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## ADWEA HSE PROCEDURE MANUAL

### MATERIAL HANDLING AND LIFTING GUIDELINES

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### **MATERIAL HANDLING AND LIFTING GUIDELINES**

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#### **1. Introduction**

Materials handling is an activity carried out by almost everyone, almost every day. When a valve is lifted onto the workbench, when a pallet is lifted onto a truck, when a 10 tonne diesel generating set is lifted onto its support frame or when a case of mineral water is lifted out of the car, these are all instances of materials handling. They all have the potential to cause injury or damage.

In the combined industrial and domestic environments, back injuries account for a very high proportion of the pain suffered and time lost from work. In the workplace, there are inherent hazards associated with materials handling due to the quantities, sizes and weights involved.

For all of these reasons, this guide has been developed to help minimise incident potential and maximise operational effectiveness, to everyone's benefit.

It is structured around:

- Key personnel and their responsibilities in materials handling operations.
- The specialist personnel in these operations.
- The lifting equipment used by these specialists, ranging from a fork lift truck to a heavy lift mobile crane to a simple eyebolt.
- The safety of materials in transit and in store.

#### **2. Responsibilities**

##### **2.1 Site/Facility Management**

Must ensure that:

- A Lifting Equipment Supervisor (or equivalent) is appointed to control the inventory of lifting equipment and arrange its periodic examination.
- All personnel involved in materials handling understand the requirements of standards and procedures.
- A system of review and control is established to ensure that standards are appropriate to the requirements of the operation.

##### **2.2 Lifting Equipment Supervisor**

The Lifting Equipment Supervisor, or equivalent, is appointed by the Site/Facility Management to examine lifting equipment on his behalf. He should be competent to inspect for damage, deterioration or other defects, and also capable of assessing and advising what effect such defects would have on the strength and function of the lifting equipment.

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The Lifting Equipment Supervisor supervises the examination and maintenance of all loose lifting equipment within his area of responsibility every six months and ensures timely inspection of other items of lifting equipment requiring inspection by third party surveyors. The Lifting Equipment Supervisor maintains a register and keeps a copy of certificates for each piece of lifting equipment under his control. This information includes:

- Date received
- Serial number/Company unique number
- Description
- Safe working load
- Date last inspected/certified
- Colour code
- Date destroyed

This record is to include permanently attached slings on equipment under his responsibility, and will be available for inspection.

#### 2.3 Supervisors

Supervisors must ensure that persons under their supervision involved in or in the area where materials handling operations are being conducted:

- Are trained in the techniques required for the safe execution of their work.
- Only use equipment which has been inspected and certified in accordance with Company requirements.
- Do not try to manually handle an article beyond their physical capability to manage.
- Are aware of the hazards associated with, and on the perimeter of, their work area.
- Understand and follow procedures and guidelines.

#### 3. Personnel

##### 3.1 General

All personnel, both Company staff and Contractors, should receive instruction in basic manual lifting and handling techniques at the time of their induction. The correct technique for manual lifting is shown in Appendix 1.

##### 3.2 Specialist

Materials handling involves a number of specialist activities carried out by people either as their full-time occupation or as an additional part of their job. These activity-related tasks include:

- Riggers and Slings
- Banksmen
- Pedestal Crane Operators
- Mobile and Crawler Crane Operators



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- Fork Lift Truck (FLT) Operators
- Self-load (e.g. HIAB) Truck Drivers

Note: when a diesel-hydraulic excavator is used with fitted lifting attachments, it becomes a crane and its operator is included in the category of Mobile Crane Operator.

#### 4. Hand Trucks

Hand trucks are for moving loads over short distances and may be designed for lifting and moving packages or pallets. In the latter case, the facility to jack up the truck may be incorporated.

Hand trucks used in Company operations are suitable for transporting loads not exceeding 1500kg over distances not normally greater than 100m.

General requirements for hand trucks are that:

- They are clearly marked with their Safe Working Load (SWL) and have an in-date certificate of inspection from a third party surveyor.
- They are not used on sloping steel surfaces such as ramps and particularly not on long inclines (max. recommended gradient 1:15). If there is no alternative, consideration should be given to using trucks fitted with brakes.
- They are not used on uneven or soft surfaces. Such surfaces, e.g. cracked concrete, distorted tarmac, sand and grassy areas, increase both the physical effort required and the risk of toppling.
- Special care is taken when using hand trucks in split level areas, e.g. loading bays, especially where no guard-rails are fitted.
- They have all their wheels in contact with the working surface at all times during their use.
- Users report any mechanical defects to the appropriate supervisor.

