Crane Safety – Developments in Europe
- EN13000 standard -

WSHC – Cranes Safety Symposium 2011

Singapore / August 5th 2011

Vincent Stenger – Terex Cranes
Content

- Background information
- TEREX Cranes products
- EN13000 – workgroup
- EN13000 – Definition & Scope
- EN13000 – main requirements
- EN13000 – current developments
  - Amendment 2012
  - Revision 2014+
- Other Safety Topics and current work items beside standard committees
Background Information

Vincent Stenger

- Mechanical Engineer
- With Terex since 2008 located in Zweibrücken / Germany
- Product Safety Manager
  - Tasks:
    - “Prevention” standards, risk analysis, support court proof organization
    - “Defense” support in litigation, interface Terex entity <-> Lawyer
- Participant in CEN TC147 / WG11 (EN13000) and FEM Mobile Cranes

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Terex Cranes
Product portfolio
EN13000 standard
Background
Machinery Directive

- Law
- Dual objective:
  - To permit the free movement of machinery within the European market
  - To ensure a high level of protection of health and safety.
- European Directive must be transposed into national law
- Main requirements / changes vs previous directive:
  - Risk Assessment, Limits of machinery, Reasonably foreseeable misuse
  - Nominated person responsible for technical file
  - “New approach”
    - harmonized standards
    - Provides presumption of conformity

→ EN13000
EN13000 standard
Workgroup
Definition & Scope
EN13000 – Workgroup TC147 WG11

A comprehensive and representative group

- Manufacturers
  - Crane manufacturers (FEM)
  - Crane control system suppliers
- Users (ESTA and national organizations)
- HSE (national HSE representatives)
EN13000 – References

EN13000 belongs to the „family“ of EN standards and makes reference to:

- 40 ISO standards (including EN ISO standards),
- 35 EN standards and
- FEM rules 5.004 and 1.001
Definition & Scope

EN13000 - Scope

- Design
- Construction
- Installation of safety devices
- Information for use
- Information for maintenance
- Information for testing/inspections
Mobile Crane – definition – ISO4306-2

- Self-powered
- Jib-crane
- Capable of travelling, laden or unladen
- Hoist
- Relying on gravity for stability

3.18 mobile crane

self powered jib crane capable of travelling loaded or unloaded without the need for fixed runways and relying on gravity for stability.

NOTE 1. Examples of mobile cranes are given in the Annexes A, B.1 and B.2.
NOTE 2. Mobile cranes can operate on tyres, crawlers or with other mobile arrangements. In fixed positions, they can be supported by outriggers or other accessories increasing their stability.
NOTE 3. The superstructure of mobile cranes can be of the type of full circle slewing, of limited slewing or non slewing. It is normally equipped with one or more hoists and/or hydraulic cylinders for lifting and lowering the jib and the load.
NOTE 4. Mobile Cranes can be equipped either with telescopic jibs, with articulated jibs, with lattice jibs – or a combination of these – of such a design that they can readily be lowered.

NOTE 5. Loads can be handled by hook block assemblies or other load-lifting attachments for special services.
Definition & Scope

Product types **not covered**:
- Loader cranes (see EN 12999)
- Off-shore cranes (See EN 13852-1)
- Floating cranes (See EN 13852-2)
- Variable reach truck / Telehandler (See EN 1459)
- Mobile self-erecting tower cranes
- Earth-moving machinery including material handlers (see EN474-series).

Applications **not covered** (non-intended use):
- Lifting of person (incl. entertainment e.g. bungee jumping, suspended restaurant)
- Duty cycle work
TEREX Cranes
TEREX Cranes – Mobile Cranes
EN13000 standard
Main requirement of EN13000:2010
Rated Capacity Limiter (RCL)

LOADING CONTROL

- Load chart for **selected configuration** (outrigger base, CWT…)
- → rated capacity
- Sensors (angle, length, pressure)
- → actual load state

![Diagram showing load calculator and actual load state]

<table>
<thead>
<tr>
<th>NET (t)</th>
<th>MAX (t)</th>
<th>LAST (t)</th>
<th>RAD (m)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>4.2</td>
<td>1.4</td>
<td>14.6</td>
<td>33 %</td>
</tr>
</tbody>
</table>
Provision shall be made to override the rated capacity limiter for the purpose of tests and assembly/erection. The control device to override the rated capacity limiter shall move to the neutral position when released.

