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Studio & Production Equipment Companies



GUIDANCE IN THE PROVISION & SAFE OPERATION OF CAMERA CRANES



FOREWORD

The first edition of the “Crane Guidance” was published in 2002 and quickly came to be recognised as the industry standard for the safe operation of cranes. This new, revised version has been updated and amended to reflect legislative changes, the availability of new equipment and evolving work systems. As with the first edition, the intention has been to encourage and support safe, professional and legally compliant crane operating practices for the benefit of the individuals working within the film, digital, TV and broadcast industries.

Thanks to generous sponsorship, this guide is available free of charge to those working full-time in the industry and can also be downloaded from the website:

www.plasa.org/aspec

ACKNOWLEDGEMENTS

There were so many people involved in this updated version of the “Crane Guidance” that it would be impossible to thank them all individually. This is an industry that understands the need to take a lead on safeguarding the people that work within it and the importance of ensuring that the highest safety standards are met. It goes without saying that help was given generously and willingly with a view to building on the sterling work that made the first edition possible.

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INTRODUCTION

WHAT DOES IT COVER?

Camera Cranes are defined as any kind of counterbalanced or mechanically operated boom used for the positioning of cameras (and occasionally other equipment). Some may utilise electrical or hydraulic power, whilst others are manually operated; but regardless of type and size, the same requirements for suitability, stability and operation apply. This guide describes the use of cranes for all types of media and situations.

The guide does not cover the use of construction cranes or other devices for general lifting, nor is it a ‘How To...’ manual on camera crane use. Instead, it sets out arrangements, precautions and information exchange required for camera cranes to be used safely in all types of circumstance.

WHO SHOULD READ THIS?

This guidance is intended for anyone involved in the use of camera cranes in film, TV and live media events. Production companies, equipment rental houses, crane technicians, grips and others should be aware of the hazards associated with the use of cranes, and their own role in managing safety.

RELEVANT LAW

Safety law applies in two ways; Firstly the use of a crane on a production is a work activity, therefore general workplace safety law is in force. Secondly, a crane is an item of work equipment, which means it must be designed, maintained and constructed according to “machinery” laws. Failure to comply with safety law is a criminal offence, and it is the responsibility of the relevant company or operator to understand their duties.

Where a particular Regulation applies or official guidance is given, it will be highlighted in the text like this:

“Where appropriate, the SWL of the lifting equipment should be reduced to take into account the environment and mode in which it is being used.”
LOLER Approved Code of Practice 8

The reader is signposted to HSE publication L113 “Safe use of lifting equipment”, which provides comprehensive guidance on how the law applies and what is expected of those operating and supplying lift equipment such as camera cranes. A list of relevant regulations and how they may apply is given in **Appendix A**.

ROLES AND RESPONSIBILITIES

Most safety law assigns duties of an ‘Employer’, which sometimes leads to confusion if companies or sole traders are involved in a contract for services rather than ‘employed’. When used in a safety law context the word Employer means the person or organisation who has **control** over the workplace and work activity, regardless of tax, National Insurance or other employment arrangements. It is critically important that everyone in the supply and use of camera cranes understands their particular role and safety responsibilities. Below is a summary and examples to help illustrate how duties are *shared* between organisations - further examples are provided throughout the guide of planning, co-operation and co-ordination to implement safe working.

THE PRODUCER OR PRODUCTION COMPANY

The Production Company will normally have the safety duties of the Employer, since they have control over the shoot i.e. the workplace and how the work activity is carried out. This means they effectively assume overall responsibility for managing safety on the shoot.

Production Company or their appointed Grip must.

- Conduct a risk assessment for the shoot to identify threats to, or arising from use of the crane
- Accurately specify the crane type required
- Ensure a safe means of access to and from the location/site/crane position is provided

In conjunction with the Grip or Rental Company:

- Identify how and where the crane can be safely positioned
- Identify resources (including personnel) to ensure the shoot can be achieved safely
- Agree a schedule to / enable construction, operation and dismantling of the crane to be achieved safely

THE RENTAL COMPANY

A rental company supplies equipment to a Production or other third party for their use. Their duties will include:

- Ensure equipment is in safe condition and all maintenance, periodic inspections or thorough examination/testing has been carried out (See **Appendix B** for detail)
- Provide relevant information on safe use to accompany the crane, such as a copy of the last examination report, Instruction Manual/SWL/Model, Serial number and crane weight.
- The rental company should understand the capability and limits of the equipment they supply and should assist customers in selecting suitable devices

CRANE TECHNICIAN

Regardless of how they are employed, the Crane Technician must be trained and competent [see *Appendix C*]. They shall also ensure:

- Familiarity with the operation and technical capability of the specific crane in use, including SWL, weight and limitations
- Have ready access to the Operator Manual and records of relevant tests and inspections
- Safe assembly and installation of the crane in the configuration requested by the Production Company or Grip
- A visual inspection and functional tests are carried out before the crane is used
- Each shot and move is discussed with the Grip and other Crane Technicians, and that sufficient trained staff are engaged to operate the crane safely
- Ensure any additional equipment or material attached to the crane is within its SWL and securely attached
- Dismantle and re-check the crane, reporting any defect or damage to the Rental Company

Depending on circumstances, and only if competent to do so, the Crane Technician may need to carry out periodic inspection or maintenance on behalf of the Owner/Rental Company. This should be agreed in advance.

THE CRANE DESIGNER/MANUFACTURER

Any company that designs and manufactures work equipment has a duty to ensure:

