

Impact Blocks

Working at Height and Rigging Instructions



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Generic work at height warnings

Work at height is a high risk activity. It is your responsibility to manage those risks. Before using Personal Protective Equipment (PPE) and rigging components you must:

- Have a broad technical understanding of the tools used prior to starting work;
- Inspect each component for defects and ensure an inspection regime is in place to detect component defects, abrasion and damage prior to any safety issues arising;
- Read and understand all relevant User Instructions;
- Understand the scope of application of each component and any limitations;
- Recognise, register and manage the risks involved;
- Gain instruction from *competent personnel* where appropriate; and
- Accept that there can be no claim for damages, injury or death resulting from misuse of equipment.

Failure to manage risks may result in serious injury or death.

Any questions should be sent to: post@dmmwales.com

Generic lifting operation cautions

- This equipment is designed for use as part of a *lifting system*;
- Lifting operations may only be adopted when a thorough *risk assessment* has demonstrated that the work can be performed safely and the use of other, potentially safer work equipment is not reasonably practicable;
- A clear site hierarchy must be established for all personnel on work sites involving lifting operations;
- All site personnel must understand their own role and the role of every other person involved in the lifting operation, be aware of the agreed communication system between personnel and the identity and location of the *responsible person* and *competent person*;
- All site personnel must be aware of the communication path within the lifting team including the procedure to pause or stop a lift;
- The *competent person* must be able to contact the *responsible person* and understand when and how to seek additional technical advice;
- The *load* must be securely attached to at least one anchor point at all times;
- Each anchor point, and the means of attachment to it, shall be of suitable and sufficient strength and stability for the purposes of supporting any foreseeable loading including those in an unanticipated and/or emergency contingency;
- The system must be installed and used in such a way as to prevent unplanned or uncontrolled movement of the *load*;
- The potential for, and magnitude of, an impact *load* shall be minimised at all times;
- Whenever possible, the anchor point shall be vertically above the centre of mass of the *load*;
- The *load* must be attached in such a way that it can be safely lifted, held and relocated;
- Where the *load* being lifted includes people, the *lifting system* shall only be used if:
 - a) The system includes a suitable *redundancy* for preventing or arresting a fall (and the user is connected to it); or
 - b) Where it is not reasonably practicable to comply with a), all practicable measures are taken to ensure that the *lifting system* does not fail.

Equipment description, its intended purpose, application and limitations

Impact Blocks are heavy duty pulley blocks designed to be anchored to a structure (normally a tree) by textile anchor components. The *load* shall typically be applied via a synthetic fibre rope of defined maximum diameter which may move over, or be held on, a sheave which is able to rotate under a defined Working Load Limit (WLL). These components have been independently certified to meet the quoted *performance criteria*. System configuration and the neighbour component compatibility are not defined and have therefore not been verified. Impact Blocks are designed to tolerate peak *loads* correctly applied to the sheave over a short time period (i.e. *impact loads*) and more consistent *loads* such as those associated with winching operations. Impact Blocks are also designed to be tolerant of forces applied to the cheek plates and spindle ends from contact with structures as the *load* moves during the lifting operation.

Impact Blocks were primarily developed for the lifting operations associated with the controlled dismantling of trees within confined spaces and in winching operations where fibre ropes are employed e.g. timber harvesting. Users must be fully conversant with the structures with which they work and any constraints imposed by those structures.

Lifting systems where the rope moves (running rope systems), demand special consideration to rope damage e.g. abrasive and/or sharp edges. Care should be taken to ensure that the running rope (or any other part of the system) is routed away from surfaces that may damage the rope (or any other component), or that suitable and sufficient protection is appropriately placed to ensure the rope and other components are protected.

Whenever possible, this system shall be personal issue. Any relevant documentation shall be issued to the user, read and fully understood before its' first use and remain convenient to reference. If the system is sold or passed on to another user, the User Instructions must accompany the equipment. If the system is transferred to another country, it is the responsibility of the seller/previous user to ensure that User Instructions are in the correct language for that country.

