PROVISION AND CARE OF LIFTING PLANT AND CARRYING OUT OF LIFTING OPERATIONS

21.1 Introduction

21.1.1 The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006 introduce measures intended to protect workers from risks arising from the provision and use of lifting equipment. Full guidance is given in Marine Guidance Note MGN 332 (M+F)

21.1.2 The general principles on provision and care of work equipment, set out in Chapter 7, and those on the safe use of work equipment, set out in Chapter 20, are also applicable to lifting plant, as are the provisions of the Merchant Shipping and Fishing Vessels (Provision and Use of Work Equipment) Regulations 2006. (Full guidance on those Regulations is given in Marine Guidance Note MGN 331 (M+F).) Where there is any overlap, the more stringent regulations will apply.

21.2 General requirements

Lifting Equipment

21.2.1 Lifting equipment is required to be:-

(a) of adequate strength and stability for each load, having regard in particular to the stress induced at its mounting or fixing points; and,

(b) securely anchored, or

(c) adequately ballasted or counterbalanced, or

(d) supported by outriggers,

as necessary to ensure its stability when lifting.

21.2.2 Lifting equipment should be of steel or other acceptable material and securely fastened to the vessel's structure. The maximum Safe Working Load (SWL) and maximum radius of operation of all derricks and lifting appliances are required to be part of the specification on all new constructions with associated ropes, wires and guys, eye-plates, shackles and blocks designed to meet these loads.

21.2.3 The vessel's structure, crane, derrick or other lifting device and the supporting structure should be of sufficient strength to withstand the loads that will be imposed when operating at its maximum load moment.

21.2.4 In addition to the strength and stability of the lifting equipment, consideration should also be given to the stability, angle of heel and potential down-flooding of any vessel as a result of the use of a crane, derrick or other lifting device fitted on it. This is especially important where a crane is to be fitted on a work boat or other small vessel and it is recommended that advice should be sought from the crane manufacturer in such cases prior to the crane being fitted. Similarly it is recommended that a check of the vessel's stability should be carried out by a suitably qualified person, prior to installation of a crane to ensure that the vessel is capable of operating safely with the crane fitted and in use. Failure to do this could have serious consequences for the safety of the vessel and the workers on it.

21.2.5 Any welding of material should be to an approved, acceptable standard as any fitting is only as strong as the weld that connects it to the vessel's structure.

21.2.6 If counterbalance weights are moveable, effective precautions

should be taken to ensure that the lifting appliance is not used for lifting in an unstable condition. In particular all weights should be correctly installed and positioned.

21.2.7 Lifting equipment with pneumatic tyres should not be used unless the tyres are in a safe condition and inflated to the correct pressures. Means to check this should be provided.

21.2.8 The operator should check safety devices fitted to lifting appliances before work starts and at regular intervals thereafter to ensure that they are working properly.

Accessories for Lifting etc.

21.2.9 Every part of a load that is used in lifting it, as well as anything attached to the load and used for that purpose should be of good construction, of adequate strength for the purpose for which it is to be used and free from defects.

21.2.10 When selecting accessories for lifting, the following should be taken into account:-

(a) the loads to be handled;

(b) the gripping points;

(c) the loose gear for attaching the load, and for attaching the accessories to the lifting equipment;

(d) the atmospheric conditions;

(e) the mode and configuration of slinging.

21.2.11 Accessories for lifting should be stored in conditions which will not result in damage or degradation.

21.3 Register of Lifting Appliances

21.3.1 All vessels are required to maintain a register of lifting appliances

and loose gear in a form based on the model recommended by the International Labour Organization and shown at Annex 21.2

21.4 Regular Maintenance

21.4.1 In order to ensure that all parts of lifting equipment and related equipment are kept in good repair and working order, regular preventative maintenance should be carried out. Maintenance should include regular examinations by a competent person. Such examinations should be carried out as required by the Regulations but in any event at least once annually. Checks should look for general material defects such as cracks, distortion, corrosion and wear and tear that could affect safe working load and overall strength.

