phosphor bronze or synthetic lubrication impregnated bushes with carbon or stainless-steel journals, respectively.

Plain bearings must be self-lubricating by grease, forced oil or impregnation.

Roller bearings must be adequately lubricated by oil or grease and sealed to prevent leakage of lubricant along with the shaft. Attention must be given to ensure the dismantling of bearings is simple and free from risk of damage.

Synthetic bearings

Synthetic bearings, such as Orkot, must be used only where the bearing condition can be inspected readily. Where used, synthetic bearings must be selected to be:

- compatible with the journal steel,
- suitable for the application given tolerances, and potential swelling

Synthetic bearings must be designed and installed in accordance with the manufacturer's recommendations

The expansion of bearings in water must not be greater than 0.1% of the bearing wall thickness.

Bearings and matching components must be capable of dry running and the co-efficient of friction must not exceed 0.18 (dry) and 0.02 when lubricated.

Matching components must have a surface roughness of 0.1–0.8 µm.

Journal materials must be free from cutting edges, lubrication grooves and holes – unless these are matched to non-loaded grooves in the bearing itself.

Synthetic bearings must be fully supported over their loaded area.

Housings should be designed with a 'lead-in chamfer' to enable drawing or pressing in methods without use of hammer blows.

Shoulders must be used whenever possible for retaining bearings.

The recommendations of the bearing manufacturer must be followed to achieve optimum bore closure as a result of interference fitting of the bearing to the housing and its thermal expansion and contraction.

Synthetic bearings must incorporate a solid lubricant that is released constantly throughout the wear of the bearing. This solid lubricant must be compatible with the possible use of biodegradable oils/greases.

The use of synthetic bearings should be considered as a means of preventing electrolytic action that might otherwise occur between matching surfaces of bearings of dissimilar metals.

Where synthetic bearings are used, consideration must be given to exposed electrically conducting parts of the machine that require bonding so that, when the machine is connected to earth, all exposed conducting parts are held at earth potential.

Seals

General

Seals must be selected to be compatible with the equipment and application. The seal must be best suited for the worst conditions likely to be met when the plant is in operation.

All seal materials must be compatible with and/or resistant to the fluid or gas being handled.

A closed loop design for gland cooling and flushing systems must be considered in preference to total loss systems.

Soft packed glands

Shafts must be provided with renewable gland sleeves.

Glands subject to abrasive liquors or negative pressures must embody suitably positioned lantern rings and a clean water continuous flushing system that operates whenever the plant is in motion.

Gland adjustment nuts must be readily accessible for routine maintenance.

Gland drain pipework must be installed that incorporates rodding facilities and adequate inclines of 25 mm minimum diameter discharging to the nearest sump or drainage channel.

Mechanical Seals

Mechanical seals that are subject to abrasive liquor or gas, negative pressures or corrosive elements must be provided with a clean water continuous flushing system that operates when the item of plant is in motion or the corrosive element is present. A back-to-back sealing arrangement with a flushing/cooling system may be accepted as satisfying this requirement.

Gaskets and Joint Rings

Selection

Joint rings suitable for hot or cold water or specified hydrocarbon fluids or for drainage or sewerage applications must be:

- manufactured to conform to BS EN 681, BS EN 682;
- suitable for temperatures up to 80°C or greater to suit the application.

Joints must be in accordance with manufacturer's instructions.

Storage prior to installation

Until immediately required for incorporation in a joint, each rubber ring or gasket must be:

- stored in the dark free from the deleterious effects of heat or cold
- kept flat to prevent any part of the rubber being in tension
- retained in the original packaging
- discarded when its shelf life has expired or has otherwise become degraded.
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Lubrication

General

Only lubricants recommended by the manufacturer must be used in connection with rubber rings. These lubricants must be suitable for the climatic conditions at the Site and must contain an approved bactericide.

Graphite grease or similar must be applied to the threads of bolts before joints are made.

Provision must be made for suitable lubrication to ensure smooth operation, heat removal and freedom from undue wear.

Equipment must have minimum lubrication attendance and down time for lubricant change.

The manufacturer of the lubricant(s) selected must be reviewed by the Environment Agency. A list of alternative lubricants must be supplied.