In adverse environments, the function of Impact Blocks may be affected. For example, greater care may be needed to ensure that the anchor mechanism closes fully and reliably and that sheave efficiency is maintained. Ice, mud, rain, cold, snow and tree exudates are examples of localised or climatic conditions that may demand greater attention from the user. Beware - tree exudates may create conditions similar to those created by lubricants or adhesives. Contamination of ropes with tree exudates may lead to rope hardening and reduce system reliability. Maintain ropes so that their function is reliable. Ideally, ropes should always be dry, clean and perform equally along their entire length.

Great care shall be taken to ensure that objects (such as leaves or twigs) are not trapped in the blocks as the anchor locking mechanism may be less reliable and sheave efficiency may be negatively affected. To minimise this risk, users shall plan the placement of lifting components carefully within/on the tree (and other structures where debris may be encountered) to avoid this situation.

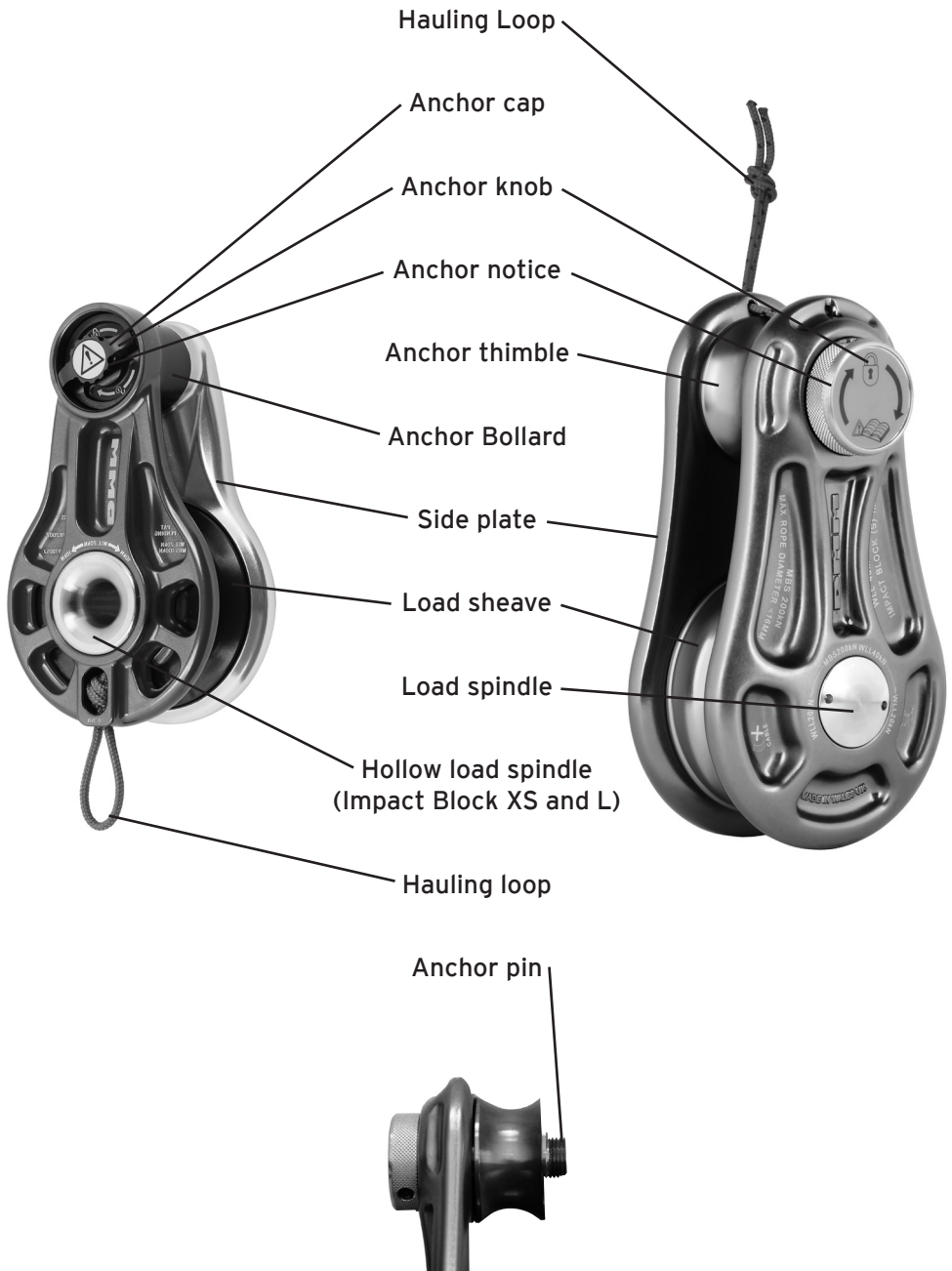
Check also at all times that objects do not contact the *anchor knob* as this may rotate the securing mechanism towards the open position. This is most likely to occur in 'busy' structures and during complex and/or impact lifting scenarios. It is vital that user vigilance is maintained at all times to avoid unanticipated opening of the closure mechanism.