21.4.2 When there is any suspicion that any appliance or item of equipment may have been subjected to excessive loads, exceeding the Safe Working Load (SWL), or subjected to treatment likely to cause damage, it should be taken out of service until it can be subjected to a thorough examination by a competent person.

21.4.3 Listed below are some suggested maintenance items:-

- Greasing should be thorough and frequent, as dry bearings impose additional loads that can lead to failure.
- The condition of all ropes and chains should be checked regularly for wear, damage and corrosion and replaced as necessary.
- Shackles, links and rings should be renewed when wear or damage is evident.
- Structures should be examined frequently for corrosion, cracks, distortion and wear of bearings, securing points etc.
- Hollow structures such as gantries or masts should be checked for trapped water inside. If water is found, the structure should be drained, appropriately treated and then sealed.
- Regular function tests of controls, stops, brakes, safety devices for

hoisting gear etc, should be carried out preferably before the start of operations.

The list is illustrative only and additional items may be appropriate dependant upon the equipment fitted to an individual vessel.

21.4.4 Any replacement parts must be in accordance with the manufacturer's instructions and be of an equivalent construction to the original part if instructions are not available. This is because replacement with incorrect parts or parts of inferior quality can seriously affect the safety of the lifting appliance.

21.4.5 After any repairs or alterations are made to any lifting appliance it should undergo a thorough examination and be retested if appropriate. Also if any significant changes are made or noticed to the general condition of the appliance the above applies.

21.5 Testing

21.5.1 No lifting equipment, accessory for lifting or loose gear is to be used after manufacture or installation, or after any repair or modification which is likely to alter the safe working load or affect the strength or stability of the equipment, without having been first tested by a competent person.

21.5.2 Upon the completion of any test of lifting equipment, accessory for lifting or item of loose gear carried out in accordance with 21.5.1, the equipment, accessory or gear shall be thoroughly examined and certified for use by the person carrying out the test.

21.5.3 The format for the "Certificate of Test and Thorough examination of Lifting Appliances" is set out in Annex 21.1.1

21.5.4 Ship's lifting equipment is not to be used unless it has been tested by a competent person within the preceding five years.

21.6 Thorough examination and inspection

21.6.1 Where the safety of lifting equipment depends on the installation conditions, it should be inspected by a competent person before it is used for the first time. Such inspections should be undertaken on initial installation or after re-assembly at another location, to ensure that it has been installed correctly, in accordance with any manufacturer's instructions, and is safe for workers to operate as well as being able to function safely.

21.6.2 Any lifting equipment or accessory for lifting which is, or has been, exposed to conditions which could cause deterioration in its condition should be:-

(a) thoroughly examined
  (i) in the case of lifting equipment for lifting persons or an accessory for lifting, at least every 6 months;
  (ii) in the case of other lifting equipment, at least every 12 months; or
  (iii) in either case, in accordance with an examination scheme; and
  (iv) whenever exceptional circumstances which are liable to jeopardise the safety of the lifting equipment have occurred; and

(b) where appropriate, inspected by a competent person at suitable intervals,

21.6.3 No accessories for lifting, other than those which are subject to paragraph 21.6.2(a), should be used unless they have been thoroughly examined within the 12 months immediately prior to such use.

21.7 Certificates

21.7.1 The employer is required to ensure that a certificate in the form set out in Annex 21.1.1 to 21.1.4 is obtained no later than 28 days after the carrying out of any test and thorough examination of any lifting equipment.

21.7.2 The period of 28 days should however be regarded as the absolute maximum. Whenever possible the certificate, or at least a "provisional certificate", should be provided at the time of test. Absence of a

valid certificate could delay operations if a port operator, or a statutory body, requests production of a valid certificate before allowing work, such as unloading, to proceed.