For a mobile crane the motions that shall normally be cut off by the rated capacity limiter when triggered are:

i) derricking out;
ii) derricking in;
iii) hoisting;
iv) telescoping out.
Rated Capacity Limiter (RCL)

RCL-override key – discussions leading to 2010 revision

Following 4 cases are relevant for RCL:

- Normal operation
- Rigging/De-Rigging
- Emergency operation
- Misuse of the bridging device to use the crane beyond the capacity chart

To better cover the possible misuse and to comply with new machinery directive (in force since end 2009), additional requirements have been defined in the EN13000:2010 amendment.
Rated Capacity Limiter (RCL)

RCL-override key – Amendment 2010

- No Override key inside the cabin

- Bridging device outside the cabin under lock and key
  - for emergency operation or in case of component failure
  - Deactivates RCL (no cut-off!!)
  - Speed reduced to 15%
  - Record in event recorder (data logger)

- Set up button
  - for rigging/de-rigging procedures when no load chart is available
  - limited to 110%
  - Speed reduced to 15%
  - Record in event recorder (data logger)

- Data logger (Event recorder)
  - When setup button or emergency switch is used and load exceeds rated capacity
Rated Capacity Limiter (RCL)

RCL-override key – Status 2004 (until 2010)

Display

Operator’s seat

Switching cabinet

Bridging device

- Hold-to-run key
- Use in emergency situations only, limited by manual
- No speed reduction
Rated Capacity Limiter (RCL)

RCL-override key – Current status (from may 1st 2010)

Set up button
- rigging, no load chart available
- escape out of dead lock situations, speed 15%*

Bridging device
Outside the cab
- Use in case of a failure of components
- Use in emergency situations
- Speed 15%*

Display
Operator’s seat
Switching cabinet
Data logger
Rated Capacity Limiter (RCL)

RCL-override key – Warning signals – FEM standard

- FEM members have set specifications to standardize the warning signals visible from outside the crane
  - Based on EN13000 requirements
  - Visual and audible warnings

- Objective
  - To define a standard way to warn people in the vicinity of the crane, regardless of the crane brand (i.e. same color code for same warning situation)
  - To define the RCL-features (Event recorder, speed reduction, operating modes)

- Implementation date: May 1st 2010
- FEM standard FEM 5.014 (currently in final approval stage)
EN13000 standard
Current discussions
Amendment EN13000:2012
Topics in discussion for next amendment 2012

- RCL emergency switch – improved solution
- Introduction of EN ISO 13849
- Outrigger monitoring
- Wind on load and Wind in out-of-service condition
- Control layout for crawler cranes (ISO 7752)
RCL-override key – Discussion

- Is current RCL “2010”-solution:
  1. Acceptable for other markets?
  2. Fully compliant within EU (i.e. get out of cabin whilst load on hook)
  3. Efficient in all emergency situation? i.e. does it address emergency solutions where quick reaction and full speed is needed

- FEM-ESTA Survey to assess efficiency based on users’ feedback
- Position paper from SC&RA and AEM (USA), CICA (Australia), ESTA (Europe)

→ Feedback is:
  1. Emergency switch allowing full speed may help to escape from critical situations
  2. Several countries clearly prohibit to leave the cab when a load is suspended

- New technical proposal is being analysed within WG11 working group…
Implementation EN ISO 13849-2 (safety of control systems)

- Define criteria to enable the application of EN ISO 13849 for mobile cranes
  1. Performance level
  2. Compatible with available components (category, MTTFd, DC,…)

- Separate workgroup within WG11 created
- Workshop planned September 29th
Outrigger Monitoring

- **Current status**: outrigger base is not monitored and was entered by the operator without automatic plausibility check

- **Issue**: Many accidents are linked to incorrect outrigger extension

- **Amendment**: Crane control system shall compare the configuration selected by the operator and the actual position of the outriggers. Any discrepancy shall be indicated.
Amendment - EN13000:2012

Wind

- **Current status**: Load charts are provided based on one maximum wind speed

- **Issue**: load geometry with big sail area can generate high wind loads → often underestimated

- **Amendment**: Explanation to be added into operator’s manual regarding allowable wind speed calculation based on actual load shape (drag factor)
Wind

- Workflow + explanation to enable easy determination of allowable wind speed

ASSUMPTION: Working Load \( m \) is known

- A known?
  - yes
    - Estimate \( A \) = multiply height x largest width
  - no
    - is \( m < 2x \)?
      - no
        - is \( c_w \) known?
          - yes
            - can \( c_w \) be calculated or estimated?
              - yes
                - Determine \( c_w \)
              - no
                - take \( c_w = 2.4 \)
          - no
            - Plan the lift with calculated Wind speed

Plan the lift with wind given in the load chart

\[
v_{\text{allowed}} = \min(v_{\text{chart}}, v_{\text{load chart}} \times \sqrt[3]{\frac{1.2 \times m}{A_p \times c_w}})
\]
EN13000 standard
Current discussions
Revision EN13000:2014+
Topics in discussion for next revision 2014+

- RCL emergency switch (if not implemented in Amendment 2012)
- Outrigger monitoring – non-symmetrical basis
- Instructions in manual regarding regular inspection and overload testing of cranes
- Requirements regarding Work @ Height
- References to FEM standards to be removed
- Wording – consistence with ISO-standards
OTHER SAFETY TOPICS
out of standardization committee

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FURTHER SAFETY TOPICS

Topics in discussion (FEM / ESTA)

• Work @ Height
• Lifting of Persons
• Overload Testing
• Data Logger
• RCL efficiency – further feedback from Users

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Thank you for your attention!
FURTHER SAFETY TOPICS