Responsibilities of the user

It is the responsibility of the user to ensure (for example):

- The acquisition of relevant training and competence for Impact Blocks prior to first use;
- That suitable supervision is in place when and where required;
- Suitable physical and mental condition for involvement in lifting operations in both normal and emergency situations;
- That a relevant and 'live' *risk assessment* is in place for the work to be carried out which includes emergency contingencies;
- That the Impact Block is maintained using only procedures approved by DMM International Ltd. and installed in accordance with the manufacturer's procedures;
- That alterations made to any part of the Impact Block receive prior written consent of DMM International Ltd.;
- That the requirements of any relevant work at height, lifting or any other legislation, is observed. Where there appears to be a conflict between legislation and these instructions for use, the user shall postpone the use of the Impact Block until resolution has been achieved;
- That when in service or storage, the system is in a safe and functional condition and protected from damage;
- That the system is only used for the purposes for which it was intended and within an appropriate environment;
- That components or the entire system are immediately withdrawn from service, placed in *quarantine* and labelled in an obvious manner so that they can not be used by mistake if 1) there is any doubt about its' condition or 2) it has been used outside its' scope of application. Components may only be returned to service following the written authorisation of a *competent person*;
- That anchor points are directly above the work position whenever possible;
- That the potential for a pendulum swing has been minimised;
- That each anchor point system meets the full range of requirements of each individual lift;
- That an inspection regime is in place to detect component defects and abrasion damage prior to any safety issues arising e.g. pre-use checks, weekly inspections, thorough examinations (see national legislation) and examination after exceptional circumstances;
- That potential for the conduction of electricity through the system or structure is minimised prior to, and during, any work activity;
- That trailing work equipment, such as rope or lanyards, does not cause a hazard e.g. by becoming entangled in other work equipment or restricting lowering of a *load*;
- That climatic stress (e.g. extreme hot, cold or humidity) does not lead to impairment of judgement, increase in risk levels and/or injury;
- The use of appropriate *PPE* for the task which (as a minimum) ensures compliance with legislation e.g. head, ear, foot and eye protection;
- That all safety warnings have been understood and acted upon;
- That lifting lines are long enough for all anticipated operations; and
- That vigilance is maintained at all times.