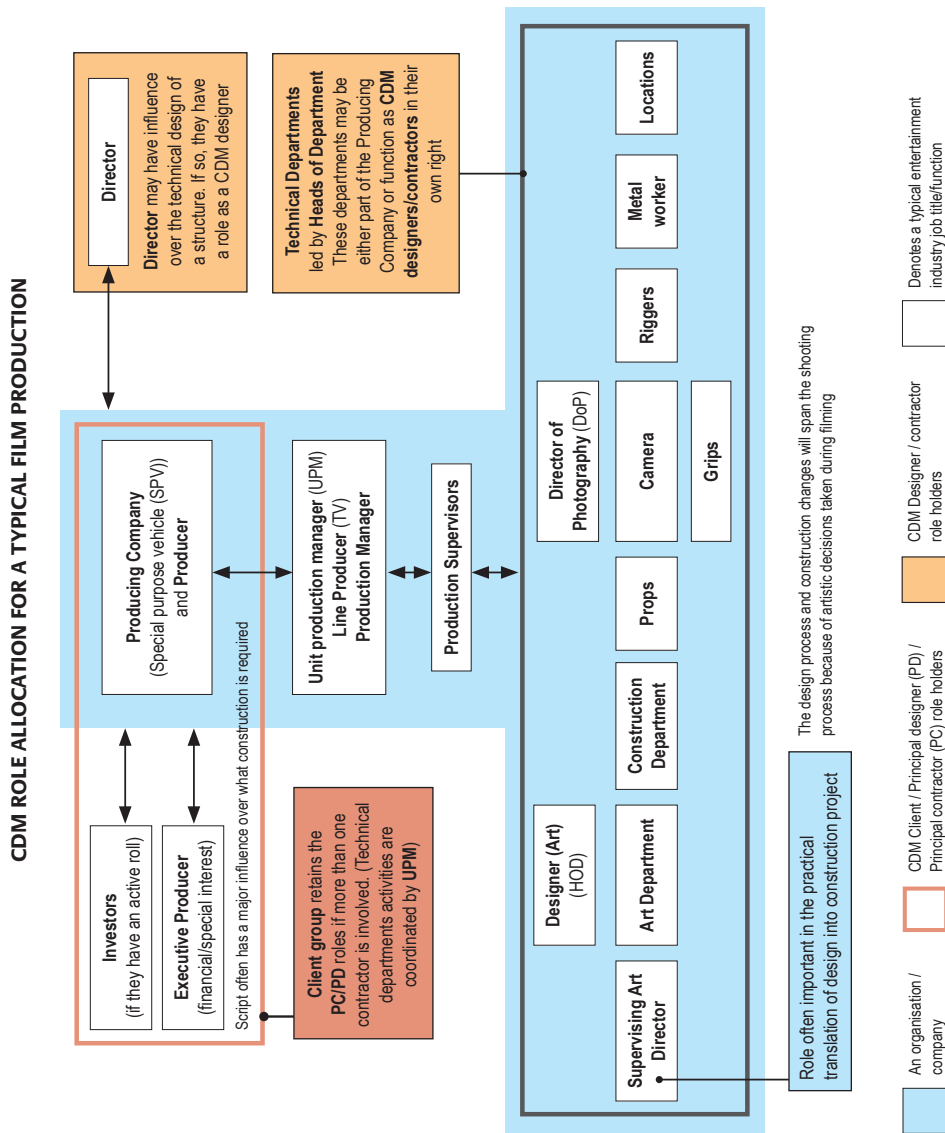
- It is fit-for-purpose i.e. designed to be strong and stable enough for intended use
- Hazards to users have been eliminated through good design
- Limits of operation and use (such as safe working load) are clearly identified
- Provide adequate information to users so they can operate and maintain the equipment safely

FREELANCERS

Self-employment is commonplace in the industry, however self-employed or freelance workers need to understand their obligations as both employer and an employee; after all they are employing themselves. Any freelancer providing equipment and labour-services will have the duties of both the operator and the Rental Company.

The diagram below shows how the Health and Safety Executive (the body responsible for UK workplace safety) envisage a production might meet the requirements of the Construction (Design and Management) Regulations.

Although the below may not be an accurate representation of the structure on every shoot it is taken from HSE documentation to illustrate how the HSE views the general hierarchical structure and responsibility.



CRANE EQUIPMENT

SUITABILITY OF CRANE EQUIPMENT

“In selecting work equipment, every employer shall have regard to the working conditions and to the risks to the health and safety of persons which exist in the premises or undertaking in which that work equipment is to be used and any additional risk posed by the use of that work equipment.”

LOLER 1998, Regulation 4(1)

When selecting crane equipment for a shoot the Production Company or their appointed Grip must take into account:

- The nature of the shot to be achieved
- Whether any person is required to ride the crane
- Weight of camera (and other equipment)
- Demands of the location environment

Crane suppliers should consult with potential clients to ensure that a suitable product is provided to ensure that the desired working height, reach distance and operating position can be safely achieved. As well as what the crane can do to achieve the desired shot, equal consideration must be given to what the device requires, in terms of its footprint, weight, crew requirement, power and so on.

Getting the desired shot may require the crane or operator to be positioned on moving vehicles, boats or aircraft, or might need to be adjacent to building edges, cliff tops or traffic. A detailed Risk Assessment shall be drawn up in advance of all shoots with the Production Company and the Crane Supplier exchanging information so each can meet their respective duties to protect staff, other people on the shoot, equipment and the location environment. Solutions should not be improvised on location.

At every point the stability and safe working load of the crane must be recognised as absolute limits which cannot be exceeded. No adaptation should be made to the fundamental design of a crane without the authorisation of the supplier. The manufacturer should be consulted, if possible, and a duly competent person shall conduct a thorough examination (see section on Inspection & Maintenance) before the modified crane is used.

STRENGTH AND STABILITY

Every employer shall 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.

LOLER 1998, Regulation 4

Any crane, however configured, must be of such design and construction to hold its load without risk of component failure or the possibility of overturning. When considering the capability of the crane, all forces need to be accounted for, including technical equipment, personnel and wind loadings. The dynamics of each shot should be assessed; sudden acceleration or deceleration of the boom will exert additional load compared to a static shot.

SAFE WORKING LOAD

All cranes must be clearly marked with a Safe Working Load (SWL) to indicate the maximum weight the crane can safely lift. The Crane Technician shall ensure that they are familiar with variations in SWL for any given configuration of the crane or degree of boom extension and shall ensure that any such limits are not exceeded. If the crane is supplied with a telescopic boom, the load can be moved further away from the pivot, creating a long lever arm which amplifies the forces in the boom. If there is any doubt the manufacturers manual should be consulted.

DERATING AND THE FACTOR OF SAFETY

“Where appropriate, the SWL of the lifting equipment should be reduced to take into account the environment and mode in which it is being used.”

LOLER Approved Code of Practice 8

The safe working load means exactly what it says; it is the maximum amount that is safe to lift under normal circumstances. Calculation of the SWL includes applying a Factor of Safety. If a crane were marked with a 100kg SWL, and the jib actually broke if 101kg were applied, there would be virtually no margin of error, making operation extremely dangerous. Therefore the SWL is calculated using a Factor of Safety: the load at which components might actually fail is divided by the FoS to give a safe lift capacity with headroom for error, wear, damage etc. The FoS varies depending on the type of item and how it may be used, with a range from 1.5 up to 10. The FoS for a camera crane should be in the order of 4 to 5 for the overall assembly.

If the crane is designed to carry people, then the FoS would be double that of an identical item which is not intended to lift people.