#### 5. Fork Lift Trucks (FLTs)

##### 5.1 Pre-Use Checks

Before use, operators must check their FLT and associated equipment to ensure they are in safe and proper condition.

Operators must ensure audible and visual warning equipment is working correctly by carrying out function tests prior to any lifting operations.



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#### 5.2 Parking

When unattended, FLT's should be left with the fork arms tilted forward and lowered to rest on the ground/deck. The engine must be switched off, the key removed and the handbrake applied.

Keys must be kept in a secure place and only issued to licensed Operators for the duration of the duty period or task.

When not in use, FLT's should be parked in secure areas to prevent access by unauthorized personnel.

#### 5.3 Operating Areas

Care must be taken at all times during FLT operations to avoid pedestrians, other vehicles and hazards within their area of operations.

FLT's must only be used in areas where there is enough room for their safe operation. Particular care must be taken to ensure that FLT's used in aisles have enough room to circulate and maneuver either loaded or empty.

Sharp bends and overhead obstructions should be avoided as far as possible. Special care needs to be taken to avoid hazards such as loading bays, excavations, columns, pipe-work, racking and other plant.

Industrial FLT's must only be driven on suitable surfaces; road humps and rough or soft surfaces are to be avoided.

FLT's should not be operated on excessive gradients. (In general, FLT's should be driven forwards up a slope, backwards down a slope and in line with the incline. It may be necessary to raise the forks slightly at the bottom of a slope to avoid grounding.)

FLT's must not be operated across gradients.

#### 5.4 Loads and Handling

FLT's may only be used to lift loads within their certified capacity.

Loads must be correctly placed and secured on the forks to avoid tipping forwards or sideways. Figure 1 shows the correct techniques for FLT use.

Wherever possible, FLT's should be driven with the forks in the lowered position and with the mast slightly tilted back, with care taken to avoid scraping the fork heels on the ground/deck.

Movement with loads in excessively raised positions must be avoided to minimise the danger of toppling, especially on uneven surfaces and while cornering.

FLT's must only be used for loads which can be carried safely on the forks or attachments fitted. Non-standard, non-packaged and excessively wide loads should be avoided



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wherever possible. In particular, long tubes should be carried using appropriate attachments.

#### 5.5 Attachments

FLT's must only be used with attachments that have been specifically designed, constructed and certified for it and the intended load, and attachments only used as prescribed.

Attachments must be produced by a recognised specialist manufacturer and certified in accordance with requirements.

Care must be taken to ensure that where attachments are used, any consequential de-rating of lifting capacity is not exceeded.

#### 5.6 General Safety Precautions

- Operators must not carry passengers anywhere on the FLT.
- Operators must not allow pedestrians to walk underneath the load.
- A load must not be picked up if someone is standing close to the load.
- FLT's must only be driven in a direction where visibility is not blocked.
- Stacking and un-stacking on inclines must never be attempted.
- Rapid acceleration, hard braking and sharp cornering that increases the risk of load tipping must be avoided.
- Operators must exercise caution and drive slowly on slopes, uneven and damaged surfaces.
- Particular care must be taken when operating near pedestrians and other vehicles.
- Operators must obey site traffic regulations or, in their absence, keep to the right.
- Operators must be aware of hazards in and at the perimeter of their areas of operation.

#### 5.7 Rough Terrain Operations

The operation of rough terrain FLT's involves special hazards requiring additional care and consideration:

- Care must be taken at all times to ensure that traction is retained. Loss of traction due to the nature of the terrain or weight-transfer taking load off the driving wheels is to be avoided.



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- Care must be taken and speeds minimised to reduce the risk of load toppling caused by the imbalance induced when operating on rough terrain.
- Operators must ensure that the parking brake is capable of holding the FLT stationary on an incline. (Some rough terrain vehicles are capable of climbing inclines steeper than those on which the parking brake will hold the vehicle.)
- Checks for overhead obstructions must be made before lifting and transporting loads.
- Special care shall be taken near other materials handling vehicles such as mobile cranes.
- Driving rough terrain FLTs on public roads should be kept to a minimum. When public road travel is necessary, fork arms should be removed, folded or protected in some way so that they do not present a hazard to other road users. Where this is not possible, forks should be painted or otherwise made highly visible.
- Rough terrain FLT Operators must wear seatbelts while operating their vehicles.

#### 6. Cranes

##### 6.1 Specifications

Cranes include wheeled and tracked mobile units with fixed or telescopic booms, self-loading HIAB-type units fitted to trucks, and diesel hydraulic excavators when they are fitted with lifting attachments.