The supplier must supply the first fill of oil and grease from approved lubricant suppliers.

All grease points; oil cups and dipsticks must be accessible, being piped to a point as near as practicable to the lubrication point.

All grease points must be fitted with plastic covers to prevent the ingress of dirt and the application of paint.

Lubrication points must be labelled with the lubricant to be used.

Lubricants must comply with BS ISO 6743 unless otherwise specified.

Oil lubrication

Gearboxes and oil baths must be provided with:

- adequately sized filling and draining plugs;
- a suitable means of oil level indication.

Roller chain drives must have oil bath reservoir lubrication. Suitable drain plugs must be fitted to aid complete drainage.

Drain points must be located or piped to a position such that an adequately sized container can be placed beneath it. Where a large quantity of oil is involved or drainage to a container is difficult, a drain valve must be provided at the point of discharge.

Bearings equipped with forced fed oil lubrication must be automatically charged prior to machine start-up. Pressure monitoring must be performed during operation with automatic shutdown of machinery and alarm on low oil pressure.

Access to lubrication systems (without the use of portable ladders) must be such as to permit maintenance, drainage and refilling.

The design of breathers must take into account the humidity and atmospheric contamination at the vent point.

Measures must be incorporated to prevent contamination of the lubricant.

Grease lubrication

Designs should reduce the requirement for greasing where possible for instance by using self-lubricating bearing types.

Grease application must be by steel lubrication nipples of a suitable type for the equipment.

Anti-friction bearings requiring infrequent charging must be fitted with hydraulic type nipples.

Plain bearings requiring frequent charging must be fitted with button head pattern nipples.

A separate nipple must be provided to serve each lubrication point. Where a number of nipples supply remote lubricating points, they must be grouped together on a conveniently placed battery plate and spaced in accordance with best engineering practice.

Grease points must be easily accessible without the need for access equipment or PPE.

Lubricating pumps and ancillaries

Where continuous feed lubrication is required, an automatic means of lubrication must be provided for all moving parts such that attendance by an operator is required less than once per month under normal operation and once per week under the maximum anticipated continuous operation.

Where possible, all greasing and lubrication points must be accessible to allow routine servicing without the need to remove guards.

Where remote lubrication points are unavoidable, they must be fitted with suitable extension tubes, grouped together on a plate, labelled and mounted in an accessible position.

All oil and grease reservoirs for static and automatic systems must have sufficient capacity for a minimum of seven days' continuous use of the main plant. Each grade of oil or grease used must have a dedicated reservoir.

For total loss systems, lubricating pumps must be controlled to start the pump when power is first applied to the main plant. A timer may switch the lubricating system on and off at pre-determined times as required. These times will depend on the size and speed of the bearings and must be confirmed during on-site testing.

Recirculating systems must switch on and off with the main plant with a timed over-run. Pumps must be mechanically or electrically (hard-wired) interlocked with the main plant.

Automatic lubrication reservoirs must have a charge level indication and be positioned to allow easy filling and maintenance.

The lubrication system must be fitted with an over-pressure relief device to prevent damage to the seals.

Automatic lubrication systems must be capable of delivering to the number of lubrication points required with at least one spare. Easy and separate adjustment at each point must be provided.

Biodegradable oils and greases for hydraulic/lubricating purposes

Biodegradable oils and greases must:

- be non-toxic;
- have achieved at least 96% biodegradation in 21 days (as assessed by the CEC L-33-A-93 standard test method);
- be insoluble in water and therefore not easily introduced into the water table;
- match the performance of material oil alternatives in terms of corrosion resistance, thermal resistance, viscosity and shear stability;
- be approved for use by the manufacturer of the main plant.

Where biodegradable oils and greases are used, the following must apply:

- Normal operating temperature must be -20 degrees Celsius (°C) to 60°C. Intermittent temperatures up to 120°C may be acceptable.
- Equivalent viscosity oils must be used when biodegradable oils are used as a replacement for mineral oils.
- Seals and bearings must be compatible with any proposed biodegradable oils and greases.
- A maintenance procedure must be set up to monitor oil for water concentration, acid number, percentage change in kinematic viscosity and calcium content. Where the oil manufacturer's limits for these parameters are reached or exceeded, the oils must be discarded.
- Zinc, zinc plate or lead must not be part of the plant where biodegradable oils are used.
- Applications must be approved as suitable by the oil manufacturer.

