

# NSL



PART OF ASCOWORLD

# The International **RIGGING & LIFTING** Handbook

International English | 14th Edition



NSL Safety Awareness & Training Materials

## # IMPORTANT NOTICE

This handbook is designed to give guidance aimed at reducing the risk of injury during Rigging and Lifting operations.

It is intended to be used as a reference guide. It is not intended as a fully comprehensive manual on health and safety nor as a substitute for formal training.

The information contained in this handbook is intended to comply with and reflect the guidance given in UK health and safety legislation current at the time of publication. The users must always satisfy themselves, as to the relevant health and safety legislation affecting the work site.

Lifting equipment, lifting operations, specific tasks and work sites have inherent associated risks and hazards. While following the procedures and recommendations contained in this book should reduce the risk of injury, it will seldom be possible to eradicate risk completely.

This book contains general recommendations only. The users will require to satisfy themselves that these recommendations are suitable for their particular circumstances  
**AND DO NOT CONTRADICT GUIDANCE GIVEN BY MANUFACTURERS FOR THEIR PARTICULAR EQUIPMENT.**

All statements, technical information, diagrams and recommendations contained in this book are believed to be correct but no guarantee is given as to their accuracy or completeness. In particular and without prejudice to the foregoing generality, no guarantee is given regarding information which has been sourced from third parties. To the fullest extent permissible by law, North Sea Lifting Limited shall have no liability whatsoever for any loss, claim or damage arising as a result of anything contained in or omitted from this book.

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Workplace / Location: \_\_\_\_\_



## # Introduction

The purpose of this handbook is to provide an awareness of lifting equipment and of its correct and safe usage.

**It is a statutory requirement of SI 1999 No.3242 – The Management of Health and Safety at Work Regulations 1999, that work is carried out by trained personnel.**

Irrespective of your normal job designation or duties, the occasion may arise when you have to operate lifting equipment.

The prime considerations are for the health and safety of personnel and then to ensure that materials and cargo are handled with the minimum risk of damage.

This handbook reflects recognised policies and process of industries for safe lifting practices and the guidance given by regulatory authorities. Statutory requirements are the minimum standards acceptable and in many cases these practices will exceed the minimum requirements.

The individual sections under the heading "Safe Use of Equipment" have been compiled in general terms as the equipment can originate from various manufacturers. Should any doubt exist as to the limitations of the equipment, the manufacturer's technical and operational literature should be consulted.

Each lifting appliance or accessory should have an identification number and its Safe Working Load (SWL) or Working Load Limit (WLL) clearly marked. Although not required by law, it should also be colour coded to indicate its certification status. Only use equipment marked with the current colour code which will be prominently displayed at the worksite.



**Remember:** if there is no SWL / WLL, ID / or colour code, do not use!

This handbook is issued in support of existing Health and Safety at Work Policies. It provides information on lifting equipment and lifting operations which, if used properly, will lead to safer working practices.

## # Scope of Application

This Handbook has been produced to comply with the requirements of Health and Safety at Work Regulations, The Lifting Operations and Lifting Equipment Regulations SI 1998 No 2307(LOLER), Health and Safety Codes of Practice and various Safety Guidance Notes. Principally, it provides guidelines for the safe use of lifting equipment at worksites but also contains information relating to general rigging practice and standards relevant to lifting operations.

The handbook is aimed at any personnel involved in Lifting operations and those working with lifting equipment.

The aim of this handbook is to alleviate "every day" mechanical handling problems. It is not intended to solve **complex** rigging problems. These must be addressed separately and individually.

## # British Standards

British Standards give guidance and recommendations and compliance is not mandatory however we recommend the guidance contained within these standards is followed as this will help you comply with your duties under Health & Safety legislation. However, where standards have been revised / rewritten and no longer contain the level of technical information or safety advice of the superseded standards, reference to "withdrawn" standards technical information is made.

