

Introduction

This BDA Technical Guide has been developed in response to findings from BDA Audits conducted over the past three years. The audits have identified repeated issues with winches, wire ropes and lifting accessories, together with errors and inconsistencies with the Report of Thorough Examination's provided for the drilling machines and accessories being used. The components are a safety critical part of any machine, and the Reports are essential to prove compliance, therefore the extent of these audit non-conformances warrants highlighting and attention. The guide reflects on the requirements of BS EN 16228 Drilling and Foundation Equipment Rig - Safety – Part 1 (Common requirements) and Part 2 (for mobile drill rigs for civil and geotechnical engineering, quarrying and mining). The intention is to:

- Provide definitions and explanation of relevant terminology.
- Provide information on the steel wire ropes and winches which are commonly used on plant, machinery and equipment in the Drilling sector.
- Define expectations for Reports of Thorough Examination.

As outlined in the article published on the BDA website regarding drilling and boring machines and the LOLER 1998 Regulations (<https://www.britishdrillingassociation.co.uk/news/navigating-loler/>), members are reminded that both the BDA and AGS consider the machines used in our sector are designed to drill and bore (by rotation, resonance or percussive techniques), and not to lift. However, both trade associations accepted that mirroring the requirements and expectations of elements of LOLER as outlined below are entirely reasonable and appropriate. This document also provides clarifications on expectations for steel wire ropes, accessories and certification for BDA audit purposes.

Working Load Limit / Safe Working Load / Minimum Breaking Load fundamentals

The LEEA Code of Practice for the Safe Use of Lifting Equipment Edition 9 2019 provides appropriate definitions. Essentially, the Working Load Limit (WLL, also called rated capacity) is the load value assigned to the 'maximum' Safe Working Load (SWL) under ideal conditions (by calculation) and in most cases, the Working Load Limit (WLL) and the Safe Working Load (SWL) will be the same value.

A trained and qualified 'Competent Person' can account for working conditions and the configuration or use of an accessory, based on the manufacturer's recommendations, and reduce the calculated WLL to create a lower SWL value. Essentially, this reduces the capacity of the accessory according to how and where it will be used.

For steel wire ropes, the WLL is established by calculation, using the Minimum Breaking Load (MBL) value stated by the manufacturer, and by applying a Factor of Safety (FoS), i.e., $WLL = MBL/FoS$.

BS EN16228 Drilling and Foundation Equipment Rig – Safety

BS EN 16228-1:2014 indicates that a FoS of 3:1 can be applied to a wire rope which is used solely for winching tooling and equipment (lifting loads of known weights) into and out of a borehole for the purposes of machine operation. As such, any winch rope operating under a FoS of 3:1 must not be used to pull driven or drilled casings or SPT rods from the ground, because the friction on the outside of the rod or casing may significantly increase the load being pulled.

Conversely, BS EN 16228-1:2014 indicates that the FoS applied to a wire rope lifting loads of an unknown weight, or using a snatching technique shall be 5:1. This is applied primarily to cable percussion free-fall (main) winch ropes, but equally applies to any service winch ropes on rotary drilling machines where they are used to lift or pull loads whose weight cannot be accurately determined due to friction.

Factor of Safety for Steel Wire Ropes on Drilling Machines.

In the land drilling sector, steel wire ropes are generally fitted to winches on the machines and fundamentally, the wire rope and any accessories attached to it, **MUST** have a SWL equal to or greater than the capacity (pull) of the winch. Therefore, a 2t service winch must be fitted with a wire rope, shackles, safety hooks etc., with a SWL of equal to or greater than 2t.

There are exceptions to this rule for BDA (and audit) purposes. If an accessory is utilised for a specific purpose, will be lifting a known load, and the SWL is greater than the weight of the load it is lifting, it is deemed safe to use. For example, an SPT sleeve or a bailing hook are repeatedly lifting known loads, thus their SWL / WLL rating does not need to exceed the pull of the winch, only the weight of the specific load. Equally, there may be accessories that are designed to be perishable, such as the overshot used when wireline drilling. All BDA auditors are experienced with lifting equipment and accessories, and if in doubt, they will work with BDA members and their auditees to come to a safe and pragmatic resolution.

Therefore, the wire ropes on rotary drilling machines, along with the electric winch wire rope on a cable percussion machine, can utilise a FoS of 3:1, but the SWL / WLL **MUST** always be equal to or greater than the line pull of the winch they are fitted to. On the other hand, the main wire rope on a cable percussion machine should always utilise a FoS of 5:1, as by its nature it regularly lifts unknown loads or snatches its loads.