Nomenclature








Glossary, explanation of terms and material specifications

When glossary terminology is referred to in the text it appears in *italics*

Anchor assembly	The full range of parts required for the anchor mechanism to fully function.
Anchor cap	A threaded cap which receives the <i>anchor pin</i> to enable the <i>anchor assembly</i> to be locked.
Anchor knob	A disk shaped handle mounted on the end of the <i>anchor pin</i> used to rotate <i>anchor pin</i> clockwise to its' locked position. With the aid of a suitable tool, the two opposing holes on the side of the knob can be used to apply additional torque.
Anchor notice	Caution notice to ensure that the <i>anchor assembly</i> is correctly secured. Check with User Instructions for approved procedure.
Anchor pin	A <i>load bearing</i> shaft connected between the two <i>side plates</i> , located by a flanged surface and a male locking thread.
Anchor thimble	A ring of metal mounted on the <i>anchor pin</i> , with a concave outer surface, around which a bight of rope is formed, so that the thimble provides a surface upon which the rope bears. When the <i>anchor assembly</i> is correctly secured, the thimble is fixed in place.
Competent	Possessing the requisite qualifications and experience to perform a task.
Competent person	<p>A <i>competent person</i> (sometimes called the site safety coordinator) is a member of the on-site personnel who can demonstrate that they have sufficient professional or technical training, knowledge, actual experience, and authority to enable them to:</p> <ul style="list-style-type: none"> • carry out their assigned duties at the level of responsibility allocated to them; • understand any potential hazards related to the work (or equipment) under consideration; • detect any technical defects or omissions in that work (or equipment), recognise any implications for health and safety caused by those defects or omissions, and; • be able to specify a remedial action to mitigate those implications.
Fall arrest	<p>A <i>fall arrest</i> system comprises an energy absorbing element attached to a full body harness by a thoracic attachment. It is intended to arrest a fall and stop a person hitting the ground or other obstacles. The system is designed to limit the <i>impact force</i> of the fall and retain the user upright in the harness.</p> <p>Key elements of <i>fall arrest</i> are:</p> <ul style="list-style-type: none"> • a fall that is catered for during work planning e.g. <i>risk assessment</i>; • specific equipment is specified for the task e.g. full body harness with sternal and dorsal attachment points • a clear zone must be present i.e. impact is not made with the structure or other objects e.g. the ground • a capacity in the <i>fall protection system</i> to dissipate energy away from the climber, normally by gradual deceleration i.e. force generated in arresting the fall is kept below 6kN(6G) by energy absorbers.
Fall protection system	<p>An assembly of components for protection against falls from a height at work when the risk of a fall exists, generally but not always including at least a body holding device (harness) connected to a reliable anchor.</p> <p><i>Fall protection systems</i> should be designed by a <i>competent person</i> to ensure that:</p> <ul style="list-style-type: none"> • each component and the system is of suitable and sufficient strength and appropriate for the service conditions; and • each component is correctly configured and compatible with neighbouring components.
Hauling loop	A small diameter accessory cord configured into a small hole of a <i>side plate</i> . Used solely for the purpose of supporting the mass of the Impact Block itself plus the anchor sling and rope. Maximum <i>load</i> 30kg.
Impact force	An instantaneous force (measured in kN or daN) commonly experienced when arresting a falling mass.
Lifting system	An assembly of components employed to lift, lower or hold a <i>load</i> .
Load	The mass to be lifted, lowered or held in place (measured in kg). A person is considered to be a <i>load</i> .