21.8 Reports, Records and marking of Lifting Equipment

21.8.1 Full details of the inspection requirements for reporting on the examination of any lifting equipment, reporting of defects and marking of equipment are contained within MGN 332 (M+F)

21.9 Controls

21.9.1 Controls of lifting appliances should be permanently and legibly marked with their function and their operating directions shown by arrows or other simple means, indicating the position or direction of movement for hoisting or lowering, slewing or luffing, etc.

21.9.2 Make-shift extensions should not be fitted to controls nor any unauthorised alterations made to them. Foot-operated controls should have slip resistant surfaces.

21.9.3 No lifting device should be used with any locking pawl, safety attachment or device rendered inoperative. If, exceptionally, limit switches need to be isolated in order to lower a crane to its stowage position, the utmost care should be taken to ensure the operation is completed safely.

21.10 Safety measures

21.10.1 A powered appliance should always have a person at the controls while it is in operation; it should never be left to run with a control secured in the "ON" position.

21.10.2 If any powered appliance is to be left unattended with the power on, loads should be taken off and controls put in "NEUTRAL" or "OFF" positions. Where practical, controls should be locked or otherwise

inactivated to prevent accidental restarting. When work is completed, power should be shut off.

21.10.3 The person operating any lifting appliance should have no other duties which might interfere with their primary task. They should be in a proper and protected position, facing controls and, so far as is practicable, with a clear view of the whole operation.

21.10.4 Where the operator of the lifting appliance does not have a clear view of the whole of the path of travel of any load carried by that appliance, appropriate precautions should be taken to prevent danger. Generally this requirement should be met by the employment of a competent and properly trained signaller designated to give instructions to the operator. A signaller includes any person who gives directional instructions to an operator while they are moving a load, whether by manual signals, by radio or otherwise.

21.10.5 The signaller should have a clear view of the path of travel of the load where the operator of the lifting appliance cannot see it.

21.10.6 Where necessary, additional signallers should be employed to give instructions to the first signaller.

21.10.7 Every signaller should be in a position that is:-

(a) safe; and

(b) in plain view of the person to whom they are signalling unless an effective system of radio or other contact is in use.

21.10.8 All signallers should be instructed in and should follow a clear code of signals, agreed in advance and understood by all concerned in the operation. Examples of hand signals recommended for use with lifting appliances on ships are shown in Annex 21.1 Code of hand signals.

21.10.9 If a load can be guided by fixed guides, or by electronic means, or in some other way, so that it is as safely moved as if it was being controlled by a competent team of driver and signallers, signallers will not be necessary.

21.11 Positioning and installation

21.11.1 Permanently installed lifting equipment should not be used unless it has been positioned or installed in such a way as to minimise the risk of any of the following occurrences-

(a) the equipment or a load striking a worker;

(b) a load drifting dangerously or falling freely;

(c) a load being released unintentionally.

21.12 Lifting Operations

21.12.1 Every lifting operation must be -

(a) properly planned;

(b) appropriately supervised; and

(c) carried out in a safe manner.

21.12.2 No lifting operation should be begun using equipment which is mobile or can be dismantled unless the employer is satisfied that the lifting equipment will remain stable during use under all foreseeable conditions taking into account the nature of the surface on which it stands.

21.12.3 All lifting operations must be properly planned, appropriately supervised and carried out to protect the safety of workers. Whilst this applies to all vessels, it is particularly important where cranes are being used on work boats and other small vessels as overloading of the crane, or attempting to lift at the wrong angle could, in some circumstances, result in the vessel sinking.

21.12.4 No person should be lifted except where the equipment is designed or specially adapted and equipped for the purpose or for rescue or in emergencies.

21.12.5 Contact with bare ropes and warps with moving parts of the equipment should be minimised by the installation of appropriate protective devices.

