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Guidance

Thorough Examination of Electrically Operated Magnetic Lifting Devices

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1. INTRODUCTION

Electrically operated magnetic lifting devices are present in the form of either single magnets or grouped configurations, suspended from chains, wires or otherwise attached to lifting equipment. They can be used for lifting and transporting most ferrous metal stock or manufactured components. They are widely used in many industrial sectors including metal/components manufacture and storage, shipbuilding, as well as the breaking and scrap handling industries.

Magnets can be round, rectangular or of a specific form constructed for a specific purpose. A number of different types of magnet are available, which include:

1.1. Electric Lifting Magnet

Equipment with a magnetic field generated by an electric current creating sufficient force for gripping, holding and handling loads with ferro-magnetic properties.

1.2. Permanent Lifting Magnet

Equipment with a permanent magnetic field which creates sufficient force for gripping, holding and handling loads with ferro-magnetic properties. The magnetic field is controlled by mechanical means.

1.3. Electro-Permanent Lifting Magnet

Equipment with a permanent magnetic field which creates sufficient force for gripping, holding and handling loads with ferro-magnetic properties. The magnetic field is controlled by an electric current, which is not required to sustain the magnetic field.

NOTE: Electro-permanent lifting magnets can be energised by mains power, battery or by stand-alone generator.

2. LEGAL REQUIREMENTS

Under the Lifting Operations and Lifting Equipment Regulations (LOLER), magnetic lifting devices that are an integral part of machinery are defined as 'lifting equipment'. Magnetic lifting devices which can be fitted to and taken off lifting equipment are considered to be 'accessories for lifting'. 'Lifting equipment' and 'accessories for lifting' are both regarded as 'work equipment' as detailed within the Provision and Use of Work Equipment Regulations (PUWER).

The key requirements within LOLER and PUWER are:

- **Suitability** — any lifting device must be suitable for the purpose for which it is to be used or provided.
- **Safe use** — every lifting device must be clearly marked with its safe working load (SWL) and must not be operated above its SWL.

- **Maintenance** — lifting equipment must be maintained in an efficient state, in satisfactory working order and in good repair.
- **Thorough examination and inspection** – lifting equipment must be thoroughly examined and, where appropriate inspected, by a competent person at least every 12 months, 6 months for 'accessories for lifting', or in accordance with a scheme of examination. Records of thorough examination should be made in accordance with the Schedule 1 of LOLER..
- **Information and training** – employers are required to ensure that employees are adequately informed, instructed and trained in the safe use of equipment.

3. STANDARDS

The European Harmonised Standard (BS EN 13155:2020) has been produced as one means for non-fixed lifting attachments to conform to the essential health and safety requirements of the Machinery Directive, as amended.

For items, which are fixed to other types of lifting equipment, this standard could be used as a best practice guide to the safe operation of magnetic lifting devices.

4. EQUIPMENT CHARACTERISTICS

4.1. Electrical Characteristics

Pure electrical problems usually result in complete failure. Shorts or open circuits resulting from insulation breakdown can initiate problems. Insulation breakdown can be as a result of age, but is also compounded by the heavy impact loading, which the magnet may sustain during in-service use. In an electrical sense the strength of an electro-magnet should not be directly impaired by its internal electrical characteristics.

A safety device should be provided, which, after the low power warning device has been activated and the magnet has been switched off, prevents the magnet from being switched on again. It should only be possible to switch on the magnet after the battery has been recharged to at least the minimum level at which the low power, warning device is not activated.

For mains fed electric lifting magnets a stand-by battery should be provided to supply power in case of mains failure. This should be capable of providing the current needed to hold the working load limit for at least 10 minutes. Where areas are cordoned off and controlled such that no person works in the vicinity of the raised load then this requirement for stand-by battery supply may not be considered necessary, after a suitable and sufficient risk assessment has been completed.

4.2. Mechanical Characteristics

The area of contact between the magnet face and the load is of first importance in allowing the full magnetic power to be utilised. The attractive power of a magnet is related directly to the 'inverse square law' and therefore weakens rapidly if an air gap is present between the magnet and the load. Other than geometry, the

effective magnetic area can be altered by excessive distortion or, material loss either from around the magnet shell casting or from the inner pole resulting in pure extraneous mechanical damage. Whilst the useful magnetic flux is designed to be at a maximum at the lifting face, it should also be noted that the entire magnet is surrounded by random flux fields. Should the shell be fractured , then the orientation of these fields will alter, likely being detrimental to the magnet's overall capabilities. When completing a thorough examination of a magnet, which is found to contain a fractured shell, this secondary consideration should therefore be appraised. The primary effect of a fractured shell (or fracture in bumper plate etc) is the creation of a point of entry for water or other contaminants.

4.3. Lifting Accessories

For lifting equipment suspension, a multiple leg high tensile chain sling and/or shackle arrangement either of standard design or of special construction is necessary. Certification in the form of a declaration of conformity and the visible marking of safe working loads are statutory requirements and should be made available for review as deemed necessary by the Competent Person at the time of the thorough examination.

5. EXAMINATION PROCESS

5.1. Examination Scope

Some of the most critical aspects to consider when completing a thorough examination of a lifting magnet include the assessment of the following;

- Integrity of the lifting chains and/or shackles retaining the lifting magnet assembly.
- Integrity of the lifting beam structure supporting the magnet assemblies.
- Integrity of the anchorage lugs for the lifting chains and/or shackles.
- Condition of the cast magnet shell and the security of the outer pole piece, which generally serve additionally as an impact/bumping plate.
- Condition and any evident damage of the magnetic faces.
- Condition of the terminal box.
- Condition of trailing cables, terminations and support trunking, (if applicable).
- Function of the automatic warning devices for low power supply.
- Function of safety devices.
- Function of control panel indicators.
- Function of the operating controls.

- Suitability of the marking of operator instructions and controls.
- Suitability of the marking of the Working Load Limit (WLL) or the Safe Working Load (SWL) whichever is applicable to the particular item.

5.2. Functionality Testing

Where practicable a common load should be raised clear of a support (no higher than 150mm). This should be held for a maximum of 1 minute proving cross travel and long travel motions of the lifting equipment, as applicable.

For mains fed electric lifting magnets the function of the stand-by battery should be verified by raising and lowering a common load with the mains supply isolated.

Where concern exists regarding the functionality of the magnet then a full load test should be called for to supplement the subsequent thorough examination.