*“Equipment not designed to be used for lifting people should be de-rated by 50%, i.e. have a factor of safety relating to strength of at least twice that required for general lifting operations”
LOLER ACoP Guidance 5*

There may be other circumstances in which the SWL of a crane should be reduced (de-rated), such as new configurations, extended reach, limitation on ground or subframe strength, and other environmental factors. The Crane Technician shall be responsible for assessing when and how the SWL should be de-rated to maintain safety and stability.

STABILITY

A number of factors can affect the stability of the crane, so alongside the SWL of the crane, it is also necessary to assess:

- The capacity of the floor, location or crane mounting. This is particularly important if the crane is mounted on a vehicle or other moving device.
- The strength of the ground or surface on which the crane equipment is positioned. Are spreader plates or subframes required to safely support the crane?
- How will ground stability vary under load conditions? Dynamic moves will change the centre of gravity, applying centrifugal effects or sudden accelerations - any of which will affect the force exerted on each wheel or support.



- Wind loading may exert significant force on the crane and its mountings - this force can be uneven, with one side lifting and another exerting even greater pressure.
- If the crane is mounted close to level changes in the ground, there may be a risk of subsidence or sudden collapse from such dynamic loads.
- Unless specifically stated otherwise, the SWL will have been calculated with the crane in a level position; therefore the crane must be installed and operated in a level position.

Various methods or combinations of methods can be used to maintain the stability of the crane, including:

- Design and construction of a suitable subframe/tubular rigging on which to position the crane equipment. A competent qualified rigger should provide calculations to demonstrate that the such supporting frame is adequate for the crane, its loading and any dynamic load
- Using an anchorage system
- Using counterbalancing weights or ballast
- Using outriggers or stabilisers

The last three measures all require suitable attachment to the crane itself to be effective, consultation with the manufacturer/supplier is required if fixing points are not clearly identified on the crane.

Where cranes are anchored to other work equipment or structures, checks should be made to ensure that the equipment or structure can withstand the forces that the crane and its use will impose on them.



INSPECTION AND MAINTENANCE

Regulation 9 of the LOLER sets out the duty of an employer, or anyone providing lifting equipment for rental to carry out periodic “thorough examination”. The recommended test period is 12 months or 6 months dependent on equipment type and in accordance with LOLER regulations. The examination must be carried out by a duly Competent Person, and in practice is normally out-sourced to a specialist contractor, although it is perfectly legal to carry out in-house. The 12 and 6 month periods are maximum values, and where a crane may be subject to any degradation from use or the environment (e.g. operating in extremes of heat and cold, sandy or corrosive conditions) then more frequent thorough examination may be required.

A formal certificate must be issued each time such an examination is carried out (or if any structural modifications have been made) and this certificate is an integral part of any crane being made available for rental.

“Every employer shall ensure that no lifting equipment... is used..., unless it is accompanied by physical evidence that the last thorough examination required to be carried out under this regulation has been carried out.”

LOLER Regulation 4

To be clear: it is a legal obligation for anyone renting out a camera crane to have it thoroughly examined by a competent person and for the evidence of that examination to accompany the crane, just as it is a legal obligation for the production renting the crane to ensure the evidence of thorough examination is present. Further information on checks and examination are included in **Appendix B**.

PRE-USE CHECKS

In addition to this periodic process, it is important that a crane is visually inspected each time it is assembled before each use. The Crane Technician must have sufficient technical knowledge and information regarding the particular crane in use to be able to assemble it in the correct configuration and conduct a pre-use check. The purpose of such pre-use checks is to identify faulty equipment and take corrective measures where appropriate.

- Before the crane is used each working day or at the start of each shift
- If the crane has been left unattended for a period of time
- Following severe weather
- Following any change of configuration or mounting

The aim of such checks is to pick up faults due to day-to-day wear and tear, to identify any broken components or items showing signs of having been over-stressed - and to verify that safety features and functions are operational. The crane technician and or NVQ III Grips are best placed to identify faults or damage because they are literally hands-on.

TRAINING, COMPETENCE AND STAFFING

“The Employer has a duty to provide... such, information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of employees.”
HSW Act (section 2(2)(c))

The law requires that people are trained and competent to carry out tasks safely. The degree of training is proportionate to the complexity and level of risk arising from the work activity. It is clear that camera cranes are high risk and technically complex, and failures in their operation could be catastrophic; therefore training must be rigorous and formalised. The law does not identify a specific qualification, however BECTU and Crane and Grip Technicians Branch have determined that NVQ Level II Crane Technician is the minimum acceptable qualification for anyone to operate or install a crane.

To be competent to supervise crane activities, a person should be qualified to NVQ Level III Grip. **Appendix C** sets out the basic competencies and qualifications ASPEC have identified as appropriate for specific roles.

The HSW Act refers to the Employer, but for a self-employed person, it is up to them to undertake training to the requisite level, and be able to prove to a potential client that they have the knowledge, skill and technical understanding to operate a crane safely. A key part of being competent is identifying risks and being able to recognise the limits of both the crane and themselves as an operator. To put it another way: it's not just knowing which button to press, it's about knowing when to say “No.”

Crane operations requires an adequate number of competent staff to ensure it they are carried out safely. **Appendix D**. sets out ASPEC's guidance on suitable staffing levels for specific types of camera crane.



PLANNING THE USE OF CRANE EQUIPMENT

“Every employer shall ensure that every lifting operation involving lifting equipment is –

(a) properly planned by a competent person;

(b) appropriately supervised; and

(c) carried out in a safe manner. “

LOLER 1998 Regulation 8

Planning of crane operations is a combination of two parts:

- Initial planning to identify a crane type which is suitable for the tasks and location environment
- Planning of individual shots or sequences of moves so they can be carried out safely

A critical part of both planning processes is to conduct a risk assessment to identify hazards and those at risk. The degree of planning to control these risks will vary considerably, and will depend upon the type of crane to be used, the nature of the location and the complexity of the crane operation. Consultation with an NVQ III Certified Grip is critical in the planning process.

INITIAL PLANNING

Initial planning starts at the first point of enquiry and should be part of a Crane Rental organisation’s hire/use procedures.

Factors taken into account when identifying crane equipment so that it is suitable for the proposed job include:

- Understanding of the range of operational task
- Type of loads (person/camera/other)
- Restrictions (height, weight, lateral movement etc.)
- How often the crane equipment will be used to carry out the task
- The environment in which the crane equipment will be used
- The personnel required to operate the crane and their knowledge, training and experience
- Special requirements such as vehicle mounting or portability

Such considerations form a basic Risk Assessment around the proposed use of the crane. To be competent to carry out this initial phase, an individual must have good general knowledge of broadcasting and film industry operations, and must understand the capability and limitations of cranes and the risks arising from their use. Familiarity with general safety law is also useful to carry out this initial risk analysis.