<i>Load bearing</i>	The parts around the hole in the <i>load sheave</i> which bear the friction. The bearing in Impact Blocks is created by two flanged bushings made from a <i>self lubricating bronze</i> (S and L) or low friction ball bearings (XS).
<i>Load sheave</i>	A ring of metal mounted on the spindle, with a concave outer surface, around which a bight of rope is mounted. The sheave is free to rotate.
<i>Load spindle</i>	The <i>load bearing</i> axis upon which the sheave is free to rotate. Connected to both <i>side plates</i> and maintaining the space between them.
<i>Notified body</i>	An accredited organisation empowered to assess whether a product meets certain specified European standards.
<i>Obsolescence</i>	A loss in the utility of a part, component or system due to the development of improved or superior equipment, incompatibility with other equipment, changes in technique, legislation or standards but not due to physical deterioration.
<i>Peak force</i>	The highest force experienced during a loading episode. Measured in kN or daN.
<i>Performance criteria</i>	The abilities of the product or system e.g. dynamic and static abilities.
<i>PPE</i>	Personal Protective Equipment. Any device or appliance designed for protection against health hazards. Within Europe, all equipment included in a <i>fall protection system</i> for work at height is categorised as type III or complex <i>PPE</i> , that is to say it protects against mortal danger. Type III equipment must: <ul style="list-style-type: none"> • undergo independent type testing (e.g. to European standards or Norms); • have appropriate technical and user instructions in the language of the country of sale; and • be produced under an independently verified quality system (e.g. ISO 9001) or be subjected to annual recertification.
<i>Redundancy</i>	A stand-by or reserve system.
<i>Rescue system</i>	A <i>fall protection system</i> by which a person can carry out a rescue, either self rescue or be rescued from a height or a depth by pulling, lifting or lowering. Usually meeting higher <i>performance criteria</i> than a personal <i>fall protection system</i> .
<i>Responsible person</i>	The person with ultimate responsibility for ensuring that work is organised appropriately, has sufficient status to be able to appoint the <i>competent person</i> 'without fear or favour', and has the knowledge, training and experience necessary for a full understanding of all the issues involved in the work being considered. The <i>responsible person</i> is not normally present on the work site when the work is carried out, but may attend site if requested by the <i>competent person</i> .
<i>Risk assessment</i>	A step in a risk management procedure. The determination of hazard, risk levels, what and who is at risk and the control measures required to minimise risk to acceptable levels.
<i>Quarantine</i>	1) The removal from service of a component, assembly or system to allow for further assessment and/or gathering of information. Following a further thorough examination by a <i>competent person</i> and any necessary maintenance and/or repair, the item may (when deemed safe to do so) be either reintroduced into service or otherwise disposed of. 2) Component, assembly or component should be clearly labelled or marked as defective and placed in a clearly identified physical location (e.g. cupboard, demarcated area of floor or container) where work equipment can be held in isolation, so that it cannot be introduced into service inadvertently.
<i>Safety factor (or design factor)</i>	SF (or DF). The ratio between the MBS and the WLL/SWL. This is applied to maintain prescribed levels of safety. For example, a typical <i>safety factor</i> used for arboricultural rigging hardware is ~5:1. Important Note - <i>safety factors</i> must be calculated with peak <i>impact forces</i> in mind, not the mass of the <i>load</i> .
<i>Self lubricating bronze</i>	A material containing lubricants held within its pores. When sliding under <i>load</i> , the lubricants form a film which reduces surface friction.
<i>Side plate</i>	The two <i>load bearing</i> plates, with rounded edges and fairlead flares, which link the <i>anchor pin</i> and <i>load spindle</i> .
<i>Work positioning</i>	A personal <i>fall protection system</i> which enables a user to work supported under tension or suspension in such a way that a fall is prevented or restricted. A <i>work positioning</i> harness normally consists of a pelvic (ventral) and side attachment points and leg loops.

Product markings

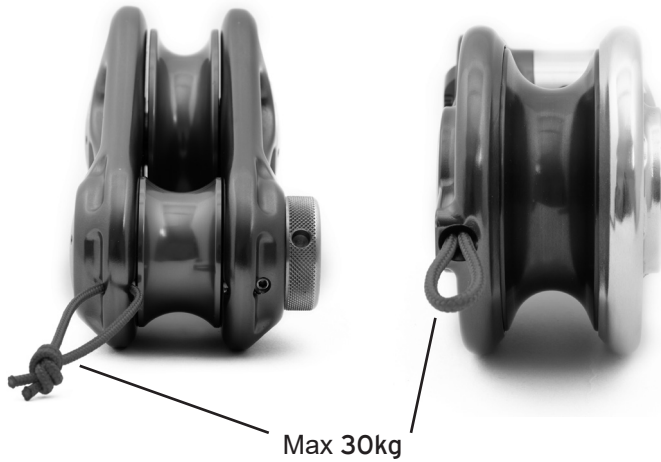
DMM	Manufacturer - DMM International Ltd, Y Glyn, Llanberis, Gwynedd, Wales, UK, LL55 4EL
	Reminder that the end user should read & understand these instructions, and those supplied with other items of <i>PPE</i> which may be used in conjunction with this item
	In association with arrows, indicates the required direction of rotation for locking the <i>anchor assembly</i>
IMB-XS/S/L	DMM product code
YRDAYXXXX#	Year/Day of manufacture and individual serial number
WLL xxkN	Working Load Limit
MBS xxkN	Minimum Breaking Strength
No.0598	<i>Notified Body</i> for EU type examination
EN12278:2007	European Standard to which the device conforms
Max rope diameter xxmm	Maximum rope diameter for use on the <i>load sheave</i>
	Max sling diameter (the upper stationary rope) and max rope diameter (the lower moving rope)
↑ ≤30kg	Maximum <i>load</i> to be applied to the <i>hauling loop</i>
	Do not use steel cable or chain
	Entanglement warning

Component performance criteria

Impact Blocks have been certified by SGS, UK to perform to the following criteria when new:

Lifting of loads		
IMB-XS	Minimum Breaking Strength (MBS) 100kN Working Load Limit (WLL) 20kN	Static Static and dynamic
IMB-S	Minimum Breaking Strength (MBS) 200kN Working Load Limit (WLL) 40kN	Static Static and dynamic
IMB-L	Minimum Breaking Strength (MBS) 300kN Working Load Limit (WLL) 60kN	Static Static and dynamic

Installation of the hauling sling



Installing an anchor sling (e.g. soft eye sling)

Components used to anchor an Impact Block must be textile e.g. rope, webbing.

