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Guidance

Thorough Examination of Electrically Operated Vacuum Lifting Devices

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CONTENTS

1. INTRODUCTION

Electrically operated vacuum lifting devices are present in the form of either single vacuum pads or grouped configurations suspended from chains, wires or otherwise attached to lifting equipment. They can be used for lifting and transporting most ferrous and non-ferrous metal stock or manufactured components. They are widely used in many industrial sectors including aircraft, shipbuilding, rolling mills, glazing, plastics, building and general engineering.

Vacuum pads can be round, rectangular or of a specific form constructed for a particular purpose. For larger component forms, the pads could be mounted on single, twin and cross beam structures. A number of different types of vacuum are available. As follows;

Self-Priming Vacuum Lifting Device

Equipment, which includes one or more suction pad(s) which utilises the load to create the vacuum.

NonSelf-Priming Vacuum Lifting Device

Equipment, which includes one or more suction pad(s) and which utilises an external source of energy to create the vacuum.

Note: Electro-pneumatic vacuum lifting devices can be energised by mains power, battery or by stand-alone generator.

2. LEGAL REQUIREMENTS

Under the Lifting Operations and Lifting Equipment Regulations (LOLER), vacuum lifting devices that are an integral part of machinery are defined as 'lifting equipment'. Vacuum 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 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 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 vacuum 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 impact loading which the device may sustain during in-service use.

A safety device should be provided, which automatically warns of a dangerous condition where vacuum losses can no longer be sustained. The warning signal should be optical or acoustic, depending upon the circumstances of use for the vacuum lifting device. The warning signal should operate even in the event of complete power failure.

For non self-priming vacuum lifting devices, at least one stand-by vacuum reservoir or battery should be provided to supply power in case of supply failure. In the event of supply failure, the vacuum lifting device should be capable of maintaining the working load limit for at least 5 minutes. Where areas are cordoned off and controlled such that no person works in the vicinity of the raised load then the requirement for stand-by vacuum reservoirs and/or battery supply may not be considered necessary, after a suitable and sufficient risk assessment has been completed.

4.2. Mechanical Characteristics

The vacuum assembly is normally mounted within a yoke, which is in turn connected either directly to a single suction pad or lifting beam structure configuration. At the upper structural cross beam or member there should be a suitable means of attachment to the lifting equipment. Depending on the type of vacuum lifting device the assembly will comprise of the necessary pneumatic circuit valve work, piping, pumps, electric motors and reservoirs for adequate and safe function.

The shape of the suction pads should be geometrically matched to that of the intended load. Furthermore, where more than one suction pad is used in conjunction with a lifting beam, the layout of the suction pads should also complement the geometry of the load. Additional to this, the suction pad seal ring should be suited to the intended load (i.e. neoprene for oil resistance and silicone for high temperature use).

For vacuum lifting devices intended for use on construction sites, a secondary positive holding device should be fitted or there should be two vacuum reservoirs, each fitted with non-return valves. Each vacuum reservoir should be connected to a separate set of suction pads. In turn, each set of suction pads should be capable of sustaining at least 2 times the working load limit.

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 vacuum lifting device include the assessment of the following;

- Integrity of the lifting chains and/or shackles retaining the vacuum lifting device.
- Integrity of the yoke and/or lifting beam structure supporting the vacuum assembly and suction pads.
- Integrity of the anchorage lugs for the lifting chains and/or shackles.
- Overall condition of the suction pads.
- Condition and suitability of the suction pad seals.
- Condition of the safety vacuum reservoir.
- Condition of the pneumatic circuit valve work, piping, pumps and electric motors.

- Condition of the terminal box.
- Condition of trailing cables, terminations and support trunking (if applicable).
- Correct function of the automatic warning devices.
- Condition and function of additional safety devices.
- Function of control panel indicators.
- Function of the operating controls.
- Suitability of the marking of the 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 nonself-priming vacuum lifting devices the function of the vacuum safety reservoir and/or 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 vacuum lifting device then a full load test should be called for to supplement the subsequent thorough examination.