

THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

LIFTING POINTS

A Design Guide

PUBLICATION No. 101 : 1984



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THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

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The Association aims to reduce members' costs by providing the opportunity for them to share resources and expertise in order to keep abreast of technological developments and improve the effectiveness and efficiency of their engineering activities. EEMUA supports the British Standards Institution, works with other institutions, associations, government departments, regulatory authorities and the Confederation of British Industry, and is also actively involved with other standards-making bodies, both national and international, such as the American Petroleum Institute.

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FOREWORD

This document has been produced by the Engineering Equipment and Materials Users Association, in the absence of any international or national standard on the design of lifting points for plant. Lifting points are provided to facilitate lifting and handling for installation, maintenance and dismantling. The provision of adequate means for lifting is important for safe and efficient handling and to minimise risk of injury and damage.

The term 'rated load' of the lifting point is used in the document. The term 'safe working load' is ascribed to lifting gear and appliances used in the method of lifting.

The design criteria for lifting points have a theoretical basis. Although outside the scope of the document some advice is given on the selection and application of lifting gear used in the method of lifting. The lifting gear and appliance to be used should be taken into consideration early in the design stage. This is particularly important where shackles are to be used because there are two grades of shackle material available, i.e. higher tensile and alloy steel which size for size have different SWL's.

The derating factors recommended for multi-leg slings take account of out of balance lifting where the total load may be taken by the opposing two legs of a four leg sling or any two legs of a three leg sling.

Lifting points are required for loads in excess of 55 kg in order to facilitate mechanical handling. Loads between 15 kg and 55 kg should be provided with facilities for controlled handling, e.g. handles or hand holes for one or more persons although the 55 kg load criteria can be adopted for any load below 55 kg if necessary. In applying these values, note should be taken of current HSE* proposals which may lead to legislative requirements.

The words 'shall', 'should' and 'recommend' are used to indicate the degree of importance which the Association believes should be attached to the precise feature in question. The word 'shall' indicates something which the Association believes to be essential in the interests of safety and efficiency and to have no practical alternative. The words 'should' and 'recommend' indicate what the Association believes to be good practices whose implementation should at least be given serious consideration.

The term 'plant' used in this document includes machines, machinery, sub-assemblies, components and equipment.

1. SCOPE

This document specifies the design, fabrication, preferred types and marking of lifting points on plant. It defines the rated load for design purposes applicable to each lifting point and recommends the SWL for associated lifting gear and appliances. Examples are given on the design of lifting points for multi-point lifting for various applications.

2. REFERENCES

- BS 2903 – Specification for higher tensile steel hooks for chains, slings, blocks and general engineering purposes.
- BS 3032 – Higher tensile steel shackles.
- BS 3551 – Alloy steel shackles.
- BS 3643 – ISO metric screw threads.
- BS 4278 – Eyebolts for lifting purposes.
- BS 5500 – Unfired fusion welded pressure vessels.
- BS 6166 – Recommendations for rating of lifting gear for general purposes.

* Health and Safety Commission Consultative Document – "Proposals for Health and Safety (manual handling of loads) Regulations and Guidance"

BS/PD 6439 – A review of methods of calculating stresses due to local loads and load attachments of pressure vessels.

ASME V111 – “Boiler and Pressure Vessel Code” Section VIII.

HSE/PM 16 – Health and Safety Executive Guidance Note ‘Eyebolts’.

The Chain Testers Association of Great Britain ‘Code of Practice for the Safe Use of Lifting Equipment’.

3. DEFINITIONS

For the purpose of this document, the following terms and definitions shall apply:

Lifting Point: A generic term for the calculated and designed point(s) or attachment(s) on an item of plant from which the plant can be safely lifted using certified lifting gear and appliances of adequate capacity. It includes such common names as lifting lugs, lifting cleats, lifting eyes, trunnions, eyebolts and jacking points.