Note: Chain, wire rope and other metal parts will damage the *anchor thimble*, *side plates* and other parts. Anchor slings must be suitably proportioned i.e. when in use, they must not apply outward pressure to the *side plates*. Flat webbing slings and other wide components (or combinations of components) may not be appropriate.

Maximum width of textile anchor slings on the

anchor thimble:

IMB-XS Ø20mm

IMB-S Ø22mm

IMB-L Ø27mm



Never use an anchor configuration which applies lateral forces on the *side plates*.

1.

Turn the *anchor knob* anticlockwise to the end of the thread. It may be necessary to pull the knob a few additional millimetres so that the end of the *anchor pin* is fully recessed within the *anchor thimble*. Rotate the two *side plates* away from one another.



2.

Pass a bight of cordage over the *anchor thimble* e.g. a spliced or stitched eye termination.



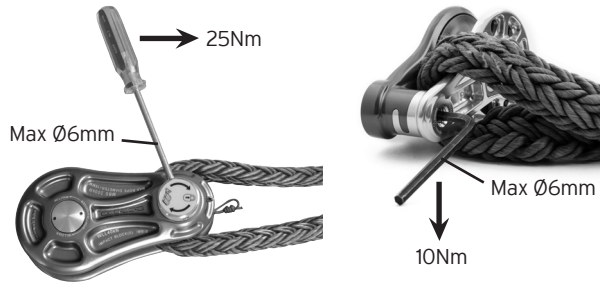
3.
 Rotate the *side plates* towards each other until they are aligned. Be careful to ensure that the textile anchor sling is not trapped between metal parts.



4.
 Push the *anchor knob* inwards until the end of the *anchor pin* locates in the *anchor cap*. Rotate the *anchor knob* so that the threads of the *anchor pin* and *anchor cap* engage, continue until the gap between the *anchor knob* and *side plate* has closed and the *anchor assembly* is secured in position.



5.
 If necessary, insert an appropriate tool to apply a securing torque. Note: the *anchor thimble* will be fixed in position when the *anchor assembly* is correctly secured i.e. it shall not rotate.



Hauling the sling, block and rope assembly to a climber work positioning with a hitch climber system



Insert a connector into the *hauling loop*. For the best combination of efficiency and safety use a DMM Revolver Locksafe Rig.



Pull a bight of climbing line from between the friction hitch and the Hitch Climber Eccentric pulley. Extend the bight until it reaches co-workers on the ground. Attach the Impact Block, anchor sling and rope assembly to the bight of climbing line using the Revolver Locksafe Rig karabiner. By hauling on the fall of the climbing line, co-workers can lift the block, sling and rope assembly to the climber. The climber can then transfer the assembly to their harness, or hold the assembly in place by tying a blocking knot under the Hitch Climber Eccentric pulley. In this way, the weight of the assembly is held by the climbing line.

Note: It is important that communication is maintained between climber and co-workers during these hauling operations, especially at the transfer stage after the assembly has arrived with the climber.

Co-workers should:

- Avoid standing directly under the assembly;
- Maintain control of the hauling rope at all times;
- Only release the hauling rope when instructed by the climber.

Climbers should:

- Ensure that no co-workers, members of the public or important objects are underneath the *load* as it is hauled;
- Monitor the lifting process and be ready and prepared to brake the line if the co-worker loses control;
- Instruct the co-worker to release the hauling rope only when the *load* has been secured aloft.

Attaching a soft eye sling and block assembly on a tree (cow hitch)

Note: Many anchor sling and knot assemblies exist. The following sling type and configuration is commonly used for many applications. It is not possible to show all of the potential combinations of sling and knot installations. Users should ensure that the sling/knot combination is well matched to the intended task.