Noise

Noise level

Noise emitted by any single item of equipment must not exceed sound thresholds defined in the Control of Noise at Work Regulations 2005 (the Noise Regulations). Noise assessment will be carried out as stated in BS 4142.

Major items of equipment must be provided with certificates from the manufacturer covering noise level tests carried out on the items or type test certificates for similar items of equipment.

If any equipment in its standard build does not comply with the noise level requirement above, the sound pressure level must be reduced by providing an acoustic enclosure or sound-insulating materials until the requirement is met.

Equipment such as compressors, diesel generators, blowers etc., where reduction in noise emission to below 80 dB(A) at 1 m is impractical, must be installed in separate rooms constructed of, or containing, sound-absorbing material. Hazard warning notices must be provided at the entrance to the room or structure indicating that ear defenders are to be worn.

Vibration

General Requirements

All rotating elements must be dynamically balanced.

Machinery vibration must not exceed the limits defined in BS EN 60034-14 and BS ISO 20816. Equipment must be positioned to reduce vibration and noise transmission (that is, not close to walls, structures, etc.)

The first critical speed must be at least 50% higher than the maximum operating speed.

All rotating components must be statically balanced as individual units and then dynamically balanced as complete rotating assemblies so that the level of vibration at any point on a machine when operating at site, either singly or with other machines, and at any speed throughout the operating range does not exceed the vibration limits.

Balancing must be achieved by machining and not by the addition of weights.

Pipework, valves and other equipment connected to the machine, or forming part of the operating system, must be provided with adequate supports, brackets and

fixtures, as necessary, to restrict any induced vibration to a minimum, under any operating condition.

Measurements

Vibration measurements shall be carried out in accordance with BS ISO 20816.

Equipment vibration levels shall not exceed the limits defined in applicable sections of BS ISO 10816 Part 2 – 21.

Pipework

General

Metallic pipework systems must be designed, manufactured, installed, inspected and tested in accordance with BS EN 13480. Plastic pipework shall be installed in accordance with the manufacturer's recommendations.

Pipework vibrations and loading must not be transmitted to associated plant. All pipework must be installed in a vertical or free draining attitude, with a fall of not less than 1 in 50 in the direction of normal flow.

Pipework must not pass directly in front of, or obstruct access to:

- doors;
- windows;
- control equipment;
- other plant.

Pipework expansion and contraction movement must be fully accommodated and not transmitted to adjacent plant.

Dead legs must be avoided however if this is not possible, provision must be made for purging, flushing and draining the dead leg.

All purging, flushing and drain connections must be provided with isolation valves. Where the system is classified as pressurised, these valves must be supplemented by blank flanges bolted to the valve body.

! Important This pipework specification does not apply to pipework conveying flammable gases. Pipework conveying flammable gases shall be designed and constructed specifically for the application. Natural Gas and LPG installations shall only be carried out by "Gas Safe" registered contractors.

Selection

Pipe material must be as specified, if there is no specification, it must be suitable for the type of fluid/gas/air being conveyed.

Pipelines must be identified in accordance with BS 1710. Service identification and flow direction must be provided for all visible pipelines.

Pipes must be sized for the allowable maximum velocities within the pipe as specified in the project specification.

A pipe diameter above 75 mm must be selected from standard sizes available in the market. Proprietary fittings or fabricated sections must be used to effect changes in pipe diameter.

Safe working pressure

Pipework and fittings must in all cases be suitable for a safe working pressure equivalent to maximum working pressure of the system. Despite the above, the minimum pressure rating of pipework and fittings must be 10 bar.

Ductile iron pipework and fittings must have a minimum pressure rating of 16 bar.

Plastic pipework and fittings shall have a pressure rating of at least 10 bar or higher if the application requires it.

The safe working pressure of pumping mains must be the closed valve head of the pump plus the maximum positive suction static head. Maximum surge pressure must be limited to 125% of maximum working pressure.