WORK @ HEIGHT

- Leadership: FEM / ESTA
  - 40 participants (OEM, Owners, users, HSE, experts)
  - 3 workshops 2010 ; 3 workshops 2011
- Define requirements for Work @ Height
- Introduce these requirements as Manufacturer standard (FEM)
- Introduce these requirements as EN-standard (EN13000 revision)
FURTHER SAFETY TOPICS

LIFTING OF PEOPLE

• Leadership: FEM
• Position paper published June 2011

• New entertainment activities (bungee jumping, suspended restaurant)
• Recommendation of manufacturers that cranes are not intended for lifting personnel
• First contact with “Event in the sky”
FURTHER SAFETY TOPICS

OVERLOAD TESTING

• Leadership: FEM
• FEM Position paper in work
  • Based on existing manufacturers statement
• Recommendation of manufacturers that regular overload testing is not recommended and may lead to premature damage of the crane
• Some national legislations require it
• Difficulties for users to perform tests
• Requirements to be defined within EN13000 revision together with HSE
FURTHER SAFETY TOPICS

DATA LOGGER

- Leadership: FEM
- Statement required by USA / SC&RA
  - Usage of data logger
  - Ownership of data
  - Legal aspects
- Existing recommendation from PCSA
- Requirements/Recommendations to be defined within EN13000 revision together with HSE

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ReCOMMENDATION

from the Crane Technical Committee of the
Power Crane and Shovel Association (PCSA)
A Bureau of the Association of Equipment Manufacturers (AEM)

DATA LOGGERs AND EVENT RECORDERS FOR MOBILE CRANES

Issued February, 2011

This recommendation has been developed by the Crane Technical Committee of the Power Crane and Shovel Association (PCSA), formed in 1963 by United States manufacturers of power cranes and shovels, as one of the oldest and most respected manufacturer associations in the construction industry. The PCSA is a recognized voice for the crane industry worldwide and liaisons with governmental agencies such as OSHA. Among its activities is the promotion of operating safety on an overall industry basis. Related to this has been the establishment and updating of industry standards in keeping with the advances of technology in newer materials and methods to give the manufacturer, integrator, and the operating organization guidelines.

The purpose of this document is to promote a standardized set of recommendations to manufacturers of mobile cranes, mobile crane manufacturers of mobile equipment, end users, governmental authorities, and code-writing agencies. It is further intended to update and expand similar information contained in ANSI/ASME B30.3 consensus standards, as well as OSHA 29 CFR 1926.550, Subpart N, and the new crane rule, 29CFR 1926, Subpart CC, which serve as guidelines to the crane and shovels industry. To date, there is no mandate of data loggers or event recorders in OSHA’s crane rule 29 CFR Part 1926, Subpart N, and no requirements for their installation.

Manufacturers may install data recording devices on their equipment, depending on the type of equipment involved, the size of the crane, or other requirements. Installation of data recording devices is not mandatory in the United States, but is within the European Union.

With the new amendment to EN 13000 related to mobile cranes, which became effective in June 2012, European Standard EN 13000 requires that cranes equipped with a set-up button and/or a bridging device also be equipped with data recorders.

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PCSA

POWER CRANE AND SHOVEL ASSOCIATION

November 7, 2009

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FURTHER SAFETY TOPICS

FEEDBACK ON RCL EFFICIENCY

- Leadership: FEM / ESTA
- Survey sent to ESTA-members (users)
  - To assess efficiency of current solution
  - Identify possible improvement
  - Identify remaining risks
- Requirements/Recommendations to be defined within EN13000 revision based on survey results
Rated Capacity Limiter (RCL)

RCL-override key – Warning signals – FEM standard

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## Rated Capacity Limiter (RCL)

### RCL-override key – Warning signals – FEM standard

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<tr>
<th><strong>Operation</strong></th>
<th><strong>Limits</strong></th>
<th><strong>Speed reduction to 15%</strong></th>
<th><strong>Data recording</strong></th>
<th><strong>Visual</strong></th>
<th><strong>Audible</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>normal</td>
<td>load ≤ 90%</td>
<td>no</td>
<td>No</td>
<td>green light</td>
<td>no siren</td>
</tr>
<tr>
<td>approach</td>
<td>90% ≤ load &lt; 100%</td>
<td>no</td>
<td>No</td>
<td>green yellow light</td>
<td>no siren</td>
</tr>
<tr>
<td>overload</td>
<td>load &gt; 100%</td>
<td>siren</td>
<td>yes</td>
<td>green red light</td>
<td>no siren</td>
</tr>
</tbody>
</table>

**SETUP**

- **Warning OUTSIDE cabin**
  - **Visual**
    - green light
    - yellow light
    - red light
  - **Audible**
    - no siren

**EMERGENCY**

- **Warning OUTSIDE cabin**
  - **Visual**
    - green light
    - yellow light
    - red light
  - **Audible**
    - no siren

- **Internal**
  - **Visual**
    - green light
    - yellow light
    - red light
  - **Audible**
    - siren
Thank you for your attention!