Rated Load: The maximum vertical load which can be accepted by a lifting point. Account is taken at the design stage of forces due to angular loading.

Safe Working Load: The maximum load which lifting gear and appliances may raise, lower or suspend under the service conditions which apply.

Lifting Gear: Any item used to connect a load to a lifting appliance but which is not in itself capable of providing any movement to lift or lower a load.

Lifting Appliances: Any machine that is able to raise, lower or suspend a load, excluding machines incorporating a guided load and continuous mechanical handling devices.

4. TYPES OF LIFTING POINTS

4.1 Preferred types

The preferred type of lifting point depends to some extent on the plant to be lifted and in view of this the following list is not an order of preference.

- (a) Welded-on lifting points with holes suitable for shackles or hooks. (In general shackles are preferred to hooks in order to minimise the dimension of the lifting points).
- (b) Welded-on or integral pads for jacking points.
- (c) Integral lugs with holes suitable for shackles or hooks.
- (d) Holes inherent in the design of the plant which may be designated as lifting points.
- (e) Bolted-on or screwed-on lifting points with holes suitable for shackles or hooks.
- (f) Trunnions.

4.2 Other types

In addition to the preferred types, eyebolts may be used subject to the agreement of the purchaser. When used as lifting points they shall be part of the original design and supplied with the plant. Documentation shall be provided by the supplier specifying the method of lifting, the British Standard number (or other design standard agreed with the purchaser), type and size of the eyebolt and confirmation that the lifting point is rated in accordance with this document.

4.2.1 Eyebolts (other than dynamo) shall be either:

- (a) Eyebolts with link to BS 4278 threaded ISO metric (these permit angular loading without derating up to 15° to the vertical axis), or
- (b) Collar eyebolts to BS 4278 threaded ISO metric.

4.2.2 Dynamo eyebolts are excluded from general use but may be used for vertical lifts only on some rotating electrical plant such as motors and alternators with tapped holes specifically for that purpose. They shall be to BS 4278. However, if a **vertical** lift cannot be guaranteed then consideration should be given to using eyebolts with link or collar eyebolts.

5. DESIGN AND FABRICATION

5.1 General

All plant requiring to be lifted separately and weighing more than 55 kg shall be designed and manufactured with adequate provision for safe lifting.

Purpose designed lifting points shall be provided except where:-

- (a) The provision of such features may interfere with the assembly and/or functioning of the plant.
- (b) Due to shape, mass distribution and strength, the basic design provides adequate facilities for safe lifting.
- (c) Inherent features of the plant can be designated and rated as lifting points.

In the case of 5.1 (a) and 5.1 (b), the supplier shall indicate the required method of lifting.

5.2 Distribution and number of lifting points

- (a) Where practicable, lifting points shall be positioned so that each supports an equal proportion of the total load.
- (b) The number of lifting points should be kept to a minimum consistent with the stability and permissible stresses in the plant to be lifted and the SWL of the lifting gear and appliances normally available.

5.3 Design

Lifting points shall be considered in the initial design of the plant and shall comply with appropriate British Standards and/or company standards for the plant. Where fabricated lifting points are associated with plate, the supplier shall ensure that the design can withstand transverse bending of the plates or welds. Where practicable, the lifting points on an item of plant shall be of the same type, size and rated load.

5.4 Factor of safety

Each lifting point shall be designed to have a factor of safety of the ultimate tensile strength relative to the combined stress of not less than 4 to 1, (or such higher value as may be required by the purchaser) when carrying its rated load with the lifting force applied at any angle up to 60° from the vertical in any direction. Where this is not practicable, e.g. by reason of operational characteristics and/or weight considerations, the factor of safety shall be agreed with the purchaser and a safe method of lifting shall be drawn up and fully documented. Figures 1, 2, 3 and 4 show the theoretical loads for 1, 2, 3 and 4 point lifting.

Each jacking point shall be designed to withstand at least three times its rated load with the lifting force applied normal to the jacking surface.