A sample template, which can help with producing a detailed Risk Assessment, is provided in **Appendix E**. It should be noted, that the template is simply a set of prompts for a competent person to conduct a suitable and sufficient assessment. It is not a pre-made assessment nor is it exhaustive of all potential hazards. The duty to conduct a detailed but proportionate assessment

remains that of the duty holder as defined under the relevant regulations, but the template may be useful to set out risk controls in an logical manner.

SHOT PLANNING

For routine crane operations the planning of each individual crane operation will usually be a matter for the NVQ III Certified Grip. It is good practice that the Grip be involved in the location reconnaissance and review of the initial planning. When planning for a particular shot or crane operation, the following shall be taken into account to create a detailed Risk Assessment for higher risk activities:

VISIBILITY

- The Crane Technician should maintain a clear view of the path of the camera throughout the shot. If this is not possible then one or more Grips will be required to assist as spotters. The Grips must be in a safe position where they are able to see all crane movements and either be in view of the Crane Technician or able to communicate directly with them
- To be effective, verbal communication must be simple, robust and reliable and may be achieved through radio, telephone or direct speech. The Risk Assessment should identify action to be taken if such a communication link fails

If hand signals are used, they should be discussed in advance, and wherever possible a standardised set of signals should be used (see BS 7121-1:2006).

ENVIRONMENT

- Weather conditions may have an adverse effect on safety. Excessive wind, poor visibility due to mist or fog, lightning and heavy rain will all lead to heightened risk. In the instance of weather challenges, the Crane Technician and Grip shall determine whether it is safe to continue or if the operation should be suspended
- Heavy rain may also lead to erosion or subsidence of the ground
- In rain protective covers should be attached to eliminate potential risk via electrical supplies
- A safe system of work needs to be in place which sets out action required to protect from environmental risks. This should form part of the advance Risk Assessment and not simply be left to Technicians or Grips raising concerns on the day

OVERTURNING

Each crane operation should be assessed for risk of overturning. The Technician and Grips must be competent (i.e. have sufficient knowledge and experience) to judge whether or not the equipment is likely to be over stressed or become unstable.

This could arise, for example:

- Poor ground conditions or insufficient load spread
- Positioning a mobile crane with a raised boom
- Persons riding the crane when re-positioning
- High winds
- Using a crane to lift an unknown load

PROXIMITY HAZARDS

This means coming into contact with someone, or something within the sphere of operation of the crane. As well as causing injury or damage, contact with objects has the potential to destabilise the crane so the detailed shot risk assessment must consider the potential for contact with anything within the operating radius of the crane. Examples include:

- Overhead structures, lighting, rigging, set, gantries, cables
- Performers, crew audience or general public
- Vehicles or other moving items on set
- At live events such as concerts or sport, the crane crew should have full knowledge of proposed moves and activities of the participants/performer and any effects such as lasers, pyrotechnics or moving props
- Overhead power lines

The risk from contact with overhead power cables cannot be overstated; any contact may be instantly fatal to the Crane Crew and others in the vicinity. Crane operations in close proximity to overhead lines **MUST** be avoided. The chassis of a crane should never be positioned where the boom, or any part of the load, may be swung into contact with a line. “Don’t worry, I won’t swing that far round” is not a sufficient control mechanism. The safe zone around overhead lines will vary depending on the height and voltage, for further information consult HSE publication GS6 ‘Avoiding danger from overhead power lines’, or contact the energy provider.

CRANE EQUIPMENT USED ON TRACKS

Tracks play an integral role in crane stability and must be considered as part of the overall lifting assembly. Therefore the same approach to safety as with the rest of the crane needs to be taken:

- Only ever use track specified for the crane
- Cranes should never be operated on curved track
- Ensure tracks are properly stored and maintained
- Only competent persons should install tracks and ensure levelled before use
- Thorough visual inspection and functional testing should be carried out prior to use
- Ensure any loose material that may cause derailing is removed
- Install means to prevent the crane rolling off the end of the track

Although tracks can help spread the load of the crane, any ground settlement can cause tracks to become misaligned and the running surface to become uneven. Such settlement must not be allowed to develop to the extent that the crane can become unstable or liable to be derailed in use.

MOBILE CRANE EQUIPMENT FITTED WITH PNEUMATIC TYRES

The use of solid tyres for mobile crane equipment is strongly recommended, however, where pneumatic tyres are being used the following measures must be adopted:

- Correct tyre pressures for the weight and configuration of crane must be confirmed
- Tyre pressures are checked before use and then on a regular basis
- Ensure a means of tyre inflation is available - there is no point in just checking pressure
- Use a pressure gauge that can be calibrated to confirm that the pressures meet manufacturer/suppliers recommendations
- Worn, cut or blistered tyres shall be rejected and replaced
- Where possible pneumatic tyres shall be fitted with inner tubes
- When tyre checks or inflation is carried out, ensure the crane is lowered to a safe position in case the valve jams or fails

FLOATING VESSELS

If the crane is positioned on a floating vessel (whether that vessel is moving or not), it is effectively operating on a variable out-of-level base and thus subject to significantly different loading conditions than would be the case on firm, level ground. The Captain or Master of the Vessel shall be consulted to determine appropriate positioning for the crane and a safe maximum angle of pitch or roll of the vessel/crane combination. Unlike on solid ground the vessel/crane combination may create a feedback loop whereby the crane induces roll in the boat, which in turn tips the crane further over, inducing greater roll. This can rapidly lead to dangerous instability, particularly if the vessel is operating where waves or wind may also be a factor or if the boom extends beyond the side of the vessel. Where necessary an inclinometer should be available to provide an accurate assessment of roll or pitch.

The crane equipment may be subject to greater dynamic loading than when used on land. For example, there may be increased side loading on the crane arm and greater forces in panning due to changes in inclination of the vessel. The crane may therefore require it to be de-rated from its normal land based duties. A competent person, based with details from the crane manufacturer's recommendations for floating duties, should determine the extent of such de-rating.

If the camera is required to enter the water, consideration must be given to how buoyancy may affect counterweight and if the vessel is moving, what effect drag may have on the operator and the vessel itself.

