Extracts from ISO 4309 2017 11

3 Terms and definitions
For the purposes of this document, the terms and definitions given in ISO 17893 and the following apply.
ISO and IEC maintain terminological databases for use in standardization at the following addresses:
— ISO Online browsing platform: available at https://www.iso.org/obp
— IEC Electropedia: available at http://www.electropedia.org/

3.1
nominal diameter - diameter by which the rope is designated

3.2
measured diameter - actual diameter
dm - average of two measurements, taken at right angles to one another, of the diameter that circumscribes the rope cross-section

3.3
reference diameter - dref - measured diameter (3.2) of a section of rope that is not subject to bending, taken directly after running in the new rope
Note 1 to entry: This diameter is used as the baseline for uniform change in diameter.

3.4
crossover zone - that portion of rope coincident with a crossing over of one wrap by another as the rope traverses the drum or rises from one layer to the next at the drum flange

3.5
Wrap - one revolution of rope around a drum

3.6
Reel - flanged spool on which rope is wound for shipment or storage
1) This edition of ISO 4301-1 has been provisionally retained.

3.7
wire rope periodic inspection
in-depth visual inspection of the rope plus measurement of the rope and, if practicable, an assessment of its internal condition
Note 1 to entry: If required, this may include an MRT (3.11) performed by a person competent in the operation of MRT equipment and interpretation of trace data.

3.8
competent person - person having such knowledge and experience of wire ropes on cranes and hoists as is necessary for that person to assess the condition of the rope, make a judgement as to whether it may remain in service and stipulate the maximum time interval between inspections
Note 1 to entry: If an MRT (3.11) is required, it has to be performed by a competent person in that discipline.

3.9
valley wire break - wire break that occurs at the inter-strand contact point or valley area between two outer strands
Note 1 to entry: Outer wire breaks that also occur within the rope anywhere between one valley area and the next — see Figure 1 — including any strand-core breaks, may also be regarded as valley wire breaks The red lines indicate the contact points and the location of the valley breaks.

3.10
severity rating - amount of deterioration expressed as a percentage towards discard
Note 1 to entry: The rating may relate to either an individual mode of deterioration [e.g. broken wires, decrease in diameter or loss of metallic area as detected by MRT (3.11)] or the combined effect of more than one mode of deterioration, e.g. broken wires and decrease in diameter.

3.11
magnetic rope test - MRT
non-destructive testing (NDT) based on the measurement of the magnetic flux leakage of a magnetized rope

3.12
test head - device on that part of the MRT (3.11) instrument positioned around the rope during testing which generates the magnetizing field and contains the detecting or sensing elements

3.13
base trace - signals on the MRT (3.11) recording display as the rope travels through the test head on the first occasion that it is tested
Note 1 to entry: The trace is the datum against which future in-service deterioration effects are compared. The trace reflects the construction of the rope and changes in magnetic characteristics of the rope along its length, e.g. magnetic permeability differences.

3.14
local fault - local flaw – LF - short discontinuity in the wire rope, such as a wire break, welded wire, corrosion pit or inter-strand nicking

3.15
loss of metallic area - LMA
change in metallic cross-sectional area expressed as percentage of nominal metallic cross-sectional area of the new rope
Note 1 to entry: Loss of metallic area is normally associated with damage such as uniform corrosion, wear, abrasion/mechanical damage or wire breaks.

4.6
Running-in the new rope - Before bringing the rope into full operation on the crane, ensure that all hoisting limiting and indicating devices associated with the operation of the crane are correctly functioning.
In order to allow the components of the rope to better adjust to the normal operating conditions, the crane should be operated at reduced speed and loading [i.e. down to 10 % of the working load limit (WLL)] for a number of operational cycles.

4.7
Maintaining the rope - Maintenance of the rope shall be carried out relative to the type of crane, its frequency of use, the environmental conditions and the type of rope.

During the life of the rope, and before it shows any signs of dryness or corrosion — particularly over those lengths which travel through sheaves and enter and exit the drum and those sections which are coincident with a compensating sheave — the rope shall be dressed from time to time, as determined by a competent person. In some cases, it may be necessary to clean the rope before applying the dressing in order for it to be effective.
The rope dressing shall be compatible with the original lubricant applied by the rope manufacturer and shall have penetrating characteristics. If the type of rope dressing is not identified in the crane manual, the user shall seek guidance from the supplier of the rope or the wire rope manufacturer.

5 Inspection

5.1 General

In the absence of any particular instructions regarding inspection provided by the manufacturer of the crane in the operator's manual and/or by the manufacturer or supplier of the rope, the general principles for inspection given in 5.2 to 5.6 shall be followed.