21.12.6 Weather conditions can play a significant part in the carrying out of lifting operations whether in the open air or within the vessel. In the former case high winds or wave action can for example cause suspended loads to swing dangerously or cause mobile equipment to topple. Movement of the ship due to wind or wave action can also have a similar effect in relation to lifting operations inside the ship. Consideration should be given to the effects of weather conditions on all lifting operations whether inside the ship or outside on deck, and such operations should be suspended before conditions deteriorate to the extent that lifting becomes dangerous.

21.12.7 Loads should if possible not be lifted over a person or any access way, and personnel should avoid passing under a load which is being lifted.

21.12.8 All loads should be properly slung and properly attached to lifting gear, and all gear properly attached to appliances.

21.12.9 The use of lifting appliances to drag heavy loads with the fall at an angle to the vertical is inadvisable because of the friction and other factors involved and should only take place in exceptional circumstances where the angle is small, there is ample margin between the loads handled and the safe working load of the appliance, and particular care is taken. In all other cases winches should be used instead. Derricks should never be used in union purchase for such work.

21.12.10 Any lifts by two or more appliances simultaneously can create hazardous situations and should only be carried out where unavoidable. They should be properly conducted under the close

supervision of a responsible person, after thorough planning of the operation.

21.12.11 Lifting appliances should not be used in a manner likely to subject them to excessive over-turning moments.

21.12.12 Ropes, chains and slings should not be knotted.

21.12.13 A thimble or loop splice in any wire rope should have at least three tucks with a whole strand of rope and two tucks with one half of the wires cut out of each strand. The strands in all cases should be tucked against the lay of the rope. Any other form of splice which can be shown as efficient as the above can also be used.

21.12.14 Lifting gear should not be passed around edges liable to cause damage without appropriate packing.

21.12.15 Where a particular type of load is normally lifted by special gear, such as plate clamps, other arrangements should only be substituted if they are equally safe.

21.12.16 The manner of use of natural and man-made fibre ropes, magnetic and vacuum lifting devices and other gear should take proper account of the particular limitations of the gear and the nature of the load to be lifted.

21.12.17 Wire ropes should be regularly inspected and treated with suitable lubricants. These should be thoroughly applied so as to prevent internal corrosion as well as corrosion on the outside. The ropes should never be allowed to dry out.

21.12.18 Cargo handling equipment that is lifted onto or off ships by crane or derrick should be provided with suitable points for the attachment of lifting gear, so designed as to be safe in use. The equipment should also be marked with its own gross weight and safe working load.

21.12.19 Before any attempt is made to free equipment that has become jammed under load, every effort should first be made to take off the load safely. Precautions should be taken to guard against sudden or unexpected freeing. Others not directly engaged in the operation should keep in safe or protected positions.

21.12.20 When machinery and, in particular, pistons are to be lifted by means of screw-in eye bolts, the eye-bolts should be checked to ensure that they have collars, that the threads are in good condition and that the bolts are screwed hard down on to their collars. Screw holds for lifting bolts in piston heads should be cleaned and the threads checked to see that they are not wasted before the bolts are inserted.

21.13 Safe Working Load (SWL)

21.13.1 A load greater than the safe working load should not be lifted unless:

(a) a test is required by regulation; and
(b) the weight of the load is known and is the appropriate proof load; and
(c) the lift is a straight lift by a single appliance; and
(d) the lift is supervised by the competent person who would normally supervise a test and carry out a thorough inspection; and
(e) the competent person specifies in writing that the lift is appropriate in weight and other respects to act as a test of the plant, and agrees to the detailed plan of the lift; and
(f) no person is exposed to danger thereby.

21.13.2 Any grab fitted to a lifting appliance should be of an appropriate size, taking into account the safe working load of the appliance, the

additional stresses on the appliance likely to result from the operation, and the material being lifted.

21.13.3 In the case of a single sheave block used in double purchase the working load applied to the wire should be assumed to equal half the load suspended from the block.

