



FEDERATION
EUROPEENNE DE LA
MANUTENTION

Product Group Cranes
and Lifting Equipment

FEM
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- Guideline -
“Hydraulic Hoses on Mobile Cranes”

- Leitfaden -
“Hydraulikschläuche an Mobilkranen ”

- Guide -
"Tuyaux hydrauliques sur les grues mobiles "

Fédération Européenne de la Manutention - Product Group Cranes and Lifting Equipment

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Sources see end of the document

CONTENT

	Page
1. Introduction	3
2. Scope	3
3. Existing Standards	3
4. Lifetime	3
5. Inspection	4
6. Documentation:.....	6
7. References	7

Legal Note: *This paper should serve only as a reference and overview: it is meant to provide guidance in the assessment of risks related to hydraulic hoses on mobile cranes. It neither addresses each and every imaginable scenario, nor is it a binding interpretation of the existing legal framework. It does not and cannot replace the study of the relevant directives, laws and regulations. In addition, the specific features of different products and their various applications have to be taken into account. This is why the assessments and procedures referred to in this paper may be impacted by a large variety of circumstances. Accordingly, a number of other interpretations are also possible.*

1. Introduction

Following a road accident with fatalities caused by a car skidding on a film of oil allegedly leaking from a poorly maintained mobile crane, European Mobile Crane Manufacturers organized as FEM issue this guideline about the service life of hydraulic hoses in addition with information regarding regular inspection, and replacement of hoses.

Hydraulic hoses are made of rubber bulk hose and fittings and are intended to convey hydraulic oil up to a working pressure of 420 bars.

2. Scope

This document applies to all hydraulic hoses in mobile cranes and is considered as complementary information to the machine operators' manual. It applies to all types of mobile crane as defined in EN13000 Cranes- Mobile Cranes.

FEM herewith provides consistent information from manufacturers of mobile cranes to users of the equipment about the characteristics of hydraulic hoses, and the necessity and content of their inspection and replacement.

3. Existing Standards

Hydraulic hoses are designed, tested and manufactured according to following standards e.g.:

- ISO 8331, Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance,
- ISO 2230, Rubber products — Guidelines for storage,
- ISO 1402, Rubber and plastics hoses and hose assemblies — Hydrostatic testing
- ISO/TR 17165-2, Hydraulic fluid power — Hose assemblies — Part 2: Recommended practices for hydraulic hose assemblies
- EN 853 – EN 857 – Rubber hoses and hose assemblies

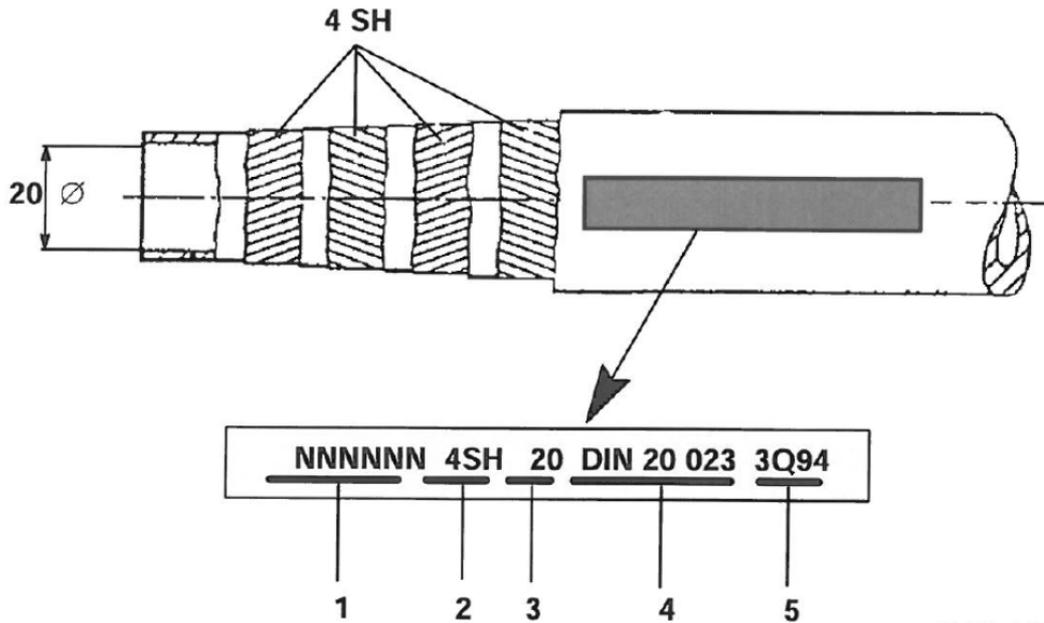
or German standards/regulations e.g.:

- DIN 20066:2002-10 Although this is a German standard, it is often taken as reference in hose manufacturer standards or guidance,
- BGR 237 Feb 2008 – BG-Regel: Hydraulik Schlauchleitungen – Regeln für den sicheren Einsatz.

4. Lifetime

Hydraulic hoses are made of rubber bulk hose which is subject, by nature, to changes in physical properties over the years and has therefore a **limited lifetime**. The manufacturer of the bulk material guarantees a shelf life time of minimum 10 years from the date of manufacture. This lifetime is based on the assumption that the hoses are stored, installed, and used correctly.

NOTE The date of manufacture of the bulk material is usually indicated by marking on the rubber hose, see example below. The date of manufacture of the hose assembly is usually indicated by marking on the fittings.



Key

- 1 Manufacturer of bulk material
- 2 Hose type (classification)
- 3 Rated width
- 4 Standard Reference
- 5 Date of manufacture of bulk material (quarter and year)

NOTE Please refer to the relevant standards relative to hydraulic hoses at the end of this document for more details.