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Figure 1. FTIR spectra of poly(1,4-phenylene terephthalic anhydride) at various temperatures: (A) 200, (B) 250, (C) 300, and (D) 350 °C.

and 350 °C. The infrared spectra of the polymer at different temperatures are shown in Figure 1. The absorption bands at 1780, 1500, 1450, 1220, 1050, and 700 cm<sup>-1</sup> are assigned to the stretching vibrations of the carbonyl group, the aromatic ring, and the C=C double bond.<sup>10</sup>

The infrared spectra of the polymer at different temperatures show that the absorption bands at 1780, 1500, 1450, 1220, 1050, and 700 cm<sup>-1</sup> are very strong at 200 °C, and the intensity of the absorption bands decreases with increasing temperature. At 350 °C, the absorption bands at 1780, 1500, 1450, 1220, 1050, and 700 cm<sup>-1</sup> are very weak.

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# **BASIC PRINCIPLES OF RIGGING & LIFTING**

**1.0** GLOSSARY  
OF TERMS

**3.0** DEFINITION AND  
PRINCIPLES OF  
LIFTING EQUIPMENT

**5.0** SELECTION OF  
LIFTING EQUIPMENT

**2.0** REGULATIONS

**4.0** EXAMINATION OF  
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TO LIFTING

## #1.0 GLOSSARY OF TERMS

### ##.1 Competent Person (For Lifting Equipment Inspection)

A person having the appropriate practical and theoretical knowledge and experience of the lifting equipment so that they can detect defects or weaknesses, and assess how important they are in relation to the safety and continued use of the equipment.

This person should not be the same person who performs the routine maintenance of the equipment and be sufficiently independent and impartial to make objective decisions

### ## 1.2 Working Load Limit (WLL)

The maximum load which an item of lifting equipment is designed to raise, lower or suspend. The WLL does not account for particular service conditions which may affect the final rating of the equipment (see SWL below).



**Note:** The Working Load Limit as determined by the Manufacturer must never be exceeded.

### ## 1.3 Safe Working Load (SWL)

The maximum load (as certified by a Competent Person) which an item of lifting equipment may raise, lower or suspend **under particular service conditions**, e.g. the SWL can be **lower** than the WLL.



**Note:** The Safe Working Load as determined by the Competent Person must never be exceeded.

### ##.1.4 Factor of Safety / Safety Factor

The ratio of the load that would cause failure of an item of lifting equipment to the load that is imposed upon it in service, i.e. SWL (this is to allow for detrimental criteria such as wear and tear, dynamic loadings, etc).

### ##.5 Colour Code

A method of marking equipment (normally with paint) to give a visual indication of its certification status. This colour should be changed at each periodic examination.

**##1.6****Plant / Identification Number**

A unique number given to an item of lifting equipment for registration purposes and to facilitate traceability.

**##1.7****Headroom**

The maximum vertical distance between the item to be lifted and the point of suspension of the hoisting machine, e.g. between the lifting eyes and the underside of runway beams.

**##1.8****Height of Lift**

The amount of possible travel between the top and bottom connection points, e.g. hooks of a hoisting machine.

**##1.9****Drawn-up Dimension**

The minimum distance between the suspension level and the bottom hook saddle (also known as closed-height).

**##1.10****Load Sensors**

A piece of equipment used for detecting the actual loadings at a rigging point, e.g. load cell shackle, test clock or compression load cell, etc.

**##1.11****Lifting Equipment**

A generic term which includes lifting appliances and lifting accessories.

**##1.12****Thorough Examination**

A systematic and detailed examination of lifting equipment by a competent person to detect defects that are, or might affect the safe use of the equipment.

## # 2.0 REGULATIONS

The principal Statutory Legislation & Regulations which govern lifting activities are:

- The Health and Safety at Work, etc. Act (1974).
- SI 1998 No. 2307 The Lifting Operations and Lifting Equipment Regulations 1998.
- SI 1992 No. 2793 The Manual Handling Operations Regulations.

### ## 2.1 Health and Safety at Work, etc. Act (1974)

This Act came into force in 1975 for onshore areas and was extended in 1977, to offshore areas. It is important that persons involved with lifting and lifting equipment ensure the safe use of lifting appliances and lift gear.

### ## 2.2 The Effects of the Act

It is the duty of every employer to ensure, so far as reasonably practicable, the health, safety and welfare at work of all his employees. This duty includes the provision of all necessary instruction, training and supervision.

