Guidance on the thorough examination of electrically operated magnetic lifting devices

Number: MLCC08

Prepared by: Machinery Lifts and Crane Committee (MLCC)

Status: Issue 01.1 **Date:** 15th December 2016

Reference: Electrically operated magnetic lifting devices

INTRODUCTION

Electrically operated magnetic lifting devices, in the form of either single magnets or grouped configurations, suspended from chains, wires or otherwise attached to lifting equipment, 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 particular purpose. A number of different types of magnet are available, which include:

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.

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.

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.

LEGAL REQUIREMENTS

Under the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), magnetic lifting devices that are an integral part of machinery are classed as “lifting equipment”; those that can be fitted to and taken off lifting equipment are considered to be ‘accessories for lifting’. ‘Lifting equipment’ and ‘accessories for lifting’ are both ‘work equipment’ within the meaning of the Provision and Use of Work Equipment Regulations 1998 (PUWER).

The key requirements under the LOLER and the PUWER 98 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 efficient 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 prescribed particulars contained within the LOLER, Schedule 1.

  Note: Where the safety of lifting equipment depends on its installation, e.g. a crane, it should be thoroughly examined after assembly and before being put into service at a new site or location.

- **information and training** – employers are required to ensure that employees are adequately informed, instructed and trained in the safe use of equipment.

STANDARDS

The European Harmonised Standard (EN 13155) has been produced as one means for non-fixed lifting attachments used on cranes 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.

EQUIPMENT CHARACTERISTICS

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.

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 introduced between the magnet and the load. Other than geometry, the effective magnetic area can be altered by excessive distortion or the mechanical details or from chipping away of the metal from around the magnet shell casting or from the inner pole as would result from pure extraneous mechanical damage. Whilst the useful magnetic flux is designed to be at a maximum at the lifting face, it should be remembered that the entire magnet is surrounded by random flux fields. Should the shell be cracked, then the orientation of these fields will alter, probably with detriment to the magnet's overall capabilities. When examining a magnet, which is found to contain a cracked shell, this secondary consideration should therefore be appraised. The primary effect of a cracked shell (or cracked bumper plate etc) is of course the creation of a point of entry for water or other contaminants.

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 scrutiny as deemed necessary at the time of the thorough examination.

EXAMINATION PROCESS

Examination Scope

Some of the most significant points, particular to lifting magnets, which need to be taken into account when carrying out an examination are as follows:

- Assess the integrity of the lifting chains and/or shackles retaining the lifting magnet assembly.
- Assess the integrity of the lifting beam structure supporting the magnet assemblies.
- Assess the integrity of the anchorage lugs for the lifting chains and/or shackles.
- Assess the condition of the cast magnet shell and the security of the outer pole piece, which generally serve additionally as an impact/bumping plate.
- Assess the condition and any evident damage of the magnet faces.
- Assess the condition of the terminal box.
- Assess the condition of trailing cables, terminations and support trunking, if applicable.
- Assess the function of the automatic warning devices for low power supply.
- Assess the function of safety devices.
- Assess the function of control panel indicators.
- Assess the function of the operating controls.
- Assess the suitability of the marking of operator instructions and controls.
- Assess the suitability of the marking of the Working Load Limit (WLL) or the Safe Working Load (SWL) whichever is applicable to the particular item.

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 checked 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.