MEANS OF ACCESS

*“Where access to or egress from any part of the lifting equipment is required you should provide a safe means of doing so. Any means of access or egress which forms part of the lifting equipment should be suitable for the purpose.”
LOLER ACoP 3(65)*

Where someone is required to access the crane, whether their work involves maintenance, crane construction or actual operation of the camera, there is a duty to provide a safe means of getting to and from the work position. It is not permissible for people to be put at undue risk of falls or other hazards. The same applies to working areas around the crane (albeit from different Regulations), which means ensuring that scaffolding or raised decks must be inherently safe and have suitable steps and edge protection.

Any person carried on the crane must be provided with a seat or secure workplace and suitable restraint belt or fall protection (see section on Work at Height) and a safe way of getting on and off.

Along with the safety of people accessing the crane during operation, a separate aspect to be considered is arrangements to actually get the crane into the required position. In some instances the location itself presents a serious access challenge, and a detailed Risk Assessment should be conducted by the Production Company to identify a safe means of getting the crane and crew in place. The Location Manager, Grip and Crane Technician must implement the findings of the Risk Assessment and co-operate to provide safe and reliable means of getting equipment and personnel installed.



SAFE OPERATION

Crane equipment MUST NOT be operated by any person under the influence of alcohol, or drugs (including certain prescription medication). All physical moves must be well within the capacity of the crane crew; notably their general physique, strength and endurance. Operating under high levels of stress or when fatigued can also impair judgement and safe working and should be avoided.

Under all circumstances the Crane Technician must remain aware of the risks arising from the specific task at hand and should bring any concerns to the attention of the supervising NVQ III Grip.

The Crane Technician should always verify the load to be manoeuvred and the risks arising from travelling in a raised position or contact with overhead obstacles at the studio/location.

Under no circumstances should a Crane Technician or Grip undertake a shot/loading/move/work position which they believe to be unsafe.

Under no circumstances should a crane be used to carry a person unless it is marked as being suitable, and a safe work position and means of access are provided.

UNCONTROLLED MOVEMENT

A key aspect of safe operation is to ensure that crane movements and loads are under control at all times. To prevent free fall or slewing of the crane, the following steps should be adopted:

1. Ensure the crane is properly staffed. Unless detailed by manufacturer's instructions or a risk assessment, two NVQ III Grips (the second Grip can be NVQ II Certified) and one NVQ II Crane Technician should be in attendance when operating a crane (one grip at each end of crane). See *Appendix D*.
2. Ensure travel end stops and movement limits are engaged (all such mechanisms should be engaged when the crane is not in use)

Loads and counterbalance weights should only be added or removed when adequate staff are present and with lock-off/Strapping/Bonds engaged.

All loads must be securely attached and if necessary linked to the crane with a secondary bond (safety cable).

OPERATOR SAFETY

Crane Technician, Grips and others should be able to undertake their work without being exposed to hazardous parts of the crane, which includes risks of crushing, entrapment, shear points and so on. Operators shall also be properly protected from environmental risks. The operating Risk Assessment should address:

- Requirements for personal protective equipment to protect against any residual hazards which cannot be controlled at source. Such PPE may be required during installation and dismantling as well as during the actual shoot. Examples include hard hats, high-viz clothing, protective boots, gloves, hearing protection and so on. Some crane installations may take place in environments where PPE is a standard workplace requirement, and in such circumstances the site requirements must be adopted
- Extremes of heat and cold
- Exposure to smoke, fumes, dust
- Risks arising from moving vehicles and general site/location traffic
- Risks arising from special effects

The most common factor to protect against is likely to be the weather, and the operational Risk Assessment should consider operator protection for likely weather conditions and contingency measures for extremes of weather, including lightning, hail and so on.

It is not acceptable that Crane Technicians or Grips work in conditions where slips and falls may cause serious injury. A stable surface must be provided for the Crew, with cables and other equipment routed to avoid impeding movement. Suitable edge protection (including kickboards) must be provided on raised platforms or edges:

- Where a fall is likely to cause serious injury
- Where traffic route passes close to the edge of the crane equipment
- Where large numbers of people are present
- Where a person might fall onto a sharp or dangerous surface or material/substance
- Where a person might fall into fast flowing or deep water

If edge protection is not practicable, then personal restraint and/or fall arrest equipment must be used throughout the period of risk. All elements of personal fall prevention equipment must be fit for purpose and CE marked and supplied by production.

EFFECTS OF HIGH WIND

“Where appropriate, the maximum wind speed in which the lifting equipment can be used should be included in the instructions on use. Measures therefore should be in place to determine the wind speed and also reduce its effect.”

LOLER ACoP 3.85

Wind applies a sideways load on a crane, the force of which is amplified by the length of the jib and the distance of the camera from the base. Crane equipment used in open air locations can easily become unstable if used in high wind conditions. Operating Crew need to be confident when determining if the device may be unstable and that requires specific information about the crane’s limits in each particular configuration.

Measures to determine wind speed range from weather forecasting services providing a general idea of the expected conditions at the location each day, through to on-site wind measuring equipment. Because wind speed varies greatly with altitude, measurements need to reflect the actual operating height of the crane. The most common way of providing an instantaneous indication of the wind speed is to use a handheld anemometer, but this is unlikely to be a true reflection of wind speed at the camera if the jib is raised.

There may be some instances where wind affects the stability of cranes used indoors, for example where studio doors are opened allowing the wind to ‘funnel’ through a building, therefore the stability of lifting equipment should be taken into account if such situations arise consideration should also be given to wind machines and special effects.

Two important factors should be borne in mind: the force exerted by the wind depends on the surface area of the object it is acting upon. So, adding reflectors or lights to the crane head may fall within the SWL (which is mostly concerned with gravity) but still make the crane unstable through wind action. Crane Technicians and Grips must always consider potential wind loading when attaching any additional equipment or material to the crane.

Crane Technicians and Grips are not expected to be mathematicians or meteorologists, but they are expected to have access to loading tables and information on wind speed limits, and logically apply these to the tasks at hand.