**YOU** have a legal responsibility to take reasonable care for your own health and safety for that of other people who may be affected by your conduct at work. You must comply with any safety requirements and co-operate with your employer / supervisor as far as necessary to enable that duty or requirement to be performed or complied with.

### ## 2.3 The Penalties for Non-Compliance

Legally, **YOU** are liable for the same statutory penalties as your employer if you do not comply with your obligations under the Act.

If you are in breach of the Act, you commit a criminal offence and may be prosecuted **whether or not an accident occurs**. The Act allows for substantial fines and / or imprisonment.

### ## 2.4 SI 1998 No. 2307 The Lifting Operations and Lifting Equipment Regulations 1998 (This is backed by an approved code of practice).

These regulations came into force in December 1998. The parts of this Statutory Instrument pertinent to this handbook and that affect you "the user" are Regulations **4, 5, 6, 7, 8** and **9**. Relevant information has been extracted from these regulations and is shown here:

**##2.5****Regulation 4 – Strength and Stability:**

Regulation 4 considers the safety risks of lifting equipment that could fail or collapse under load because of:

- inadequate physical strength of any part of the equipment; OR
- instability in the lifting system.

Employers are required to ensure that:

- a) lifting equipment is of adequate strength and stability for each load, having regard in particular to the stress induced at its mounting or fixing point;
- b) every part of a load and anything attached to it and used in lifting it is of adequate strength.

**##2.6****Regulation 5 – Lifting Equipment for Lifting Persons:**

Under this regulation, equipment for lifting persons must be specifically designed for that purpose and will include all the necessary / additional safety features. Any such equipment will be marked accordingly. **Do not attempt to use standard lifting equipment which is NOT marked accordingly for lifting, lowering or suspending personnel.**

**##2.7****Regulation 6 – Positioning and Installation:**

Under this regulation, lifting equipment must be positioned and installed in such a way as to minimise the risk of damage to the load or injury to personnel. In certain cases, this includes the fencing off or erection of safety barriers around shafts or hoistways. **Never cross or venture beyond these barriers even if it appears safe.**

**##2.8****Regulation 7 – Marking of Lifting Equipment:**

All lifting machinery and accessories shall be plainly marked with their safe working load / working load limit (or loads if dependent on lifting configurations). **No lifting appliance or piece of lifting gear shall be used by any person for any load exceeding the SWL / WLL marked thereon.**

**##2.9****Regulation 8 – Organisation of Lifting Operations:**

Every lifting operation must be properly planned by a Competent Person, appropriately supervised, and carried out in a safe manner. ("lifting operation" means an operation concerned with the lifting or lowering of a load). **This would include risk assessment at a level proportionate to the complexity and the perceived level of hazard.**

**## 2.10 Regulation 9 – Thorough Examination and Inspection:**

Every lifting appliance and every piece of lifting gear must be thoroughly examined and, where necessary, tested by a Competent Person before it is used for the first time, after any substantial repair or modification and thereafter at regular intervals. **Outwith this, all equipment and gear must be examined by you prior to and after each use.**

Note: LOLER does not apply to lifting equipment which is not provided for use at work.

**## 2.11 The Manual Handling Operations Regulations 1992**

The Manual Handling Operations Regulations 1992, Statutory Instrument 2793 actually came into force on the 1st of January 1993. Manual handling is the handling of loads by human effort, as opposed to mechanical handling, i.e.: the lifting, putting down, pushing, pulling, carrying or moving of a load by hand or bodily force. A "load" includes persons, animals, material supported on a fork or shovel, etc. Further information on Manual Handling can be found in section 26 of this handbook and in the HSE Guidance document.

#### Definition

##### 3.1 Lifting Equipment

Work equipment for lifting or lowering loads and includes its attachments used for anchoring, fixing or supporting it and comprises of Lifting appliances and lifting accessories.

#### Lifting Appliances

Mechanical device capable of raising or lowering a load, e.g.: Cranes, Forklift Trucks, Lifts, Suspended Cradles, Powered Hoists, Manual Hoists, Lever Hoists, Rope Hoists, Beam Trolleys, Beam Clamps, Sheave Blocks, Winches, Runway Beams.