The service life of a hose used on a mobile crane may significantly vary from the indicated lifetime of the hose. The service life is influenced by a number of factors such as environment (temperature, humidity, corrosive air...) and use, duty cycles, bending cycles, abrasion, fluid etc. External unfavourable factors like heat, repeated bending under pressure etc. can reduce the life time significantly whereas other circumstances could allow a service life that may even exceed the given period. Only a competent person (see below) may extend the lifetime beyond the 10 years life time of a hose assembly based on his inspection, except the operators manual of the manufacturer is stating shorter exchange intervals of hoses (e. g.: hoses for rear axle steering).

As such it is necessary to assure that the routing of the hose is maintained as foreseen by the manufacturer to avoid abrasion and/or excessive bending/torsion acting on the hose and that regular inspections are carried out.

5. Inspection

The daily visual check of the equipment by the operator before starting the operation shall include an inspection of the hydraulic hoses as far as possible; any traces of hydraulic oil on the crane or beneath a parked mobile crane shall lead to further investigation. The daily check might indicate irregularities and/or leakages in the hydraulic system to be taken care of immediately. In addition to these daily checks FEM considers that regular inspections of the hose assemblies are necessary.

Frequency of Inspections:

The inspection of hydraulic hoses shall be done according to manufacturer's information in the manual; the maintenance manual shall describe the inspection interval. The owner shall make his own risk assessment on basis of the manufacturer information and others. If no information is provided, following general rule shall be applied:

- If crane age <10 years; at least 1 inspection every year
- If crane age >10 years; at least 1 inspection every 6 months

Competency of Person carrying out the Inspection:

- The inspection shall be carried out by a competent person with the adequate knowledge and experience in hydraulics and mechanics.
- The person doing the inspection shall be aware of all requirements described in the applicable standards (standard references see above).

Scope of inspection:

The inspection of hydraulic hose shall be mainly focused on following aspect:

- The hose shall not present any signs of outer damage or abrasion; this could be the result of:
 - Contact with others parts due to incorrect routing or due to vibration/movement of the hose during operation.
 - The environment, e.g. projection of external particle (hoses mounted on exposed areas such as underneath a vehicle being projected by stones, water, salt etc. during driving) or aggressive environment (corrosive atmosphere, etc.)
 - Hoses not fully accessible for inspection shall be disassembled; if hoses are protected with a protection hose (e.g. corrugated hose), the protection hose shall be inspected as well (detection of contact area on protection hose may indicate that an abrasion occurs on the hydraulic hose).

Inspection criteria:

Hydraulic hoses shall be replaced if any of following criteria is true:

- Damages on outside surface of the bulk hose (e.g. crack, cuts, abrasion)
- Embrittlement due to ageing of outer surface (cracks appearing)
- Deformation that does not correspond to the original routing and shape of the hose, this criterion shall be checked in both non-pressurized and pressurized conditions and/or when bending (e.g. check for separation of hose layers, formation of blowholes, crushed points, kinks, torsioning).
- Leakages
- Damages or deformation at hose fittings (sealing functionality affected)
- Movement between hose bulk and hose assembly, hose creeping out of fitting
- Corrosion on fittings that can affect strength or function of the fitting.
- Further requirements and details can be found in the relevant standards listed above.

Replacement of Hydraulic Hose If replacement of hydraulic hose assemblies is required, it shall be considered to use original spare parts from the OEM or hose assemblies according to the OEM specification which includes the fittings, bulk material and manufacturing process.

Routing of hose during assembly or replacement:

Following guidelines for the routing of hose assemblies are applicable for the crane manufacturer, but also for users when replacing hose assemblies:

- **Hose Bending Radii**

The values of bending radii chosen by the OEM are based on international or hose manufacturer specifications and have been proven by testing of the hose assemblies. Bending the hose below the minimum bending radius specified by the OEM leads to loss of mechanical strength and hence possible hose failure.

- **Hose Assembly Routing**

- The routing of a hose assembly shall be as specified by the OEM to avoid any damage to the hose by e.g. stretching, compression, kinking or abrasion over sharp edges to assure maximum service life and safety. It shall be checked after replacement that the routing is correct for the pressurized and non-pressurized hose assembly. It might be necessary to check for moving parts in the direct surrounding of the hose assembly.
- When the hose assembly is installed in straight direction, slack in the hose to allow for length changes needs to be assured. Length changes will occur when pressure is applied; e.g. when pressurized, a hose will shorten and a hose that is too short may pull loose from the fittings or will stress the hose fittings, causing premature metallic or seal failures.
- Mechanical straining of the hose needs to be avoided, so the hose must not be twisted during installation. Clamping (holding/supporting) of the hose assembly according to the OEM specification securely routes the hose and/or avoids contacting surfaces that will cause damage to the hose. It is important, that the hose can keep its functionality as a “flexible-pipe” and is not restricted from changing its length when under pressure.
- Hoses for high- and low-pressure lines shall not be crossed (with direct contact) or clamped together, as the difference of changes in length could wear the hose covers.
- Hoses should be kept away from hot parts as high ambient temperatures will shorten hose life. Protective insulation of the hose as foreseen by the OEM may be necessary in high ambient temperature areas and needs to be reinstalled after repair.

6. Documentation:

When hoses are inspected any remarkable observation shall be documented by the competent person: it is proposed to document the location and state of such hose assemblies, date and time. If the competent person decides not to exchange hose assemblies exceeding the normal life time or with minor damages, this decision shall be documented. The date for the next inspection of these hydraulic hose assemblies shall be given in the documentation.

Any observation and decisions of the competent person shall be kept in the documentation of the crane.

7. References

Established by the Technical Committee of Product Group Cranes and Lifting Equipment of the Fédération Européenne de la Manutention (FEM)

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