Steel wire ropes and accessories are sold by manufacturers with a Report of Thorough Examination showing the WLL, mostly calculated using a 5:1 FoS. This Report should always be retained on file. The FoS is derived by reference to the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), however, according to page 37 of BS EN 16228 Part 1, the following FoS can be applied in different applications:

- *Feeding and pulling down ropes = 3:1 – often referred to as winching and applied to rotary drilling machines.*
- *Cable tool percussion drilling = 5:1. - according to item 5.8.4 of BS16228, the safety factor of 5:1 is the ratio between MBL and the static weight of the drilling tool when empty.*

Additional information on steel wire ropes:

- *Permanent rope end terminations shall consist of pressed, swaged or spelter poured sockets.*
- *Detachable rope end terminations using the wedge type socket shall be manufactured and fitted in accordance with EN 13411-6:2004+A1:2008 or EN 13411-7:2006+A1:2008. This type of fitting is used to attach the steel wire rope to the winch.*
- *Rope end connections using wire rope clamps (Bulldog grips) are only permitted for free fall applications and shall comply with Annex E of BS EN 16228. The grips are often used to re-terminate steel wire ropes when a damaged section is removed and discarded.*

Report of Thorough Examination (RTE)

The Report of Thorough Examination for machines **MUST** include all of the relevant detail outlined in Schedule 1 of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER). The BDA would urge its members to ensure that RTE's are provided by independent organisations that have a detailed understanding of the machines and equipment, and how they are used. This is particularly important when it comes to BS EN 16228 which defines different expectations for the machines and applies a FoS for the type being inspected and certified.

For the purposes of a BDA audit, the auditee must confirm how the steel wire rope, lifting accessories and equipment (winches) that are recorded on the RTE are configured. This should include where the any unique identification mark

is located on the steel wire rope or accessory, where the WLL or SWL are detailed, and what FoS has been used to calculate the WLL or SWL. This information is most effectively recorded on a detailed RTE as demonstrated below.

Lifting Operations and Lifting Equipment Regulations (LOLER) 1998

Schedule 1. Regulation 10(1). <i>(Extracted from LOLER ACOP L113 2nd Edition produced and published by the Health and Safety Executive)</i>		Additional BDA Guidance Notes. Please also refer to the annotated and colour coded example certificate below.
1	The name and address of the employer for whom the thorough examination was made.	
2	The address of the premises at which the thorough examination was made.	
3	Particulars sufficient to identify the equipment including where known, its date of manufacture.	This information (unique ID number) should be recorded on the machine's information plate to correspond to the certificate.
4	The date of the last thorough examination.	
5	The safe working load of the lifting equipment or (where its safe working load depends on the configuration of the lifting equipment) its safe working load for the last configuration in which it was thoroughly examined.	The BDA further recommends that the Factor of Safety used to calculate WLLs of the Drilling machine components is added to the certificate as per the example below.
6	In relation to the first thorough examination of lifting equipment after installation or after assembly at a new site or in a new location: (a) that it is such thorough examination; (b) (if such be the case) that it has been installed correctly and would be safe to operate.	
7	In relation to a thorough examination of lifting equipment other than a thorough examination to which paragraph 6 relates: (a) whether it is a thorough examination (i) within an interval of 6 months under regulation 9(3)(a)(i); (ii) within an interval of 12 months under regulation 9(3)(a)(ii); (iii) in accordance with an examination scheme under regulation 9(3)(a)(iii); or (iv) after the occurrence of exceptional circumstances under regulation 9(3)(a)(iv);	 For lifting accessories e.g., wire ropes (unless permanently fitted to the machine), shackles, swivels safety hooks etc. For lifting equipment (machines) and ropes ('permanently' fitted to winches). E.g., significant maintenance or replacement of a key component.

	(b) (if such be the case) that the lifting equipment would be safe to operate.	The certificate MUST state that the machine and accessories are safe to use.
8	In relation to every thorough examination of lifting equipment:	
	(a) identification of any part found to have a defect which is or could become a danger to persons, and a description of the defect;	Equipment should not be in use where a defect has been identified for immediate rectification, or until that defect has been completed.
	(b) particulars of any repair, renewal or alteration required to remedy a defect found to be a danger to persons;	
	(c) in the case of a defect which is not yet but could become a danger to persons:	Where defects are identified for action a date for their rectification should be determined and recorded on the RTE.
	(i) the time by which it could become such a danger;	The equipment should not be used after that date or until the company can 'prove' (using a maintenance or repair record or new RTE) that the defects has been rectified.
	(ii) particulars of any repair, renewal or alteration required to remedy it;	
	(d) the latest date by which the next thorough examination must be carried out;	
	(e) where the thorough examination included testing, particulars of any test;	
	(f) the date of the thorough examination.	
9	The name, address and qualifications of the person making the report; that he is self-employed or, if employed, the name and address of his employer.	
10	The name and address of a person signing or authenticating the report on behalf of its author.	
11	The date of the report.	