#### Lifting Accessories

Any device which is used or designed to be used directly or indirectly to connect a load to a lifting appliance (see above) and which does not form part of the load, e.g. Wire Rope Slings, Chain Slings, Man-made Fibre Slings, Hooks and Fittings, Swivels, Shackles, Eye Bolts, Rigging Screws, Wedge Sockets, Plate Clamps.

##### 3.2 Principles of Lifting Equipment

All lifting equipment should be of adequate strength, sound material, of good construction and suitable for the duty which it has to perform. It should be tested in accordance with statutory requirements (i.e. a proof load applied) and a test certificate should be raised prior to its first use. The certificate is an important legal document.



**Warning!** The use of improvised (home made) lifting equipment is strictly prohibited.

### 3.3 Factor of Safety / Safety Factor

Good practice requires that any lifting equipment shall have an adequate factor of safety incorporated in its design. Where appropriate in each of the separate equipment types, a minimum factor of safety for the specific item is recommended and this should not be decreased.

The purposes of a factor of safety are numerous including allowance for wear, impact, dynamic loading and accidental overloading. However, it cannot be too highly stressed that such allowances are a contingency only and must **never be purposely eroded**. Care should always be taken to avoid circumstances which can cause overload (e.g. impact, shock) and care should also be taken in circumstances where inadvertent overload can occur. In extreme cases where several adverse circumstances occur at the same time, the result may be failure even though the nominal load lifted does not exceed the safe working load of the equipment. If such circumstances are likely to occur, advice will be sought from your supervisor.

- 3.4 Many items are covered by British, European and International Standards. Where applicable these are listed against individual types of equipment (refer to Appendix 1).
- 3.5 Some lifting equipment (e.g. lifting beams) can be used in a variety of ways. It is therefore important that information on the specific intended use should be indicated by the manufacturer / supplier in such cases and the advice sought before any change of use is attempted.
- 3.6 It will be apparent when reading specific sections of this handbook that reference is made to the angle at which the equipment is used (e.g. the angle between the legs of a multi-leg sling). It is most important that allowance is made for the change in forces applied and resultant variation in safe working load which can result from using the equipment at an angle.
- 3.7 A final point to be considered when selecting equipment for a particular operation is compatibility between the various items required. A number of different grades of material are used for lifting equipment and in particular it will be found that hooks, links, rings and shackles vary considerably in size for a given capacity according to the grade of material used. Care must therefore be taken to ensure that each item of equipment seats correctly and aligns correctly with its neighbour. Where necessary an intermediate link or shackle should be used to ensure this.

## 4.0 EXAMINATION OF LIFTING EQUIPMENT

This section highlights the examinations which must be carried out to meet legal requirements and ensure safe working conditions.

- 4.1** Companies and users of lifting equipment are required by law to have it thoroughly examined periodically by a Competent Person (Examination periods are referenced further within this section – "Periodicity of Examinations"). The legal responsibility for ensuring this happens lies with senior management who would normally delegate to supervisory staff.

### 4.2 Pre-use Examination

Notwithstanding the above, all items of lifting gear must be examined by the user prior to each use to ensure, so far as is practicable, that they are in a good state of repair and SAFE to carry out the task in hand.

- 4.3** The three common particulars to check for are:
- i) The required SWL.
  - ii) Plant number / Identification number.
  - iii) If applicable, Correct Colour Code (The current colour code should be prominently displayed at the worksite and can be confirmed by referring to a supervisor).
- 4.4** Further details of what to check for during an examination are contained in the "Safe Use of Lifting Equipment" section of this handbook as the details vary according to the type of gear.



**Remember:** if there is no SWL / WLL, ID and / or colour code, do not use!

#### 4.5 Examination (And Testing) Requirements

##### 4.6 Initial examination (and testing)

All lifting equipment must be thoroughly examined (and tested where appropriate) prior to being used for the first time (unless it has not been used before or has an EC declaration of conformity less than 12 months old), after installation or re-installation or after any repair or modification which may affect the safety of the equipment.

