



BSI Standards Publication

DRAFT FOR DEVELOPMENT

Cranes – Condition monitoring – Specification for data logging equipment

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover and a back cover.

Foreword

Publishing information

This Draft for Development is published by BSI and came into effect on 30 November 2008. It was prepared by Subcommittee MHE/3/11, *Crane safety and testing*, under the authority of Technical Committee MHE/3, *Cranes and derricks*. A list of organizations represented on these committees can be obtained on request to their secretary.

Information about this document

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because the industry is still developing standard manufacturing practices and it was felt that the document would benefit from an extended period of trial and consultation. It should be applied on this provisional basis, so that information and experience of its practical application can be obtained.

A review of this Draft for Development will be carried out not later than 2 years after its publication.

Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development, will be made in an announcement in the appropriate issue of Update Standards.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

Observations which it is felt should receive attention before the official call for comments will be welcomed.

These should be sent to the Secretary of BSI Technical Committee MHE/3 at British Standards House, 389 Chiswick High Road, London W4 4AL.

This Draft for Development covers the condition monitoring of cranes, a process which recognizes the fact that no crane can be designed and built for infinite usage. All cranes have to work within the constraints of their intended use, and thus should undergo condition monitoring.

This Draft for Development covers specification for data logging devices used as a part of condition monitoring. The document sets out general parameters and performance criteria for data logging systems, but does not cover the detailed design of such systems.

Annex A (informative) gives a brief history of data logging on cranes.

A list of the minimum parameters to be measured by data logging systems on all cranes is given in Annex B (normative), whilst typical parameters to be monitored on a number of specific types of cranes are given in Annex C (normative).

Annex D (informative) gives information on typical analysis of data downloaded from a data logger fitted to a crane.

Annex E (informative) gives outline information on current data transfer methods.

Use of this document

It has been assumed in the preparation of this Draft for Development that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this Draft for Development are presented in roman (i.e. upright) type. Its requirements are presented in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a Draft for Development cannot confer immunity from legal obligations.

Attention is drawn to the following statutory regulations:

- Electromagnetic Compatibility Regulations 2006 (SI 2006/3418) [1];
- Electrical Equipment (Safety) Regulations 1994 (SI 1994/3260) [2].

Introduction

Current practice has shown that there are three main benefits to be obtained from the accurate logging of crane performance data.

a) Event recording

Event recorders record the events before, during and after a lift. This data can be used for accident analysis and to monitor operator performance (for example, persistent over-lifting). This allows a crane owner to look at the events leading up to an incident, such as overturning or structural failure, so that the exact mass and position of the load can be determined, and hence the cause of the incident ascertained. The data can also be used to identify operators who habitually abuse the crane.

b) Condition monitoring

To provide information for condition monitoring (see ISO 12482-1) against the crane manufacturer's specified criteria.

The recording of the magnitude of lifts as a percentage of rated capacity, the duration of the lift, and the duration of each of the crane motions, allows an assessment of component and structural life to be made and provides an accurate indication of the need for thorough examinations, based on the lifting cycle history rather than the traditional time period basis. This process ensures that components are examined and replaced at a time that optimizes cost control and safety.

c) Crane usage analysis

To analyse lift data for operational and marketing purposes and to guide future purchases.

Being able to obtain all the operational data on a crane, such as how long it has worked in a day, what duty it was rigged on, what percentage of rated capacity was used and whether a large capacity hook block or fly jib was used, can help to establish what customers are using a crane for, and whether it is worth carrying a fly jib with every crane. This information also enables operator hours to be accurately established.

1 Scope

This Draft for Development specifies general requirements for data logging devices which, when fitted to cranes, monitor specified parameters to provide information on crane use. The analysis of these data is beneficial to owners, operators and incident investigators, leading to the safer and more economically efficient use of cranes.

NOTE Annex A gives a brief history of data logging and its application to cranes.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7262:1990, *Specification for automatic safe load indicators*

BS EN 60068-1, *Environmental testing – Part 1: General and guidance*

BS EN 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

BS EN 60529:1992+A2:2000, *Specification for degrees of protection provided by enclosures (IP code)*

BS EN 60721-3-5, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 5: Ground vehicle installations*

BS EN 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

BS EN 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

PD IEC TR 60721-4-5:2002, *Classification of environmental conditions – Part 4-5: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 – Ground vehicle installations*

3 Terms and definitions

For the purposes of this Draft for Development, the following terms and definitions apply.