Below is an example of a RTE that contains references and content covering all the matters outlined within this Technical Guide. It is published courtesy of Geotechnical Engineering Limited. Certification can be provided in this format, or any other, so long as all of the relevant details are available at the time of an audit.

The BDA recognises that in some cases, industry 'custom and practice' can lead to differing interpretation of the Legislation. This Technical Guide is therefore provided for information, and to promote best practice. Any differences in interpretation at audit can be raised with the team or the BDA for resolution or explanation.

APPENDIX 05 - REPORT OF THOROUGH EXAMINATION FOR LIFTING EQUIPMENT RMP.14

This report complies with the requirements of the Lifting Operations and Lifting Equipment Regulations 1998

Date Of Thorough Examination	Date Of Report	Job No/Report No			
24/05/2022	29/05/2022	1367028-P29			
Name and Address of Employer for whom Thorough Examination was made		Address of Premises at which Thorough Examination was made			
GEOTECHNICAL ENGINEERING LTD OLYMPUS PARK QUEDGELEY GLOUCESTER. GL2 4NF		GEOTECHNICAL ENGINEERING LTD OLYMPUS PARK QUEDGELEY GLOUCESTER. GL2 4NF			
Description and Identification of The Equipment	Safe Working Loads(s)	Date of Manufacture if known	Date of Last Thorough Examination		
P29. COMACCHIO DRILL RIG. MODEL: GEO 305. WEIGHT: 4500 KG. SERIAL NO: 2387. c/w SERVICE WINCH SERIAL NO: 15-2411, CAPACITY 2t FITTED WITH WINCH ROPE S/N: C321A, SWL 1.4t at 5:1 FOS MBL OF ROPE = 7.12t, SWL 2.3t at 3:1 FOS - BS EN16228.	5t MAST CAPACITY	2019	22.05.2021		
AND 6MM WIRELINE WINCH SERIAL NO: 14-0593, CAPACITY 800 KG AND ROPE SERIAL NO: C919D, SWL 480KG at 5:1 FOS MBL OF ROPE = 2.65t, SWL 800KG at 3:1 FOS - BS EN16228.					
Is this the first examination after installation or after assembly at a new site or location?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	If the answer to the previous question is Yes, has the equipment been installed correctly?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Was the examination carried out: -					

5) Safe Working Load of lifting equipment (mast)

3) Unique ID details for the machine.

3) Unique ID number and details for the service winch and steel wire rope

3) Unique ID and details for the wireline winch and steel wire rope

6(a) and 6(b) – details of first thorough examination

3) Date of manufacture of machine

5) Safe Working Load of winch rope at 5:1 and 3:1 FOS

British Standard for Drilling and Foundation equipment

5) Safe Working Load of wireline rope at 5:1 and 3:1 FOS

Was the examination carried out: -						
Within an interval of 6 months	Yes <input type="checkbox"/>	No <input type="checkbox"/>	In accordance with an examination scheme?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Within an interval of 12 months	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	After the occurrence of exceptional circumstances?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Identification of any part found to have a defect which is or could become a danger to persons and a description of the defect : (If none state NONE) NONE.						
Is the above a defect which is of immediate danger to persons? If yes, a copy of this report should be forwarded to the relevant enforcing authority'				Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Is the above a defect which is not yet, but could become a danger to persons? If Yes, please state date by when :				Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Particulars of any repair, renewal or alteration required to remedy the defect identified above: (If not applicable, state NOT APPLICABLE) N/A.						
Particulars of any tests carried out as part of the examination: (If none state NONE) NONE						
IS THIS EQUIPMENT SAFE TO OPERATE?					Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Name of the person making this report:	Name of the person authenticating this report:		Latest date by which next thorough examination must be carried out:			
	Signature:		24/05/2023			
Name and address of employer of persons making and authenticating this report:						

7(a) (i) and (i) Testing interval.

8(c) (iii) Description of any repair requirements.

8(e) Type of inspection. It may reference only a visual inspection.

7(b) It MUST be stated on the certificate that the machine is safe to operate / accessory is safe to use.

7(a) (iii) and (iv) Specific reasons for the inspection and certification Testing

8(a) Description of any defect.

8(c) (i) Time defect could become a danger.

8(d) Latest date on next Thorough examination.

Note: Annotated Report of Thorough Examination provided courtesy of Geotechnical Engineering Limited.