APPENDIX A :

LAW/REGULATION	HOW IT APPLIES
<p>Health and Safety at Work etc. Act 1974</p> <p>www.hse.gov.uk/legislation/hswa.htm</p>	<p>General requirements to take all reasonably practicable steps to ensure a safe workplace and safe systems of work. Specifies adequate “information, instruction, training and supervision” to be provided to workers.</p> <p>Requires that workers to not take risks with their own health and safety.</p>
<p>Lifting Equipment and Lifting Operations Regulations 1998 (LOLER)</p> <p>www.hse.gov.uk/work-equipment-machinery/lofer.htm</p> <p>Guidance and Code of Practice Thorough Examination a simple guide www.hse.gov.uk/pubns/indg422.pdf</p>	<p>Specifies arrangements for equipment, activity and people:</p> <p>Equipment must be of adequate strength and stability, maintained and periodically inspected. It must be marked with a Safe Working Load.</p> <p>The lifting activity should be properly planned and organised.</p> <p>People involved must be trained and competent.</p>
<p>Management of Health and Safety at Work etc. Regulations 1999</p> <p>www.hse.gov.uk/managing/index.htm</p>	<p>Sets out requirements for safety arrangements within the workplace such as co-ordination and co-operation. Places duties on the organisation in control of the work to carry out risk assessments, make arrangements to implement necessary measures, appoint competent people and arrange for appropriate information and training.</p> <p>Risk Assessments need to be ‘suitable and sufficient’ for reasonably foreseeable dangers.</p> <p>The Regulations also set out the ‘principles of prevention’, which is the order that controls measures should be applied to a hazard - starting with eliminating the hazard altogether.</p>

SUMMARY OF APPLICABLE LAW AND REGULATIONS

<p>Construction (Design and Management) Regulations 2015 (CDM)</p> <p>www.hse.gov.uk/construction/cdm/2015/summary.htm</p>	<p>'Construction' is a very wide term and involves activities well outside the usual building site type of work. Scenic construction, events, concerts, theatrical work where materials and equipment are assembled or dismantled are construction activities and fall within the regulations. Thus, film productions, sound stages, and a range of location activities are likely to involve activity regulated under CDM.</p> <p>The principal requirements of the Regulations are to ensure that specific duties to design, plan and organise for safety have been allocated to key organisations.</p>
<p>Provision and Use of Work Equipment Regulations 1998 (PUWER)</p> <p>www.hse.gov.uk/work-equipment-machinery/puwer.htm</p>	<p>Requires that any equipment used for work is inherently safe, fit for purpose and in good condition. Anyone who operates work equipment must be adequately trained and know the limits of their competence.</p>
<p>Work at Height Regulations 2005</p> <p>www.hse.gov.uk/pubns/indg401.pdf</p>	<p>Every employer has a duty to avoid risks of injury following fall from height. There is no upper or lower limit set - the '2 metre rule' does not exist.</p> <p>So far as practicable all work at height should be avoided by planning and design. If high working can't be avoided, then safe means of access, egress and working position must be provided. For camera cranes this means a safe way to access all points during construction and dismantling. For ride-on devices it means safe entry/exit routes and a secure seat and restraint during operation.</p> <p>The Regulations cover all working where there is a fall risk: the edges of platforms, scaffolds, steps and so on need to be adequately guarded or other means of protection put in place.</p>
<p>Personal Protective Equipment Regulations 1992 (PPE)</p> <p>www.hse.gov.uk/toolbox/ppe.htm</p>	<p>For those risks that cannot be adequately controlled at source it may be necessary to provide protective clothing or equipment to protect workers e.g. helmets, gloves, protective footwear etc.</p> <p>PPE should be used as a last line of defence if other controls are not fully effective. PPE must be suitable for the hazard, properly maintained and fitted. It needs to be worn throughout the time the worker is exposed to risk.</p>

APPENDIX B : SUMMARY OF INSPECTION

Camera cranes are required to undergo a periodic process of **thorough examination**, defined as *“a systematic and detailed examination of the equipment and safety critical parts, carried out at specified intervals by a competent person who must then complete a written report.”* The written report must include specific information to identify the exact machine, owner, place of examination, date of last examination, the name of the competent person and a list of any defects found.

The examination and issuing of a certificate may be done in-house if an individual has the requisite degree of practical and theoretical knowledge along with experience of camera crane design, construction and use. In practice, most crane owners will engage a specialist contractor to carry out the thorough examination.

Examinations should be carried out according to the following schedule:

Before first use	If the crane doesn't have a CE Declaration of Conformity from within the last year
Every 12 months	For most cranes
Every 6 months	Any crane which lifts a person
After assembly and before use on a site	If the crane is substantially dismantled into component parts, between jobs, it will need to be thoroughly examined before next use
After exceptional circumstances	If there has been modification or in the event of damage or failure



AND TESTING REQUIREMENTS UNDER LOLER

TESTING

Most camera cranes do not need routine testing as part of the process of thorough examination ('testing' meaning the application of sample loads)

PRE-USE INSPECTION

In addition to the structured process of annual certification and thorough examination, a crane should be subject to a pre-use check by the Crane Technician who has installed and assembled it. Particular focus should be given to crane footing and stability and the proper functioning of any safety features of the device. Such an inspection should be part of the daily routine of the Crane Technician / Grip.

FAILURE

Regardless of whether a camera crane has current certificate of thorough examination, no crane should be used which shows:

- a) Any cracks or crack-like flaws
- b) Any damage causing local dents or deformation larger than 1mm
- c) Any visible curvature or deformation not an attribute of the design
- d) Any twisting of the camera mounting point beyond the available corrections or beyond $\pm 5^\circ$ relative to the fulcrum of the boom. Where no correction for twist can be made the maximum twist of the camera mounting point should be $\pm 2^\circ$ relative to the fulcrum of the boom



APPENDIX C :

Training, experience and supervision all play a role in confirming Technician/Grip competence and that safe crane operation is observed and delivered. Information, instruction, training and supervision is a legal requirement under the Health and Safety at Work etc. Act 1974, and it is, critical that the Technician/Grip undergoes continuous training and development to ensure that safe practice is implemented in crane use and that poor habits are eliminated.

The following criteria are detailed to enable employers to assess current levels of competence within their existing workforce and support future Crane Technician/operator development.