Each Department operating cranes shall keep and maintain a register of all cranes authorised for use by that Department in relation to a particular contract or operation. Such cranes shall carry full certification from a recognised certifying authority, with a copy of in-date certification displayed in the crane cab. The use of unregistered cranes is not permitted.

##### 6.2 Siting of Cranes

The ground or foundation, temporary supporting structures, packing or anchorage must be of sufficient strength and stability for the maximum loading to be imposed.

Settlement of ground support or structures must also be taken into account. Cranes must not be sited on soft or waterlogged ground unless adequate precautions have been taken to provide support to each wheel/outrigger.

Dynamic loads that might arise during operations must be estimated and calculations include a 25% margin to allow for unpredictable effects.

Sitting of cranes on sloping ground should be avoided. Where necessary, the crane may be levelled using outriggers or other means to give a level and stable working platform.

For cranes sited in flowing water, careful investigation must be made of any potential for scouring effect. Constant checks must be made during operations to monitor the situation.



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The possibility of cranes being trapped by rising water should not be overlooked and cranes moved to safe positions as necessary.

Checks must be made to ensure that cranes are not sited above or adjacent to excavations or inadequately compacted ground which may be liable to subside.

Particular care must be taken when cranes are sited in the proximity of hazards, including other cranes.

Prior to the start of any lifting operations, the temporary closure of roads and access required for crane operations must be notified to all parties likely to be affected by the closures.

Cranes must not be operated unless all personnel, including third parties and members of the public, are cleared from the radius of the cranes, booms and loads with a safety margin of 5 metres.

Mobile cranes must not be operated where the operating radius of the boom overlaps with that of another crane unless:

- There is a clear, over-riding business requirement
- There is no alternative siting or equipment that can be used
- The operators and banksmen of both cranes are supervised by a single supervisor in accordance with a written plan.

Where there is a danger of any part of the crane fouling any overhead or nearby obstruction, e.g. bridges, gantries, pipe-work, scaffolding, buildings or walls, the Operator will work under the direction of a banksman so positioned as to have a clear view of the crane and the obstruction.

Adequate clearance must be allowed between any part of a crane and the nearest obstruction, to prevent contact with or the trapping of personnel when the crane is slewed. Where it is not possible to allow such a clearance, no access is allowed whilst lifting operations are in progress.

#### **6.3 Preparation for Lifting Operations**

Preparations for lifting operations must be made in accordance with manufacturers' recommendations and current Company operating procedures.

Load indicators, overload cut-outs, limit switches and all other safety devices must be function tested before operation of a crane.

Visual load/radius indicators and safe load indicators must be checked after assembly, boom length change or any other factor that might affect correct and safe operation.



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Outriggers must be fully extended, properly supported and, if required by manufacturers, pinned in position.

Jacks and outriggers must be correctly fitted with feet to provide a firm base for the crane. Prior to operations, the crane must be jacked in accordance with manufacturer's recommendations.

Counterweights of the correct weight must be correctly fitted prior to operation. Additional counter-weighting should be fitted as necessary to suit load requirements and any boom/jib extension.

On wheeled cranes with pneumatic tyres, particular care must be taken to ensure tyres are inflated to correct pressures before lifting operations commence.

#### 6.4 Normal Loads

Cranes must not be used in a "pick and carry" mode, i.e. traveling with a suspended load, except in the case of diesel-hydraulic excavators fitted with authorised lifting attachments.

Before and during crane operations, the Crane Operator and Banksman must know the weight and nature of the load.

Before lifting operations, the Banksman must ensure:

- The load is robust and not likely to break up, deform or become damaged during the lifting operation.
- The load is properly slung and evenly balanced using certified loose lifting tackle with a SWL adequate for the operation
- The lifting gear is properly attached to the load and where lifting points are used, they are designed for that lifting operation and are in good condition with appropriate certification stating the SWL/conditions.

#### 6.5 Heavy and Large Loads

A heavy load is a single lift in excess of 25 tonnes; a large load is a single lift whose dimensions are in excess of 12 m in length by 6 m in height.

A written lifting plan must be prepared by the Banksman or his Supervisor and approved by the Supervisor representing the Site Manager/Team Leader prior to lifting heavy or large loads.

The lifting plan should include:

- A description of the load and any special precautions required, e.g. fragile, hazardous, protection of coatings/paint/finish.
- A description of the crane to be used with copies of current inspection certificates.