Pass the tail of the soft eye sling around the tree and under the standing part, close to the Impact Block.



Generate a bight of rope around the standing part by passing the tail back around the tree in the opposite direction.



Pass the tail through the bight to create a girth hitch.



Tie an inward half hitch.....



....followed by a second inward half hitch to secure the girth hitch.



Tuck the tail of the soft eye sling under at least one leg of rope at the back of the tree to keep it away from running ropes and moving loads.

Attaching the rigging line to the load



With the tail of the rigging rope defined by a slip knot, attach the rigging rope to the load.....



.....remove the slip knot and set the knots in preparation for the proposed 'lift'.

Only fibre ropes may be used on the *load sheave*.

Note: Chain, wire rope and other metal parts will damage the *load sheave*, *side plates* and other parts.

Maximum diameter of fibre rope on the *load sheave*:

IMB-XS Ø16mm

IMB-S Ø16mm

IMB-L Ø20mm

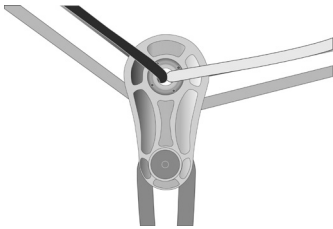
Standard configuration



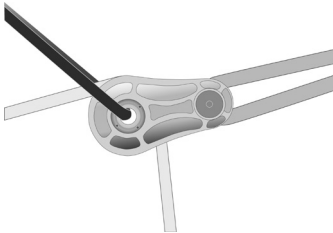
Single load line beneath a single anchor

Further configurations

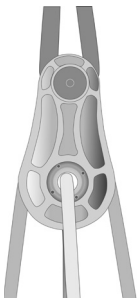
Note: The sum of forces acting on the hollow *load spindle* must not exceed the quoted Working Load Limit (WLL).



Highline configuration with two positioning lines



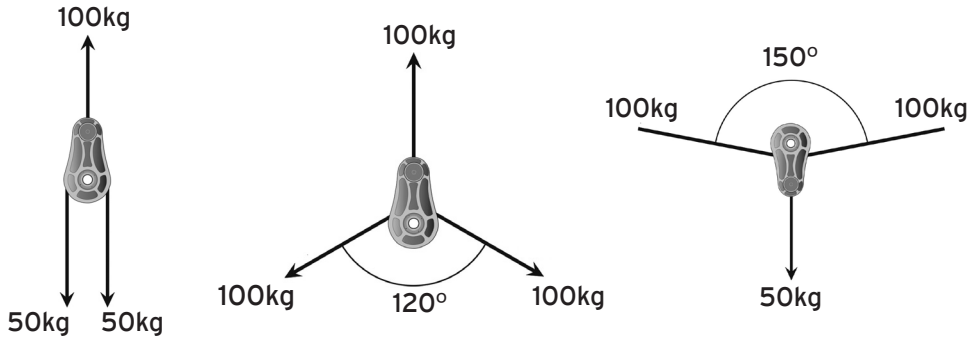
Floating sheave with two positioning lines and one load line



Two independent load lines from a single anchor

Loading scenarios for blocks and cordage

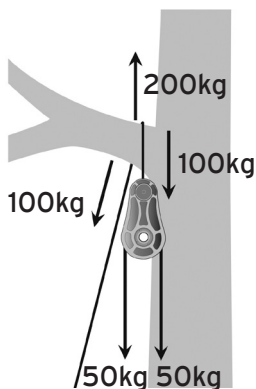
Importance of rope angle on line force and anchor loading



Angle between two legs of ropes	Load factor at anchor assembly
0 (two legs parallel)	2.00
10	1.99
20	1.97
30	1.93
40	1.87
50	1.84
60	1.81
70	1.73
80	1.64

Angle between ropes	Load factor at anchor assembly
90	1.53
100	1.29
110	1.15
120	1.00
130	0.84
140	0.68
150	0.52
160	0.35
170 (rope almost straight)	0.17

Load multiplying anchor configuration (the loads indicated apply when all legs of rope are parallel)