Joints

There must be a sufficient number of mechanical joints to enable mechanical equipment and valves to be removed from built-in pipework without disturbance of the adjacent pipework or plant. Such joints must be:

- accessible;
- not allowed to sustain the weight of any pipework.

Joints between dissimilar plastics or between plastic and metal shall be done using adaptor unions or flanges.
For plastic pipework systems, the solvent welded joints shall be done in accordance with manufacturer's instructions using manufacturer's primer, solvent adhesive and jointing procedure.

Jointing compounds must not be used when making flanged joints, except to facilitate making of vertical joints when gaskets may be secured temporarily to one flange face by a minimum quantity of jointing solution.

Bolt threads must be treated with graphite paste and the nuts tightened evenly in diametrically opposite pairs.

Thrusts

Pipework thrusts must not be transferred to adjacent equipment.

Pipes carrying non-flammable gases

Pipework systems for non-flammable gases must be provided with facilities and all equipment needed for purging, venting and condensate draining.

Pipes carrying process air

Pipework systems for process air must be sized to limit the air flow velocity to less than 8 m/s at the normal system operating pressure.

Drainage points at not less than 30 m intervals must be provided.

Pipework must be earthed to discharge static electricity.

Flanges

Flanges for pipes and pipeline fittings must, unless otherwise required by the specification, comply with BS EN 1092 for 16 bar nominal pressure rating.

Flange holes must be drilled uniformly and be radially equidistant to flange centre.

A means of leak path elimination must be provided where pipes pass through walls. Wall couplings or puddle flanges must be provided on all pipes where they pass through walls. Each puddle flange must be continuously welded to the pipe on both sides of the flange. If pipe passing through a wall is subject to thrust, a thrust flange or wall coupling must be provided in place of a puddle flange.

Gaskets

The dimensions of gaskets must comply with BS EN 1514.

Gaskets and ‘O’ rings must be made of materials compatible with the fluid to be conveyed.

Bends and tee pieces

The use of gusseted bends is not permitted. Where space allows, all bends must be even curvature manipulated bends. The use of carbon and alloy steel welding fittings to BS EN 10253 is allowed where short radius bends are required.

Tee pieces must have a radial branch to enable more streamlined flow from branch to body. Allowance must be made for reinforcement near branches.

Air locking

To avoid air locking, pipelines must be provided with vent and draining facilities in the form of valve branches and air release valves.

Pump suction

Pump suction bell mouths must be standard castings in either cast iron or ductile iron materials.

Where natural drainage does not occur, the pump suction and delivery manifold must be provided with a drain valve.

Iron and steel pipework

Ductile iron pipes, fittings, accessories and their joints must comply with BS EN 545 and BS EN 969 as appropriate for water and gas pipelines.

Ferrous pipework up to 75 mm nominal bore must be screw fitted with galvanised mild steel tube complying with BS EN 10255 heavy gauge.

Ferrous pipework over 75 mm nominal bore must be ductile iron flanged or steel specials.

Steel pipes specials and fittings must:

- comply as applicable with BS EN 10216, BS EN 10217, BS EN 10220, BS EN 10224 and BS EN 10311;
- be provided with a minimum tube thickness of 8 mm.

Plastic pipes

Where plastic pipes are used, they must comply with BS 3506, BS EN ISO 1452, BS 5391-1, BS 5392-1, BS EN ISO 15493, BS EN 1852, BS EN 12201 and BS EN 12666-1.

Plastic pipework must be installed in accordance with the manufacturer's instructions.

Pipework support

Pipework must be properly secured and supported at regular intervals. It must be supported to restrain all loads from weight, temperature, vibration and pressure with the points of support protected from chaffing.

Detailed calculations of thrust and restraint evaluation, taking into account any out of balance forces, must be made and submitted to the Environment Agency.

Valves and other components which may require removal for maintenance shall be independently supported and pipework shall be supported either side so as not to expose the pipework to additional stress when the component is removed.

Pipework shall not rely on plant or equipment for support and pipework shall not exert any stresses onto plant and equipment.

For plastic pipework, proprietary supports should be used. Use of alternative supports may be allowed if provision has been made for movement due to thermal expansion.