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- A description of the lifting equipment to be used including boom/jib length, number of parts/sheaves on the load line, slings, shackles, tag lines and load attachment arrangements.
- A description of how the lifting operation is to be carried out including a sketch of the crane location and any physical hazards or obstructions.
- A list of key precautionary measures to be taken, e.g. clearance of personnel to avoid the danger of whiplash from a broken sling, work-site barriers and warning signs.

#### 6.5 Environmental Conditions

Cranes must not be operated if the visibility of the Crane Operator or Banksman is significantly impaired by heavy rain, smoke, steam, etc. Lifting operations should be suspended during heavy rain, except where it would be more hazardous not to continue.

Cranes must not be operated in darkness without adequate lighting to illuminate the crane, the Banksman and the lifting area.

Wind imposes additional stresses on both the crane and its loads, particularly when a load starts to swing. Extreme caution must be used during windy conditions and the following restrictions apply:

Lifting bulky objects with large surface areas (steel plates, shipping containers) must be stopped when the wind speed reaches or exceeds the operating limits set by the crane manufacturer.

#### 6.6 Crane Operations

Crane Operators are required to:

- Carry out a visual examination and complete a checklist before operating any crane. The checklist is to be completed before starting work on each shift. Sample checklists are contained in Appendix 2.
- Carry out all safety checks required on the crane, maintaining an accurate record and log book.
- Give general day to day assistance with crane maintenance and upkeep.
- Assist with day to day maintenance of all lifting and slinging equipment.

Only licensed Crane Operators, maintenance/inspection personnel and learners under direct supervision of a Crane Operator are allowed to enter a crane cab or attempt to operate crane controls.

The Crane Operator is to follow instructions on operation, placement of lifting hooks and lifting of loads only from a Banksman appointed by the Work-site Supervisor. Before and



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during lifting operations, the Crane Operator and Work-site Supervisor are to jointly ensure that:

- The weight of loads to be lifted is known.
- Loads are not left suspended for longer than necessary.
- The crane controls are not left unattended while a load is suspended.
- Loads are never slewed over personnel on the floor/deck.
- Nobody is allowed underneath a suspended load and personnel are warned of crane operations prior to loads being slewed across the floor/deck.
- All practical measures have been taken to prevent a load coming into contact with any other object.
- loads being traversed over roofs and deck areas have sufficient clearance and are not slewed at an excessive height or speed; this is particularly important in "restricted" crane operating areas where impact from dropped objects is critical (e.g. over accommodation and process areas).
- Loads are not to be slewed over critical operating equipment. If this is unavoidable, the equipment must be given impact protection, e.g. suitably rated scaffold structure.

Before signaling for lifting, the Banksman must ensure the load is free and that all sling legs are properly secured and are taking equal load.

Loads must be lifted gently and crane motions operated smoothly to avoid loads swinging. At the start of a lift, the load should be taken up slowly to avoid risk and prolong the life of the sling. Snatch lifting is to be avoided.

If the rope on the drum becomes slack, cross-coiled or trapped, lifting operations must be suspended until the rope is paid out, examined for possible damage by a competent person and re-spooled correctly.

When lifting loads that approach the safe working load of the crane, the Crane Operator will raise the load a short distance from the ground and then stop the operation to check stability and safety, before continuing with the lift.

The hoist motion of a crane is not to be used for any purpose other than raising or lowering a load vertically.

Except in emergency situations and subject to dispensation from the Site/Facility Management, cranes are not to be operated in wind speeds exceeding either 30 knots or manufacturer's recommended limitations. It is the Crane Operator's responsibility to contact his Supervisor and inform him about the weather, visibility or any safety aspect of the operation.



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#### **7. Signals**

Prior to any lifting operation a Banksman is to be appointed and identified to the Crane Operator. This applies without exception in cases where:

- The load exceeds 50% of the rated capacity of the crane in the configuration used for the lift.
- The lifting is of heavy or large loads.
- Any portion of the load or load lift route is obscured from the Crane Operator's direct line of sight.

In cases where the lift is small, routine, less than 50% of the rated capacity of the lifting appliance, within visual contact of the Crane Operator at all times and has the authority of the Work-site Supervisor, this requirement may be waived.

The Banksman is the only person permitted to pass instructions to the Crane Operator, and the Crane Operator is not permitted to follow instructions from persons other than the Banksman. The Banksman will direct lifting operations and signal to the Crane Operator using standard hand signals.

A crane must not be operated unless:

- The Banksman has a clear view of the load, lifting assembly and Crane Operator to give signals.
- The Banksman has checked that Riggers and all other personnel are clear of the vicinity of the load.
- The Crane Operator has a clear view of the Banksman to receive signals.