21.13.4 The safe working load of a lift truck means its actual lifting capacity, which relates the load which can be lifted to, in the case of a fork lift truck, the distance from the centre of gravity of the load from the heels of the forks. It may also specify lower capacities in certain situations, eg for lifts beyond a certain height.

21.14 Use of winches and cranes

21.14.1 The drum end of wire runners or falls should be secured to winch barrels or crane drums by proper clamps or U-bolts. The runner or fall should be long enough to leave at least three turns on the barrel or drum at maximum normal extension. Slack turns of wire or rope on a barrel or drum should be avoided as they are likely to pull out suddenly under load.

21.14.2 When a winch is changed from single to double gear or vice versa, any load should first be released and the clutch should be secured so that it cannot become disengaged when the winch is working.

21.14.3 Steam winches should be so maintained that the operator is not exposed to the risk of scalding by leaks of hot water and steam.

21.14.4 Before a steam winch is operated, the cylinders and steam pipes should be cleared of water by opening the appropriate drain cocks. The stop valve between winch and deck steam line should be kept unobstructed. Adequate measures should be taken to prevent steam obscuring the driver's vision in any part of a working area.

21.14.5 Ships' cranes should be properly operated and maintained in accordance with manufacturers' instructions. Companies, employers and masters, as appropriate, should ensure that sufficient technical information is available including the following information:-

(a) Length, size and safe working load of falls and topping lifts.
(b) Safe working load of all fittings;
(c) Boom limiting angles;
(d) Manufacturers' instructions for replacing wires, topping up hydraulics and other maintenance as appropriate.

21.14.6 Power operated rail mounted cranes should have the following facilities incorporated in their control systems:-

(a) facilities to prevent unauthorised startup;
(b) an efficient braking mechanism which will arrest the motion along the rails, and where safety constraints require, emergency facilities operated by readily accessible controls or automatic systems should be available for braking or stopping equipment in the event of failure of the main facility;
(c) guards which reduce as far as possible the risk of the wheels running over persons' feet, and which will remove loose materials from the rails.

21.14.7 When a travelling crane is moved, any necessary holding bolts or clamps should be replaced before operations are resumed.

21.14.8 Access to a crane should be always by the proper means provided. Cranes should be stationary while accessing.

21.15 Use of derricks

21.15.1 Ships' derricks should be properly rigged and employers and masters should ensure that rigging plans are available containing the following information:-

(a) position and size of deck eye-plates;

(b) position of inboard and outboard booms;
(c) maximum headroom (i.e. permissible height of cargo hook above hatch coaming);
(d) maximum angle between runners;
(e) position, size and safe working load of blocks;
(f) length, size and safe working load of runners, topping lifts, guys and preventers;
(g) safe working load of shackles;
(h) position of derricks producing maximum forces
(i) optimum position for guy and preventers to resist maximum forces as at (h);
(j) combined load diagrams showing forces for a load of 1 tonne or the safe working load;
(k) guidance on the maintenance of the derrick rig.

21.15.2 The operational guidance in the remainder of this section applies generally to the conventional type of ship's derrick. For other types, such as the "Hallen" and "Stulken" derricks, manufacturers' instructions should be followed.

21.15.3 Runner guides should be fitted to all derricks so that when the runner is slack, the bight is not a hazard to persons walking along the decks. Where rollers are fitted to runner guides, they should rotate freely.

21.15.4 Before a derrick is raised or lowered, all persons on deck in the vicinity should be warned so that no person stands in, or is in danger from, bights of wire and other ropes. All necessary wires should be flaked out.

21.15.5 When a single span derrick is being raised, lowered or adjusted, the hauling part of the topping lift or bull-wire (i.e. winch end whip) should be adequately secured to the drum end.

21.15.6 The winch driver should raise or lower the derrick at a speed consistent with the safe handling of the guys.

21.15.7 Before a derrick is raised, lowered or adjusted with a topping lift purchase, the hauling part of the span should be flaked out for its entire length in a safe manner. Someone should be available to assist the person controlling the wire on the drum and keeping the wire clear of turns and in making fast to the bitts or cleats. Where the hauling part of a topping lift purchase is led to a derrick span winch, the bull-wire should be handled in the same way.