Operating, inspection, disinfection and cleaning, storage and transportation, lifespan and obsolescence

Operating Conditions

✓ -40°C to +50°C	✓ Static load ≤WLL	✓ Impact load ≤WLL	✗ Abrasive and/or sharp edges	✗ Contamination
✗ Corrosive acids, bases, liquids, vapours, gasses etc	! If exposed to aggressive substance: <i>Quarantine</i> and label the product in an obvious way so it can not be used accidentally; have a <i>competent person</i> check the quarantine before returning to use. If in any doubt contact DMM; Do not use again unless DMM replies, in writing, that it may be returned to service			

Generic Inspection Criteria

✓ No deformation, cracks or sharp edges	✓ No corrosion	✓ No marks arising from abrasion, impacts or cuts	✓ All components present, functional and in good condition, moving parts functioning correctly	✓ Ensure product markings are legible
✓ All surfaces/parts both inside and outside have been thoroughly checked	✗ Loss or modification of material ≥10% of any cross sectional area	✗ Marked, modified or repaired by the user unless authorised by DMM	! If defective: <i>Quarantine</i> and label the product in an obvious way so it can not be used accidentally; have a <i>competent person</i> check the quarantine before returning to use. If in any doubt contact DMM; Do not use again unless DMM replies, in writing, that it may be returned to service	

Disinfection and Cleaning

✓ Less than 30°C water	✓ Liquid soap in the pH range 5.5 to 8.5 for 15 minutes	✓ Rinse in clean water and dry naturally in a warm ventilated room away from direct heat	✓ Repeat the process to effectively clean and/or disinfect a products	✓ Lubricate the mechanism with a suitable lubricating oil
✓ Always do this after use in marine/saline/corrosive environment	✗ If cleaning and lubrication does not cure a defective mechanism replace the product immediately			

Storage and Transportation Conditions

✓ +10°C to +25°C	✓ Dry, clean and chemically neutral surfaces and environment	✗ Water or moisture	✗ Excessive heat or direct heat sources	✗ Sharp edged objects
✗ Excessive pressure or compaction	✗ High humidity	✗ Nibbling pests	✗ Corrosive or aggressive substances	✗ UV radiation

Lifespan and Obsolescence

✓ Metal: no time, subject to inspection	! In extreme service conditions, lifespan may be limited to a single use	! The product may become obsolete before the end of its lifespan. Reasons for this may include changes in applicable standards, regulations, legislation, development of new techniques, incompatibility with other equipment etc		
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For more information please read the User Instructions, or if in doubt contact DMM

Rigging references

Brown, M.G. (2000) Engineering Practical Rope Rescue Systems. Delmar Cengage Learning, Clifton Park, NY, USA. ISBN-13:978-0-7668-0197-4

Detter, A. et al (2008) Evaluation of current rigging and dismantling practices used in arboriculture. Research Report 668. Health and Safety Executive Books, UK. Download at: <http://www.hse.gov.uk/research/rrhtm/rr668.htm>

Donzelli, P.S. and Lilly, S.J. (2001) The Art and Science of Practical Rigging. International Society of Arboriculture, Champaign, IL, USA. ISBN 1-881956-28-8

Frank, J.A. [Ed] CMC Rope Rescue Technician Manual. Sixth Edition. CMC Rescue Inc., Goleta, California, USA. ISBN 978-1-7923-5480-9

Jepson, J. (2000) The Tree Climber's Companion. A reference and training manual for professional tree climbers. Second Edition. Beaver Tree Publishing, Longville, MN, USA. ISBN 0-615-11290-0

Lingens, D. (2006) Tree Climbers's Knotbook. First Edition. Schlauerlag, Stockelsdorf, Germany. ISBN 3-9810417-1-2

Merchant, D. and Ashford-Smith, D. (2009) Line Operation. ProGuide Series. USVAR.com. ISBN 978-0-9560784-2-1

Vines, T. and Hudson, S. (2016). High-Angle Rope Rescue Techniques: Levels I & II. Enhanced Fourth Edition. Jones and Bartlett Publishers, Inc, Sudbury, MA 01776, USA. ISBN-13 978-1284136159

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