Banksmen, Riggers and other personnel involved in crane operations must wear safety helmets and other relevant personal protective equipment. The Crane Operator is exempt from this requirement while he is in the crane cab, operating the crane.

Crane activities must stop in the event of any potentially dangerous situation and the Crane Operator immediately obeys ALL emergency stop signals.

#### **8. General Precautions**

Cranes must not be left unattended with a load suspended.

Cabs and control compartments must be locked and the vehicle parked without obstructing normal access.

Cranes must not be used for any purpose other than for lifting in a vertical plane.



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Crane booms must not be used to apply sideways force to an object, for example during demolition or pushing materials and boxes.

Cranes must not be used as winches to drag materials or equipment.

Cranes must not be used if they are not fully rigged or are in a defective condition, e.g. if outriggers do not fully extend, there are hydraulic fluid leaks or controls and safety equipment are defective.

Lifting operations should be conducted cautiously without hoisting, lowering or slewing at excessive speed. Load swinging and snatch loading must be avoided.

On completion of crane operations, the crane boom and hook must be properly secured before the Crane Operator leaves the crane. The crane boom should be left on any fitted rest, with the hoist rope slackened, or pointing downwind with the boom angle lower than 45°.

Any defect or damage to the crane or its structure affecting the safety of the crane or personnel must be reported. The crane must be taken out of service immediately the defect or damage is detected and not used until it has been rectified, and re-certified if necessary, or clearance to use the crane has been given in writing by the Lifting Equipment Supervisor.

#### **9. Lifting Accessories**

Any piece of equipment used to attach a free or contained load to a crane hook, or hoist a load by hand, or put load-restraining ropes under tension is classed as a lifting accessory. For many of these items, e.g. swivels, elevators, trolleys, runway beams, etc., there are no specific definitions for their use and operation, and the general requirement is set out below. For other items, there are specific operating precautions and these are covered in this sub-section.

At the end of this sub-section, Figures 5 and 6 show slinging arrangements for various lifting applications.

##### **9.1 General**

All lifting accessories should be:

- stored in a suitable, secure location under cover and dedicated to the purpose. The location will be controlled by the Lifting Equipment Supervisor.
- colour coded. Lifting accessories that are incorrectly colour coded are to be stored in a separate clearly marked area and returned for re-inspection, certification and colour coding.
- checked before they are used to confirm their correct rating for the work to be done.



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- visually examined for defects and damage prior to use. Equipment in unacceptable condition must be tagged and set aside for repair or disposal in the same place as incorrectly colour coded accessories
- used only within their certified safe working load ratings.
- loaded progressively without shock loading.
- removed from service for inspection, testing and re-certification if it is suspected they have been subjected to loads in excess of their rated capacities, including the effect of snatch lifting. A "Wire Rope Wear and Damage" sheet should be attached for reference

#### 9.2 Chains

The chains used in chain slings, chain hoists and to secure loads must not be:

- hammered to reshape distorted links.
- joined together using bolts and nuts.
- shortened by twisting or knotting.
- subjected to load if the chain is twisted and the links cannot move freely.

#### 9.3 Fiber Slings

Also known as webbing and flat belt slings, fiber slings are made of synthetic material and may be round or flat in section. Their use is restricted to lifting items such as coated pipe and turbine rotors which could be damaged by lifting with conventional chain or wire rope slings. Fiber slings must be protected from sharp edges, by sacking or similar padding, and from chemical damage.

Lifts using fiber slings must always be vertical to avoid:

- overloading the edge of a flat sling.
- the risk of tearing the sling or cutting it by lateral movement of the sling over sharp edges.

#### 9.4 Wire Rope and Wire Rope Slings

Wire ropes must not be used when:

- three or more closely-grouped wires are broken.
- the number of broken wires in 10 x rope diameter exceeds 5% total number of wires in the rope.
- there is deterioration of the rope in the vicinity of the rope termination, or maximum one broken wire within 6mm of the termination.

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- wear exceeds the maximum permitted reduction in rope diameter, i.e. 10% from nominal size (ordinary Lay 6 and 8 strand) and 3% from nominal size for multi-strand.
- Internal corrosion is confirmed and external corrosion causes wire slackness, i.e. indications of strands opening up.
- permanent distortion such as bulging, bird-caging, kinks, crush damage, stranding and core deterioration/protrusion is visible.
- there is evidence of thermal damage.