Insulation

Trace heating and lagging must be provided as required for the purpose of frost protection and/or heat conservation.

Insulation must not obstruct nameplates, expansion joints, rotating joints and other similar applications.

Mechanical installation

General

All mechanical installation work must comply with this specification.

Prevention of corrosion

Requirements set out in MEICA – Specification - Painting and protection systems shall apply to all components of the mechanical installation.

Technical submissions

O&M manuals

Operation and maintenance (O&M) manuals must be provided for all equipment/components as required by the Environment Agency as detailed in the MEICA Specification Documentation.

Related documents

Legislation

- Directive on limitation of emissions of volatile organic compounds (2004/42/EC)
- Health and Safety at Work etc Act 1974 (HSWA)
- The Workplace (Health, Safety and Welfare Regulations) 1992
- The Health and Safety (Safety Signs and Signals) Regulations 1996
- The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
- The Provision and Use of Work Equipment Regulations 1998 (PUWER)
- The Ionising Radiations Regulations 1999 (IRR)
- The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)
- The Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended)
- The Control of Noise at Work Regulations 2005 (NAWR)
- The Work at Height Regulations 2005 (as amended)
- The Environmental Noise (England) Regulations 2006 (as amended)
- The Construction (Design and Management) Regulations 2015 (CDM);
- The Supply of Machinery (Safety) Regulations 2008 (as amended)

BS Series

- BS 721-1 Specification for worm gearing. Imperial units
- BS 721-2 Specification for worm gearing. Metric units
- BS 1473 Specification for wrought iron aluminium and aluminium alloys for general engineering purposes – rivet, bolt and screw stock
- BS 1710 Specification for identification of pipelines and services
- BS 3506 Specification for unplasticised PVC pipes for industrial uses
- BS 3643 ISO metric screw threads
- BS 4142 Method for rating industrial noise affecting mixed residential and industrial areas
- BS 4211 + A1 Specification for permanently fixed ladders
- BS 4320 Specification for metal washers for general engineering purposes. Metric series
- BS 4592-0 + A1 Flooring, stair treads and handrails for industrial use. Common design requirements and recommendations for installation
- BS 4872-1 Specification for approval testing of welders when welding procedure approval is not required. Fusion welding of steel
- BS 5391-1 Acrylonitrile–butadiene styrene (ABS) pressure pipe. Specification
- BS 5392-1 Acrylonitrile–butadiene styrene (ABS) fittings for use with ABS pressure pipe. Specification
- BS 5395 Stairs, ladders and walkways
- BS 6180 Barriers in and about buildings. Code of practice
- BS 7668 Weld-able structural steels. Hot finished structural hollow sections in weather resistant steels. Specification
- BS 7818 Specification for pedestrian restraint systems in metal

BS EN Series

- BS EN 287-1 Qualification test of welders. Fusion welding. Steels
- BS EN 485 Aluminium and aluminium alloys. Sheet, strip and plate
- BS EN 515 Aluminium and aluminium alloys. Wrought products. Temper designations
- BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods
- BS EN 573 Aluminium and aluminium alloys. Chemical composition and form of wrought products.
- BS EN 681 Elastomeric seals. Materials requirements for pipe joint seals used in water and drainage applications
- BS EN 682 Elastomeric seals. Materials requirements for seals used in pipes and fittings conveying gas and hydrocarbon fluids
- BS EN 754 Aluminium and aluminium alloys. Cold drawn rod/bar and tube