##### 4.7 Periodicity of examinations

Lifting equipment exposed to conditions which may cause deterioration and result in hazardous situations must be thoroughly examined by a Competent Person:

- a) In accordance with an inspection scheme, or
- b) On a regular basis dependent on equipment type and / or usage, i.e.
  - i) Accessories and "Personnel" hoisting equipment.  
**intervals not exceeding 6 months**
  - ii) Lifting appliances and other lifting equipment.  
**intervals not exceeding 12 months\***

\* Where the equipment is used offshore, due to the harsh environment, we recommend the maximum period between examinations should be 6 months. However, lifting support steelwork with no moving parts such as runway beams, padeyes, permanently attached or integral lifting eyes, etc. could have their periodicity of examination left at 12 months (maximum) as long as:

- i) They are not used for supporting personnel.
- ii) Their use is infrequent to the extent that wear is not an adverse factor.
- iii) They are adequately coated / protected so that corrosion is not an adverse factor.

##### 4.8 Hand splices on certified wire rope are **not** required to be proof load tested.



**Warning!** Do not stow lifting tackle in lockers or tool boxes as the gear could be missed during a statutory inspection and hence become uncertified.

## 5.0 SELECTION OF LIFTING EQUIPMENT

### 5.1

The most important fact to establish prior to preparing for a lift is the weight of the item to be handled. In the majority of cases this will be known but where it is not, use a load measuring device (see figs 5.1 to 5.3 below for typical examples) to confirm the weight. As alternatives, you could consult with the manufacturer or take measurements and calculate the weight using the Material and Density Table (Appendix 2). If any doubt exists, contact your supervisor.



Fig 5.1  
Loadcell Shackle



Fig 5.2  
Crane Weigher



Fig 5.3  
Dynamometer

### 5.2

Once the weight has been established, another consideration is the available "head-room". This has a bearing on sling angles and increasing tension in the sling legs.



**Note:** The weight of the selected rigging must be added to the weight of the load to be lifted and the total weight considered when selecting the hoisting machine.

### 5.3

Check the compatibility of the various components as sizes vary according to materials used in manufacture.

### 5.4

Check suitability of hoisting equipment for specific tasks and environment, e.g. you may wish to use it under water and not all types of equipment are suitable for sub-sea use.

### 5.5

Once the equipment is selected, it must be subjected to a "pre-use" examination as described throughout the individual sections of this handbook. Should any item fail this visual examination, it must be withdrawn from service immediately and reported to the supervisor.

## 6.0 SAFE APPROACH TO LIFTING

The following section gives recommendations as to the correct procedures to adopt when effecting a lift.

### 6.1 Personnel Competence

Any person using lifting equipment must be trained in the safe use of that equipment. The person must also have a working knowledge of its capabilities and the defects likely to arise in service. This knowledge will be of value when carrying out the pre-use examinations.

### 6.2 Never Exceed the Safe Working Load / Working Load Limit

In all lifting operations care should be taken to ensure that the load imposed on any item of equipment or on part of any item does not exceed its SWL / WLL. When there is any uncertainty about the weight of the load or the load applied to a particular part of the equipment it is recommended that load sensing devices be used. In addition, care should be taken to ensure that the load remains in a stable condition through the duration of the lift. In general the load may be unstable if at any time the centre of gravity of the load is not vertically beneath the crane hook, or the centre of gravity of the load is higher than the point of attachment of the slings to the load. There are other causes of instability to be considered, e.g. liquid moving within a vessel, etc.

### 6.3 Correct Use

The equipment should be used only for the specific purpose for which it is designed and should not be adapted for any other purposes without the approval of a Competent Person and / or the original equipment manufacturer / supplier.

### 6.4 Check The Lift

The load should be lifted a nominal distance only in the first instance. This "trial lift" allows the operator to check his estimations of balance, stability, and general security of the load while it is in a safe position. If discrepancies are found the load should be lowered and the slinging revised. The sequence of trial lift and adjustment should be repeated until the operator is satisfied that the load is balanced, stable and secure.

**Warning!** Do not stand below loads; keep hands clear of rigging as slack is taken up (as per the "hands-free" lifting policy); avoid climbing on containers and stacked materials; never stand between loads and walls / bulkheads, etc.