During materials handling operations involving wire rope slinging, ensure that:

- the correct sling or combination of slings for the load to be lifted is selected.
- slings are not dragged along the ground or deck.
- slings are kept well away from operations involving welding and flame cutting.
- Riggers wear protective leather gloves and that hands are clear of slings before lifting commences. Wire rope should be passed from hand to hand and not allowed to slide through the hands.
- slings are not bent round sharp corners of a load.
- a sling is only connected to a shackle by passing the shackle pin through one eye of the sling.
- tag lines are attached to long, heavy and awkward loads.
- all personnel stand clear before the operation commences.
- spinning loads without tag lines or which cannot be stopped from spinning with tag lines shall be carefully lowered to the ground or deck to kill the spin.
- loads are supported so that slings can be removed from underneath without damaging them.

Allowance must be made for a reduction in the rated capacity of multi-leg slings due to the angle between the legs of the assembly. Always consult a Sling Chart and Safe Working Load Tables.

### 9.5 Rope Clamps

Wire rope slings and semi-permanent connections of wire ropes are frequently made by the use of rope clamps. These provide a quick and easy way to join wire ropes and when properly applied including the insertion of a thimble in the eye of the sling, provide up to 80% of the strength of the original rope.



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Clamps must have the U-Bolt section on the dead or short end of the rope, and the saddle on the live or longer end of the rope. (The wrong application of even one clip can reduce the efficiency by up to 50 %.)

When making up a sling with rope clamps, always ensure that:

- a minimum of three clamps is used.
- new clips are used; used clips do not have the full holding ability.
- a thimble is inserted in the eye of the sling; this prevents the rope from wearing and deforming.
- the clips are fitted in accordance with the manufacturers instructions.
- a check is made a few hours after the first application of clamps; the clamps slightly crush the rope and will need re-tightening.

#### 9.6 Shackles

Ensure that:

- shackles are matched to the grade of sling in use.
- the correct shackle pin is used. Never replace a pin with a bolt and nut.
- threaded shackle pins are secured in place with seizing wire prior to use.
- pre-slung loads for use offshore, e.g. cargo baskets and bottle racks, with slings permanently attached are only fitted with "nut and cotter pin" shackles. The use of screwed pin shackles on pre-slung loads is forbidden.

**Note:** Shackles and pins have matching serial numbers and should not be inter-changed. Changing pins between shackles can result in uncertified or old items of lifting gear being used and Safe Working Loads being exceeded.

#### 9.7 Plate Clamps

Wherever possible, plate should be lifted using shackles inserted in holes near the edge of the plate. If there are no holes in the plate, a plate clamp may be used with only one plate at a time being lifted.

Packing must not be inserted between the jaws of the clamp and the plate.

#### 9.8 Eyebolts

Eyebolts must be screwed down to the shoulder or until the threaded section has bottomed out (shoulder type eye bolts are preferred). Care must be taken to avoid mismatching of dissimilar threads.



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Ensure that eyebolts and lifting lugs supplied by equipment manufacturers are for the whole of the load and not just for a particular part of the assembly, e.g. the top cover of a horizontally split compressor.

Eyebolts must only be used in combination with hooks when a shackle that comfortably accommodates the hook is fitted between the hook and the eyebolt.

Slings must never be passed through eye bolts; use shackles with the eye of the sling attached to the shackle.

#### 9.9 Hooks

Care is to be taken during materials handling operations to ensure that:

- the safety latches on crane and sling hooks are in good working order and that the latches close properly.
- hooks are only used in conjunction with other lifting accessories such as rings and slings which fit properly and are secure on the hook.
- personnel are kept clear of the swing path of a hook.

#### 9.10 Chain Blocks

For operations involving the use of chain blocks or chain hoists, users must ensure that:

- the correct rating of chain hoist is used for the load to be lifted.
- only one man operates the hoist and he is able to operate it with ease (otherwise a larger capacity hoist should be used).
- loads do not remain suspended for any length of time without securing the pull chain to prevent the load dropping.
- the load chain is not run out to the point where the load is entirely dependent on the bolt holding the dead end of the chain.
- the load chain is not used to encircle the load (a sling should be used).
- a load is not lifted or tilted with the tip of the chain block hook.

#### 9.11 Load Binders

These devices, also known as chain tensioners, are used to tighten the chains used to secure loads on trucks, trailers, etc. There are two types of load binder, one operating on the eccentric lever principle and called a lever-type, the other operating on the principle of a bottle screw and called a ratchet-type.

When using load binders, operators must ensure the following:

- Use a binder only while standing on the ground; do not stand on the load being secured.