3.1 condition monitoring

monitoring the use and condition of a crane against the design constraints of its intended use, to ensure that any limits imposed by those constraints are not exceeded

3.2 data logger

device that measures signals, converts them to digital data and stores the data internally

3.3 electromagnetic compatibility (EMC)

ability of electrical and electronic products to be constructed so that they do not cause excessive electromagnetic interference and are not unduly affected by electromagnetic interference

3.4 offline analysis

all actions performed with the data after the data have been acquired

3.5 safe working period

period of time between two successive general overhauls

[ISO 12482-1:1995]

3.6 threshold value

value of a monitored parameter below which data cannot be recorded by the data logger

3.7 use period

period between the data logger being switched on (powered up) at the beginning of a work period and switched off (powered down) at the end of a work period

4 Data logging system

4.1 General

Data logging systems generally use some form of computer to capture, process, store and transfer the data so the basic system requirements shall be established before software and hardware are specified to ensure that the computer is capable of performing the required tasks.

4.2 Data parameters**4.2.1 Functions to be monitored**

The data logging equipment shall be capable of monitoring:

- a) the minimum parameters specified for all cranes in Annex B; and
- b) the minimum parameters specified for specific crane types in Annex C, as appropriate.

NOTE 1 The crane parameters to be logged vary with crane type, model and specific requirements of the manufacturer and crane owner/user. Measurement and recording of these parameters can either be derived from existing sensors or through the fitment of additional transducers.

NOTE 2 Information on limiting and indicating devices for cranes is given in BS EN 12077-2.

4.2.2 Monitoring frequency

Monitoring frequency shall be set to ensure that sufficient data are captured over a given period to enable a meaningful analysis of a major event (such as a crane overturn) to be made, and to ensure that adequate load spectrum data are collected for condition monitoring purposes.

NOTE The data sampling frequency for the parameters being logged will vary with crane type, model and specific requirements of the manufacturer and crane owner/user.

4.2.3 Date and time

The recorded time and date shall be that dictated by the data logger's internal clock.

4.3 Data integrity

4.3.1 General

The data logging system shall be such as to ensure that the data collected and stored accurately represent the crane's usage over a given period.

4.3.2 Threshold values

Threshold values shall be set at a level that will avoid false recording of events.

NOTE For example, if the threshold values are too low, every time a load bounces and the dynamic element of the total load force changes, the bounce is counted as the start of a new lift. This has the effect of rapidly filling the data logger memory with spurious data, thereby negating the benefits of data logging.

4.3.3 Rigging and other non-lifting activities

The data logging system shall be set to ensure that rigging and other non-lifting activities permitted by the crane manufacturer are not counted as overloads.

4.3.4 Full memory protocol

The data logging system shall be set to ensure that if the data storage memory fills up through lack of regular downloading, the oldest data are automatically deleted to allow new data to be stored.

NOTE This ensures that the latest data are always available for analysis in the event of an accident.

4.4 In-logger processing

Provision shall be made for processing the captured data within the data logger for functions such as:

- a) the evaluation of data against alarm threshold values;
- b) the computation of the remaining safe working period;
- c) the processing of data for visual display.

4.5 Operator identity

In order to prevent unauthorized access and to ensure that the data collected during the use period are linked to an individual operator, each operator shall be provided with individual access codes at system power-up.

4.6 Data format

The format in which data are stored in the data logger memory and downloaded for analysis shall be compatible with the offline analysis software.

NOTE 1 Choice of a particular format depends on the amount of data to be transferred and the rate of data sampling.

NOTE 2 Data formats are generally ASCII text files, binary files or database (scaled binary files). A given sample of data requires 2 MB of storage in raw binary, 8 MB in scaled binary or 24 MB in ASCII file format.

4.7 Analysis software

The software used for carrying out offline analysis of the downloaded data shall be compatible with the data format and shall be capable of running on a standard office desktop computer. The software shall be menu driven through a Graphical User Interface and shall enable all the data to be analysed and presented in an easily assimilated form, providing reports in both tabular and graphical (chart) form.

Provision shall be made for viewing reports on screen and/or printing hard copies.

NOTE Annex D gives brief outline information on methods of data analysis current at the time of publication.

5 Data logging equipment/hardware

5.1 System self-checking

Data logging equipment shall be provided with a self-checking routine that runs automatically at system start-up and at intervals that are compatible with the monitoring frequency.

5.2 Environmental protection

5.2.1 General

The data logging equipment installed on the crane shall be protected to ensure that it is unaffected by the environment in which the crane operates. As a minimum, the equipment shall conform to the environmental parameters 5K4H/5B1/5C1/5S1/5F1/5M3, as specified in BS EN 60721-3-5.

NOTE 1 Equipment intended for specific use in environments outside these parameters should be designed accordingly.

NOTE 2 See Table 1 for details on testing.

5.2.2 Enclosures

The data logging equipment shall be housed in an enclosure that provides a degree of protection, in accordance with BS EN 60529:1992+A2, of at least:

- a) IP55, for equipment which is located within the crane cab or machinery housings;