5.2 Daily visual inspections

At least the intended working section of rope for that particular day shall be observed with the objective of detecting any general deterioration or mechanical damage. This shall include the points of attachment of the rope to the crane (see Figure A.2).
The rope shall also be checked to ensure that it is sitting correctly on the drum and over the sheave(s) and has not been displaced from its normal operating position.
Any appreciable change in condition shall be reported and the rope examined by a competent person in accordance with 5.3.
If, at any time, the rigging arrangement is modified, such as when the crane has been moved to a new site and re-rigged, the rope shall be subjected to a visual inspection as described in this subclause.
The driver/operator of the crane may be appointed to carry out daily checks to the extent that the driver/operator is sufficiently trained and considered competent to carry out this action.

5.3 Periodic inspections

5.3.1 General

Periodic inspections shall be carried out by a competent person.
The information gained from a periodic inspection is to be used to assist in deciding whether a crane rope
a) can safely remain in service and by which latest time it shall undergo its next periodic inspection, or
b) needs to be withdrawn immediately or within a specified timeframe.
Through an appropriate assessment method, i.e. by visual means and/or measurement, or with an MRT, the severity of deterioration shall be assessed and expressed either as a percentage (e.g. 20 %, 40 %, 60 %, 80 % or 100 %) of the particular individual discard criteria or in words (e.g. "Slight", "Medium", "High", "Very high" or "Discard").
Any damage that might have occurred to the rope prior to it being run in and entering service shall be assessed by a competent person and observations shall be recorded.
A list of the more common modes of deterioration and whether each can be readily quantified (i.e. by counting or measuring) or needs to be subjectively assessed (i.e. by visual means) by the competent person is given in Table 1.

Table 1 — Modes of deterioration and assessment methods

Mode of deterioration	Assessment method

- Number of visible broken wires (including those which are randomly distributed, localized groupings, valley wire breaks and those that are at, or in the vicinity of, the termination)
- By counting

- Loss of metallic area caused by broken wires
- Visual, MRT
- Decrease in rope diameter (resulting from external wear/abrasion, internal wear and core deterioration)
- By measurement
- Loss of metallic area caused by mechanism other than broken wires e.g. corrosion, wear, etc.
- Visual, MRT
- Fracture of strand(s)
- Visual
- Corrosion (external, internal and fretting)
- Visual, MRT
- Deformation
- Visual and by measurement (wave only)
- Mechanical damage
- Visual
- Heat damage (including electric arcing)
- Visual

5.3.3 Extent of inspection
Each rope shall be inspected along its entire length.
However, in the case of a long length, and at the discretion of the competent person, only the working length plus at least five wraps on the drum may be inspected. In such a case, and where a greater working length is subsequently foreseen after the previous inspection and prior to the next one, that additional length should also be inspected before the additional length of rope is used.

5.6 Inspection by magnetic rope test method
An MRT may be used as an aid to periodic inspection to determine the location of those sections of rope that could be subject to deterioration.
If it is intended to carry out an MRT as an element in periodic inspection, the rope should be subjected to an initial examination (base trace) as soon as possible in its lifetime to serve as a "datum" reference point (sometimes referred to as "rope signature") for future comparison.
An MRT should be used where defects might exist which might not be identified by visual inspection alone and shall be performed together with a visual inspection.
Where there is no specific International Standard available for the qualification of MRT devices themselves, guidance should be taken from standards that cover the topics instrumentation and instrument verification, e.g. EN 12927 or ASTM E157-11(2016)e1.
NOTE Some limitations of MRT are
— it can only be used for ferromagnetic steel ropes,
— where the gap between the ends of broken wires is smaller than the sensitivity of the instrument, and
— a rope has restricted access for the measuring instrument e.g. near end terminations or equalizer pulleys.

6.3 Magnetic rope test (MRT)
When performing an MRT, the competent person shall have knowledge of at least one or the other of the following for determining LF:
— the diameters and quantities of all wires in the rope that is subject of the MRT;

— the maximum wire diameter and the metallic rope cross-section of the rope that is subject of the MRT.
In addition, for determining, LMA, the competent person shall be at least in possession of the metallic rope cross-section.
This information should be provided by the manufacturer or supplier of the rope.

The discard criteria for MRTs are given in Annex C. If the wire breaks found by an MRT can be identified as outer wire breaks in a visual inspection, the competent person may use Table 3 in or Table 4 instead of Table C.1.

6.4 Decrease in rope diameter

6.4.1 Uniform decrease along the rope

The discard criterion values for uniform decrease in rope diameter for sections of rope which spool on a single-layer drum and/or run through a steel sheave are shown, in bold, in Table 5. They do not apply to those sections of rope which are coincident with crossover zones or other sections of rope which are similarly deformed as a result of spooling on a multi-layer drum.
The calculation to determine the amount of decrease in diameter and expression as a percentage of nominal diameter of rope is given in 6.4.2.
Table 5 also shows the equivalent uniform decreases in diameter, expressed as a percentage of nominal diameter of rope, for severity ratings expressed in increments, for convenience, of 20 % (i.e. 20 %, 40 %, 60 %, 80 % and 100 %). Other severity ratings, e.g. expressed in increments of 25 % (i.e. 25 %, 50 %, 75 % and 100 %), may also be selected.