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- Position a lever-type binder so that the handle is being pulled down to tension the chain.
- Do not extend lever-type binder handles; if additional leverage is required; use a ratchet-type binder.
- After tensioning the chain, check that the lever handle is touching the chain and secured in that position either with the free end of the chain or with soft wire.
- Take great care when releasing a lever-type binder after a journey; there may be stored energy in the chain that could cause the binder handle to whip.
- When releasing a lever-type binder by hand, use an open hand palm upwards under the handle; never grip the handle and always stand clear of the path of the moving handle.
- Levers that cannot be released by hand are to be prised open by using a steel bar under the handle, with the operator standing clear to avoid injury from whip action.

#### 10. Load Security

Inadequately secured loads present a hazard because they may shift or fall and cause injury or damage. Whatever the mode of transportation, e.g. truck, van, helicopter or ship, personnel who load materials shall ensure that loads are properly secured. The persons in charge of the mode of transportation, e.g. driver, pilot or Master, shall satisfy themselves that the load is secure before leaving.

During the loading of materials and goods onto any mode of transportation, the following applies:

- Where items have to be stacked, the heaviest ones are placed at the bottom.
- Ensure a friction contact between the load and its platform; avoid metal to metal contact, slippery surfaces and loose packing material.
- Pack loads tightly before the load securing equipment is applied so that they do not vibrate free during transit.
- Keep the load centre of gravity as low as possible and near the centreline.
- Distribute loads evenly over the load platform.
- Protect items that could be damaged by rain with covers.
- Load securing devices, e.g. load binders, are used as designed and are in good condition.
- Loads are secured such that the failure of one leg of the securing system does not result in failure of the others.
- Ensure that load securing material such as rope, chains and webbing straps do not pass over sharp edges that could cut or weaken them.



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- Rope used for securing loads should be steel wire greater than 8mm diameter, polypropylene, polyester, sisal or manila. Nylon rope must not be used.
- Pipes of the same OD should be loaded together as much as possible. If different OD pipes are loaded together, packing should be used to separate the different sizes.

#### 11. Material Stacking/Un-stacking

##### 11.1 Stacking

Stacking materials maximises space utilisation and facilitates materials control. When planning materials stacking, the following points should be considered:

- The permissible floor/deck loading and the design load-handling capability of storage racking and bins.
- The site layout with adequate walkways and aisles.
- Materials routing in and out.
- Method of stacking to be used.
- Available or required materials handling facilities and equipment.
- Area lighting with avoidance of shadow areas.
- Pallet design and load bearing capacity.

Factors governing the size of stacks are volume and area available, and size, bulk, weight, type, rigidity and fragility of materials to be stacked. Note that loaded pallets should not normally be stacked more than three high.

Stability of stacks is determined by:

- a safe ratio of height to base area.
- sound interlocking of the materials, either naturally or artificially.
- how much of the aggregate weight is borne by the components in the lowest tier of the rack.
- good placement of every component in a stack, with no overhangs.

Heavy items of equipment stored in custom-built crates or containers must not be stacked one on top of the other (only the bases of these containers are designed to bear the load of the contents).

Stacks should be positioned at least 0.5m from walls/bulkheads and not allow footing for persons to gain access to unguarded machinery.



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Racking should be inspected periodically by the Lifting Equipment Supervisor to determine its condition and confirm its continuing capability to support the loads for which it was constructed.

#### **11.2 Un-stacking**

The majority of incidents involving the collapse of stacked materials occur when a stack is being taken down. During this activity, the following applies:

- One person only is responsible for the manner in which the stack is reduced.
- If the person in charge had no part in the erection of the stack, he is to familiarise himself before work begins.
- The stack is to be taken down tier by tier without “taking bites” out of it.
- Tubular or other fencing around the stack is to be reduced in height as the stack is reduced.
- The area around the stack is to be kept clear of tripping hazards.

#### **12. Pallets**

Only purpose-built pallets in good condition and without loose or broken boards and blocks should be used for transporting loads. Damaged pallets are to be taken out of service and returned for repair or disposal.

Loads should be secured on pallets with tension strapping, plastic shrink-wrap, cargo netting or, alternatively, using a box pallet.

Pallets must be secured on the load platform. Webbing straps and binders, ropes or chains may be used providing the pallets and their loads are strong enough. The use of cargo netting is adequate for light loads. If chains are used, their tension should be such that the load on the pallet is not distorted and the load fastenings slackened. If pallets are to be loaded into a constrained area, e.g. in a container or on a truck with side boards, then netting, ropes or chains may not be required if movement can be prevented by using chocks.