TRAINING STANDARD	
TRAINER REQUIREMENTS	<p>Trainers involved in crane operator training must have the following requirements:</p> <ul style="list-style-type: none"> • Skilled in training/instruction techniques to recognised level • Qualified Assessors A1/V1 (Supersedes D32/D33) • Have recognised experience in film/broadcasting crane operation • Have sufficient depth of knowledge to relate their training to film/ broadcasting environments <p>The requirements can be met by a combination of trainers</p>
TRAINING ENVIRONMENT	<p>The training environment must be controlled and be located off-the-job to prevent interruptions. On the job development may be required for crane operator assessment. Training facilities should include the following:</p> <ul style="list-style-type: none"> • Sufficient space and crane equipment • Classroom facilities for theoretical work • Training equipment and aids • Welfare and sanitary facilities
TRAINING	<p>The training should cover the critical areas for crane operation and safety. It should involve both theoretical and practical learning, which will require evaluation through assessment. Listed below are specific risk areas where crane operators will require training input:</p> <p>CRANE PREPARATION</p> <ol style="list-style-type: none"> 1. Ability to assist in undertaking risk assessment 2. Carry out visual check and inspection of crane components 3. Ensure appropriate certificates are available e.g. Thorough Examination or electrical (Portable Appliance Test) 4. Carry out reporting defects procedure ensuring remedial work is carried out 5. Prepare crane components for handling and transport

CRANE OPERATOR TRAINING

>>>

LOADING/UNLOADING

1. Use of mechanical aids for lifting heavy loads
2. Banking of reversing vehicles
3. Correct use of truck hoists/other mechanical lifting aids
4. Securing crane equipment for travel
5. Unloading crane equipment at studio/location

ASSEMBLY

1. Assess area for safe operation of crane
2. Prepare ground for stability and protect against crane arm striking overhead obstacles
3. Correct assembly of track ensuring stability
4. Assemble crane in line with manufactures instructions
5. Ensuring stability of crane during assembly
6. Manual handling best practices
7. Bonding techniques
8. Levelling a crane
9. Crane operator must be competent, having a good working knowledge in constructing temporary platforms
10. Correct electrical setup of crane
11. Securing area from damage

CONFORMITY CHECK

1. Carry out conformance check
2. Crane must be checked and signed off as ready to rent by in house technician
3. Reporting and actioning defects

USE

1. Knowledge of Crane Technicians/Grips duties (*Appendix E* refers)
2. Maintaining safe operating area
3. Awareness of studio/location hazards
4. Securing procedures when not in use
5. Operating with passengers

DISMANTLING

1. Preparing area for dismantling
2. Correct sequence and tools
3. Ensuring stability during dismantling
4. Complete post use

APPENDIX D :

The below shows the minimum crewing requirements for crane operations but specific situations may require increased crewing levels.

Crane Model	Manufacturer	No. of Grips	No. of Techs	Grip Qualifications	Crane Tech Qualifications
TELESCOPIC					
75ft SuperTechno (no tracking base)	SuperTechno	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
73ft Hydroscope (no tracking base)	Chapman	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
65ft Movie Bird (no tracking base)	Movie Bird	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
50ft SuperTechno	SuperTechno	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
50ft Movie Bird	Movie Bird	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
45ft Movie Bird	Movie Bird	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
45ft Scorpio	Service Vision	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
43ft Hydroscope	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
35ft Movie Bird	Movie Bird	2	1	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
32ft Hydroscope	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
30ft SuperTechno	SuperTechno	2	1	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
30ft Movie Bird	Movie Bird	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
24ft Movie Bird	Movie Bird	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
22ft SuperTechno	SuperTechno	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
20ft Hydroscope	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
20ft SuperTechno	SuperTechno	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
17ft Movie Bird	Movie Bird	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
15ft SuperTechno	SuperTechno	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Techno Lite	SuperTechno	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Miniscope	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Scorpio 10	Service Vision	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Techno Dolly	SuperTechno	2	2	1 x NVQ III, 1 x NVQ II	2 x NVQ II Crane tech
T10	Egripment	2	1	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
T12	Egripment	2	2	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Louma	Louma	2	1	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech

STAFFING LEVELS FOR CRANE TYPES

Crane Model	Manufacturer	No. of Grips	No. of Techs	Grip Qualifications	Crane Tech Qualifications
MODULAR/FIXED ARMS					
Lenny Arms (Modular)	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Mini Lenny Arms (Modular)	Chapman	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Film Air Giraffe - Classic (Modular)	Film Air	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Film Air Giraffe - Long Ranger (Modular)	Film Air	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Strada (Modular)	Strada	2	2	1 x NVQ III, 1 x NVQ II	
Akela (Modular)	Strada	2	2	1 x NVQ III, 1 x NVQ II	
Movie Bird Eagle 72 (Modular)	Movie Bird	2	2	1 x NVQ III, 1 x NVQ II	
GF8 / Exten (Modular)	GFM	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
GF9 (Modular)	GFM	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
GF16 (Modular)	GFM	2	2	1 x NVQ III, 1 x NVQ II	
Pixyplus (Modular)	Panther	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Foxy Pro (Modular)	Panther	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Galaxy (Modular)	Panther	2	2	1 x NVQ III, 1 x NVQ II	
MT400 (Modular)	Movietech	2	2	1 x NVQ III, 1 x NVQ II	
TDT (Modular)	Egripment	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Scanner (Fixed)	Egripment	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Scanner Elite (Fixed)	Egripment	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Super Javelin (Modular)	Egripment	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Super Maxjib (Modular)	Egripment	2	0	1 x NVQ III, 1 x NVQ II	
Skyking (Modular)	Egripment	2	2	1 x NVQ III, 1 x NVQ II	
Piccolo (Modular)	Egripment	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Tulip (Modular)	Egripment	2	1	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech

* ADD one Crane Technician for a stabilised head

continued >>>

APPENDIX D : STAFFING LEVELS FOR CRANE TYPES

Crane Model	Manufacturer	No. of Grips	No. of Techs	Grip Qualifications	Crane Tech Qualifications
JIB ARMS					
Fisher 23 Arm (Modular)	Fisher	2	**	1 x NVQ III, 1 x NVQ II	
Fisher 22 Arm (Fixed)	Fisher	2	**	1 x NVQ III, 1 x NVQ II	
Fisher 21 Arm (Fixed)	Fisher	1 (2 if tracking)	0 *	1 x NVQ II	
Fisher 20 Arm (Fixed)	Fisher	1 (2 if tracking)	*	1 x NVQ II	
Alpha Jib (Modular)	Alpha Grip	2	** *	1 x NVQ III, 1 x NVQ II	
GFM Multi Jib (Modular)	GFM	2	** *	1 x NVQ III, 1 x NVQ II	
GFM - Baby Jib (Fixed)	GFM	1	0 *	1 x NVQ II	
GFM - Mini Jib (Fixed)	GFM	1	0 *	1 x NVQ II	
GFM - Tele Jib (Fixed)	GFM	1 (2 if tracking)	*	1 x NVQ II	
GFM - Jib (Fixed)	GFM	2	0 *	1 x NVQ III, 1 x NVQ II	
Pixy Jib	Panther	1	** *	1 x NVQ II	
Foxy Pro Jib (Modular)	Panther	2	1 *	1 x NVQ III, 1 x NVQ II	1 x NVQ II Crane tech
Lightweight Jib (Fixed)	Panther	1 (2 if tracking)	0 *	1 x NVQ II	
Vario Jib S	Panther	1	0 *	1 x NVQ II	
Vario Jib	Panther	2	0 *	1 x NVQ III, 1 x NVQ II	
Super Vario Jib 1	Panther	2	0 *	1 x NVQ III, 1 x NVQ II	
Super Vario Jib 2	Panther	2	0 *	1 x NVQ III, 1 x NVQ II	
Stinger Arms (Modular)	Chapman	2	0 *	1 x NVQ III, 1 x NVQ II	
Stinger Arms II (Modular)	Chapman	2	0 *	1 x NVQ III, 1 x NVQ II	
Jan Jib (Fixed)	Egripment	2	0 *	1 x NVQ III, 1 x NVQ II	
Genie Jib (Fixed)	Egripment	1 (2 if tracking)	0 *	1 x NVQ II	
Mini Jib (Fixed)	Egripment	1	0 *	1 x NVQ II	
Aero Jib (Modular)	Aero Crane	2	0 *	1 x NVQ III, 1 x NVQ II	
Super Aero Jib (Modular)	Aero Crane	2	0 *	1 x NVQ III, 1 x NVQ II	