- BS EN 755 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles
- BS EN 818 Short link chains for lifting purposes
- BS EN 969 Ductile iron pipes, fittings, accessories and their joints for gas pipelines. Requirements and test methods
- BS EN 1011 Welding. Recommendation for welding of metallic materials
- BS EN 1092 Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories
- BS EN 1301 Aluminium and aluminium alloys. Drawn wire
- BS EN 1435 Non-destructive examination of welds. Radiographic examination of welded joints
- BS EN 1514 Flanges and their joints. Dimensions of gaskets for PN-designated flanges
- BS EN 1563 Founding. Spheroidal graphite cast irons
- BS EN 1852 Plastic piping system for non-pressure underground drainage and sewerage. Polypropylene (PP)
- BS EN 10025 Hot rolled products of structural steels
- BS EN 10088 Stainless steels
- BS EN 10210-1 Hot finished hollow sections of non-alloy and fine grain steels. Technical delivery requirements
- BS EN 10216 Seamless steel tubes for pressure purposes
- BS EN 10217 Welded steel tubes for pressure purposes
- BS EN 10220 Seamless and welded steel tubes. Dimensions and masses per unit length
- BS EN 10224 Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids. Technical delivery conditions
- BS EN 10253 Butt-welding pipe fittings
- BS EN 10255 Non-alloy steel tube suitable for welding and threading. Technical delivery conditions
- BS EN 10296-1 Welded circular steel tubes for mechanical and general engineering purposes. Technical delivery conditions. Non-alloy and alloy steel tubes
- BS EN 10296-2 Welded circular steel tubes for mechanical and general engineering purposes. Technical delivery conditions. Stainless steel
- BS EN 10311 Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids
- BS EN 12201 Plastic piping system for water supply, and for drainage and sewerage under pressure. Polyethylene (PE)
- BS EN 12666-1 + A1 Plastic piping system for non-pressure underground drainage and sewerage. Polyethylene (PE). Specifications for pipes, fittings and the system
- BS EN 13480 Metallic industrial piping
- BS EN 14399 High-strength structural bolting assemblies for preloading
- BS EN 60034-14 Rotating electrical machines. Mechanical vibration of certain machines with shaft heights 56 mm and higher. Measurement, evaluation and limits of vibration severity

BS ISO series

- BS ISO 20816 Mechanical vibration – measurement and evaluation of machine vibration
- BS ISO 3864 Graphical symbols. Safety colours and safety signs
- BS ISO 6336-1 Calculation of load capacity of spur and helical gears. Basic principles, introduction and general influence factors
- BS ISO 6743 Lubricants, industrial oils and related products (class L)
- BS ISO 10816 Mechanical vibration. Evaluation of machine vibration by measurements on non-rotating parts

BS EN ISO series

- BS EN ISO 225 Fasteners. Bolts, screws, studs and nuts. Symbols and descriptions of dimensions
- BS EN ISO 1452 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticised poly(vinyl chloride) (PVC-U)
- BS EN ISO 1461 Hot dip galvanised coatings on fabricated iron and steel articles. Specifications and test methods
- BS EN ISO 2128 Anodizing of aluminium and its alloys. Determination of thickness of anodic oxidation coatings. Non-destructive measurement by split-beam microscope
- BS EN ISO 2560 Welding consumables. Covered electrodes for manual metal arc welding of non-alloy and fine grain steels. Classification
- BS EN ISO 4759-1 Tolerances for fasteners. Bolts, screws, studs and nuts. Product grades A, B and C
- BS EN ISO 9606-2 Qualification test of welders. Fusion welding. Aluminium and aluminium alloys
- BS EN ISO 12100 Safety of machinery. General principles of design. Risk assessment and risk reduction
- BS EN ISO 14122 + A1 Safety of machinery. Permanent means of access to machinery
- BS EN ISO 15493 Plastics piping systems for industrial applications. Acrylonitrile–butadiene styrene (ABS), unplasticised poly (vinyl chloride) (PVC-U) and chlorinated poly (vinyl chloride) (PVC-C). Specifications for components and the system. Metric series
- BS EN ISO 5817 Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections

ISO series

- ISO 272 Fasteners. Hexagon products. Widths across flats

- ISO 885 General purpose bolts and screws. Metric series. Radii under the head
- ISO 888 Fasteners. Bolts, screws and studs. Nominal lengths and thread lengths
- ISO 3746 Acoustics. Determination of sound power levels and sound energy levels of noise sources using sound pressure. Survey method using an enveloping measurement surface over a reflecting plane

Others

- BS IEC 61882 Hazard and operability (HAZOP) studies. Application guide
- CEC L-33-A-93 Biodegradability of two-stroke cycle outboard engine oils in water
- PD 5304 Guidance on safe use of machinery

MEICA specifications

All standard specifications are listed in:

- MEICA - Specification - General