Where pallets are stacked, each layer must be separately restrained from movement in any direction. Lashings are not to be attached to, or pass under, the strapping used to secure the load on the pallet and each pallet in the top layer of a stack should be cross-lashed. Empty pallets must also be secured during transportation.

#### **13. Tension Strapping**

Frequent use is made of tensioned steel wire, steel banding and plastic strapping to secure individual packages and boxes or to secure loads on pallets. The strapping is normally



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applied with a hand-operated tool and removed with side-cutting shears. During application and removal of tension strapping:

- Ensure that strapping tools are in good condition and properly maintained.
- Use strapping tools in accordance with manufacturers' instructions.
- Wear hand protection and avoid trapping fingers under the strapping.
- Beware of strapping "whiplash" when its tension is released for removal.
- Coil up removed strapping and place it in a suitable waste bin or skip.

#### **Appendix 1 - Manual Lifting Technique**

Back injuries are one of the most common types of industrial accidents and although they may occur at a specific time, they are usually the result of many years of incorrect manual lifting. Proper lifting can prevent back injuries and the correct manual lifting technique is described below.

- Keep the chin in and do not let the head drop forwards or backwards.
- Take up a crouching or squatting position by bending the knees while keeping the back straight; this does not necessarily mean vertical. The important thing is not to bend the back.
- Take a firm grip of the object to be lifted, using the palm of the hands and the roots of the fingers. Wherever possible, grip diagonally opposite corners of the load, one of them underneath.
- Keep the arms as close to the body as possible allowing the body, rather than the shoulders, arms or wrists, to take the weight.
- Straighten the legs and use the thigh muscles to achieve the lift. When lifting from the ground, take up the squatting position and allow the legs to do all the work. Lift in stages, i.e. from floor to knee and from knee to carrying position. When lifting and in the carrying position, the leading foot must be pointing in the direction of travel.
- Avoid standing with a heavy load; if you must stop, set it down by reversing the lifting procedure described in the previous step.
- Do not carry a load that obstructs your view and always ensure that your line of travel is clear of obstructions.



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- Never attempt to change your grip while actually carrying a load. If a change is necessary, set the load down on a firm support, change your grip and lift the load up again.
- If the object to be handled is too heavy or awkward, get help. The lifting method for two or more people is the same as for one person. If mechanical lifting devices are available, use them.

#### **Appendix 2 – Crane Safety Checklist**

##### **Item (Pre-operations checks)**

- Up-to-date test and examination certificates available for site management to inspect.
- Daily/weekly maintenance and inspections carried out.
- Cab windows clean and screen wipers, where fitted, in working order.
- Cab and floor clean and free from obstruction.
- Crane controls in neutral before starting up.
- Gauges and instruments reading correctly after start-up.
- Safe load indicator fully operational and, where fitted, the automatic overload indicator is working correctly with the correct cam/programme selected and fitted.
- All other limit switches, e.g. over-hoist, operating correctly.
- All ropes free and without visible defects.
- Where applicable, tyre pressures as recommended by the manufacturer and tyres free from potentially dangerous damage.
- All tools and equipment checked and stowed correctly.
- Fire extinguisher, if fitted, is fully charged, free from visible defect and within periodic examination date.
- Tracks in good operational condition.
- No restrictions on access - check overall dimensions of crane compared with operating area.
- Lifting zone identified, if practical, with hazard warning tape.
- Work areas clearly visible and illuminated if necessary.
- Ground capable of taking loads (outriggers, crane, load, wind speed). If in doubt, ask your Supervisor.
- Approach and work areas as level as possible.

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- Adequate protection from overhead power lines.
- If outriggers used, they are set in the correct position as per crane manufacturer's instructions, locked and properly supported.
- Ample room to swing and lift crane boom clear of obstructions and rear of crane clear of obstacles.
- Weights of loads known and correct lifting accessories available.
- Supervision of proposed lift available on site.

**Item (Check during operations)**

- Loads lifted carefully within safe radius as per duty chart.
- Crane operating from planned/approved positions only.
- Banksman working in correct manner.
- Rear traverse watchman on station, if appropriate.
- Crane hook positioned directly over load.
- Crane motions smooth and safe.
- Crane at safe distance from open excavations.
- Safe load/radius indicators working correctly.
- All lifting accessories of correct type and serviceable.
- Loads not slewed over people and persons not standing or walking under suspended loads.
- When travelling with load suspended, load carried as near to ground as possible, level route followed and boom radius changes made to accommodate load movement on inclines.