* ADD one Crane Technician for a stabilised head

** ADD one Crane Tech and/or Grip if the base is tracking (refer to the NVQ III Grip)

APPENDIX E : CRANE RISK ASSESSMENT TEMPLATE

This template is NOT a ready-made risk assessment. A competent person must complete the form and provide relevant information and analysis. The form should be adapted and updated as details of the crane operation become available.

Name of person completing this assessment	Date of assessment
Production or event name	Location address
Type of crane	Serial/Plant number
Crane supplied by	Dates crane used (from and to)
Description of Location/Shoot/Activity	
Name of Crane Technician	Qualification
Name of Senior Grip	Qualification

Requirement	YES	NO	Notes or Control Measures
Suitability			
Is the crane design suitable for purpose?	<input type="checkbox"/>	<input type="checkbox"/>	
Cert. of Thorough Examination provided	<input type="checkbox"/>	<input type="checkbox"/>	
Overall crane weight	<input type="checkbox"/>	<input type="checkbox"/>	
Maximum floor loading e.g. at full extension	<input type="checkbox"/>	<input type="checkbox"/>	
Maximum SWL for specific configuration	<input type="checkbox"/>	<input type="checkbox"/>	
Weight of camera to be lifted	<input type="checkbox"/>	<input type="checkbox"/>	
Suitable floor/base provided	<input type="checkbox"/>	<input type="checkbox"/>	

continued >>>

APPENDIX E :

Requirement	YES	NO	Notes or Control Measures
Location Hazards			
Detailed RA provided by Grip or Location Manager			
Specific hazards present			
Exposure to weather High wind			Maximum operating wind speed = Forecast and measurement arrangements?
Exposed edges/work at height			
Overhead obstructions or services			
Pyro and SFX			
Moving vehicles			
Electricity			
Other			Specify and explain control measures
Personnel			
List the personnel required for crane installation and operation			
Will a Competent Person be required to carry out any Thorough Examination on location?			
Safe Access			
Access arrangements to install and dismantle crane			
Safe working position for assembly			
Safe working position for operation			
Safe access for any person lifted on crane			
Lifting People			
Does any person ride on the crane?			If yes, give details
Is a safe means of access provided?			How does the person get on the crane?
Is a secure work position provided?			
Are seat belts or other restraint available and functional?			

CRANE RISK ASSESSMENT TEMPLATE

Requirement	YES	NO	Notes or Control Measures
Crane Movement			
Suitable wheels provided on crane			
Is the rolling surface clean and clear?			
Are end-stops, brakes etc. provided and in good condition?			
Are tracks/rails used?			If yes, are these stable, level and of suitable radius of curvature?
Is a vehicle mount used?			If yes, is the mounting properly designed, installed and maintained?
How will the crane remain stable during rapid moves/acceleration etc?			
Is additional ballast, strapping or stabilisation required?			If yes, describe arrangements
Attachments and Adaptations			
Will any equipment other than the camera be carried on the crane?			If yes, list here
What measures are in place to ensure SWL and wind loading are not exceeded?			
Have any adaptations been made to the crane itself?			If yes, give details
If adaptations made, has subsequent Thorough Examination been carried out?			

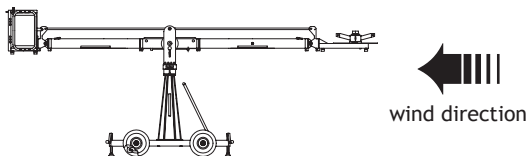
Other risks identified or control measures required

Signature of competent person

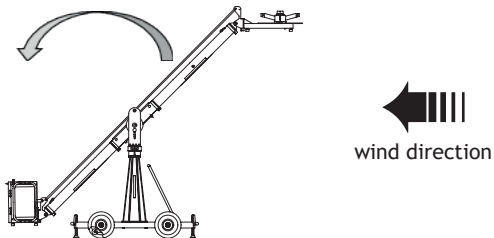
APPENDIX F : WIND LOADING GUIDANCE

The degree of force exerted on a crane depends on a number of factors, including the location and orientation of the jib, surface area of the crane and attachments and the wind speed itself. It is beyond the scope of this document to provide detailed information on particular cranes because configuration and use will vary considerably. The Crane Technician and Grip must refer to the technical data supplied with each crane regarding maximum safe wind speed and additional tie down or ballast requirements. What is universally clear is that wind can exert lateral (sideways) loading on a crane which may cause instability and collapse if not properly managed.

With the jib lowered, the actual wind speed at the camera head is likely to be lower and the force is acting relatively close to the base

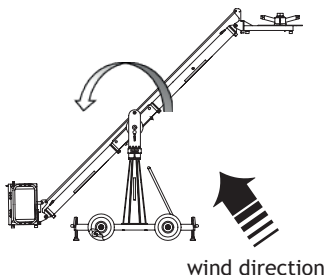


With the jib raised, the wind speed at the camera head may be greater and there is an increased overturning force which the base is poorly positioned to resist.



The potential for overturn is far higher at the same ground windspeed.

The force exerted on the crane is proportional to the area the wind acts against. Wind blowing from the side “sees” the whole surface area of the boom arm, and may exert a far greater force than if it were blowing parallel to the boom. The wheelbase of the crane might also be narrower in the sideways plane, making overturn more likely in this orientation.



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