21.15.8 To fasten the derrick in its final position, the topping lift purchase should be secured to bitts or cleats by first putting on three complete turns followed by four crossing turns and finally securing the whole with a lashing to prevent the turns jumping off due to the wire's natural springiness.

21.15.9 When a derrick is lowered on a topping lift purchase, someone should be detailed for lifting and holding the pawl bar, ready to release it should the need arise; the pawl should be fully engaged before the topping lift purchase or bull-wire is released. The person employed on this duty should not attempt or be given any other task until this operation is complete; in no circumstances should the pawl bar be wedged or lashed up.

21.15.10 A derrick with a topping winch, and particularly one that is self-powered, should not be topped hard against the mast, table or clamp in such a way that the initial heave required to free the pawl bar prior to lowering the derrick cannot be achieved without putting an undue strain on the topping lift purchase and its attachments.

21.15.11 A heel block should be secured additionally by means of a chain or wire so that the block will be pulled into position under load but does not drop when the load is released.

21.15.12 The derrick should be lowered to the deck or crutch and properly secured whenever repairs or changes to the rig are to be carried out.

21.15.13 If heavy cargo is to be dragged under deck with ship's winches, the runner should be led directly from the heel block to avoid overloading the derrick boom and rigging. Where a heavy load is to be removed, a snatch block or bull wire should be used to provide a fair-lead for the runner and to keep the load clear of obstructions.

21.16 Use of derricks in union purchase

21.16.1 When using union purchase the following precautions should be strictly taken to avoid excessive tensions:-

(a) the angle between the married runners should not normally exceed 90° and an angle of 120° should never be exceeded;

(b) the cargo sling should be kept as short as possible so as to clear the bulwarks without the angle between the runners exceeding 90° (or 120° in special circumstances);

(c) derricks should be topped as high as practicable consistent with safe working;

(d) the derricks should not be rigged further apart than is absolutely necessary.

21.16.2 The following examples will show how rapidly loads increase on derricks, runners and attachments as the angle between runners increases:

- At 60° included angle, the tension in each runner would be just over half the load;
- At 90° the tension would be nearly three-quarters of the load;
- At 195° the tension would be nearly 12 times the load.

21.16.3 When using union purchase, winch operators should wind in and pay out in step, otherwise dangerous tensions may develop in the rig.

21.16.4 An adequate preventer guy should always be rigged on the outboard side of each derrick when used in union purchase. The preventer guy should be looped over the head of the derrick, and as close to and parallel with the outboard guy as available fittings permit. Each guy should be secured to individual and adequate deck or other fastenings.

21.16.5 Narrow angles between derricks and outboard guys and between outboard guys and the vertical should be avoided in union purchase as these materially increase the loading on the guys. The angle between the outboard derrick and its outboard guy and preventer should not be too large and may cause the outboard derrick to jack-knife. In general, the inboard derrick guys and preventer should be secured as nearly as possible at an angle of 90° to the derrick.

21.17 Use of stoppers

21.17.1 Where fitted, mechanical topping lift stoppers should be used. Where chain stoppers are used, they should ALWAYS be applied by two half-hitches in the form of a cow hitch suitably spaced with the remaining chain and rope tail backed round the wire and held taut to the wire.

21.17.2 A chain stopper should be shackled as near as possible in line with the span downhaul and always to an eyeplate, not passed round on a bight which would induce bending stresses similar to those in a knotted chain.

21.17.3 No stopper should be shackled to the same eyeplate as the lead block for the span downhaul; this is particularly hazardous when the lead block has to be turned to take the downhaul to the winch or secure it to bitts or cleats.

21.17.4 The span downhaul should always be eased to a stopper and the stopper should take the weight before turns are removed from the winch, bitts or cleats.