TECHNICAL SPECIFICATION

ISO/TS 23624

First edition
2021-05

Cranes — Safe use of high-performance fibre ropes in crane applications

Appareils de levage a charge suspendue — Utilisation en sécurité des câbles synthétiques haute performance pour les applications sur les appareils de levage à charge suspendue

Reference number
ISO/TS 23624:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 HPFR performance considerations **3**
4.1 Responsibilities 3
4.2 Risk assessment 3
4.3 Rope 4
4.3.1 Types of ropes 4
4.3.2 Selection of ropes 5
4.4 Proof of competence 7
4.5 Safety factor at discard for HPFR 7
5 Crane design considerations **8**
5.1 Termination on the drum 8
5.2 Termination at load side 9
5.3 Drum 9
5.3.1 Lowering limiter 9
5.3.2 Forces on flange and tube (Multilayer drum) 9
5.3.3 Shape of grooves on drums 10
5.3.4 Clearance between rope and diameter of drum flange 10
5.3.5 Temperature limits 10
5.4 Sheaves 10
5.4.1 Shape of grooves 10
5.4.2 Material of sheave 10
5.4.3 Minimum D/d ratio 10
5.5 Crane 11
5.5.1 Contact surfaces 11
5.5.2 Fleet angles 11
5.5.3 Substitution on existing design and optimization on new designs 11
5.5.4 Substitution on used cranes 11
6 Qualification testing of HPFR **11**
6.1 General 11
6.2 Basic data of HPFR 12
6.2.1 General 12
6.2.2 Minimum breaking strength, MBS 12
6.2.3 Residual breaking strength, RBS 12
6.2.4 Residual lifetime 12
6.3 Qualification testing 12
6.3.1 General 12
6.3.2 Bending fatigue performance 13
6.3.3 Multilayer spooling performance 13
6.3.4 Tension fatigue performance (rope and termination) 13
6.3.5 Termination performance (Static) 14
6.4 Interpolation of test results 14
7 Information to be provided regarding care, maintenance and inspection **14**
7.1 General 14
7.2 Installation of HPFR 14
7.2.1 Stationary ropes 14
7.2.2 Running ropes 14
7.3 Maintenance 15
7.3.1 Maintenance of the rope 15

7.3.2 Maintenance of rope-related parts of the crane 15
7.4 Inspection 15
7.5 Discard criteria 15
Annex A (normative) **Selection of ropes** **18**
Annex B (informative) **Qualification testing** **22**
Annex C (informative) **HPFR test report – Spreadsheet** **28**
Annex D (informative) **Example of discard** **38**
Bibliography **42**

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 3, *Selection of ropes.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Recent developments of high-performance fibre ropes (HPFR) made from synthetic fibre have led to comparable strength with regard to steel wire ropes. The main advantages of using HPFR on cranes are:

a) light weight (significant weight reduction);

b) no environment pollution by grease (no re-lubrication);

c) easy handling (faster and easier assembly/disassembly);

d) robust spooling (increased tolerance for spooling failures).

The use of HPFR on cranes has already started, however, there is limited experience with HPFR in comparison to the long-term application of steel wire ropes.

For steel wire ropes, substantial experience over many decades covering both rope selection and discard criteria exists, which can be found in International Standards (e.g. ISO 16625 and ISO 4309). Currently, there is no standard available that deals with design and discard criteria for the use of HPFR on cranes. Therefore, this document has been developed based on the content of the FEM 5.024 guideline.

The FEM 5.024 guideline was developed by the Fédération Européenne de la Manutention (FEM) as a joint project with various stakeholders in the industry. It is based on first experiences with mobile cranes and the requirements/limits in some cases can be specific to mobile cranes only.

This document includes additional input from tower crane and electric overhead traveling crane manufacturers. Adaptation to other crane types or applications can be necessary.

This document reflects the current knowledge about the use of HPFR on cranes.

Cranes — Safe use of high-performance fibre ropes in crane applications

1 Scope

This document gives guidance for the safe use of high-performance fibre ropes (HPFR) in crane applications.

This document also covers winch applications. The mention of crane applications implicitly includes winch applications.

This document covers performance criteria and the necessary evaluation to enable selection of HPFR as well as best practice guidelines on procedures, testing and maintenance to safely operate HPFR in crane applications including provisions for assembly/disassembly.

The performance criteria are related to tasks performed when using cranes as intended, including assembly/disassembly, operation and required checks and maintenance.

This document does not deal with so-called hybrid ropes which are a combination of steel wire and high-performance fibres, where the load bearing capability is shared between steel wires and the high-performance fibre. This document does not deal with HPFR used for high risk applications (e.g. transport of hot molten metal).

2 Normative references

The following documents are referred to in the text in such a way that some or all their content constitutes requirements 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.

ISO 2307:2019, *Fibre ropes — Determination of certain physical and mechanical properties*

ISO 4309:2017, *Cranes — Wire ropes — Care and maintenance, inspection and discard*

ISO 9554:2019, *Fibre ropes — General specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
assembly/disassembly
operations needed to set up/down a crane in a specific configuration or change the configuration

3.2
competent person
designated person, suitably qualified by knowledge and experience, and with the necessary instruction to ensure that the required operations are carried out correctly