Drill Rig Safety

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Protection against Rotating Parts

Biggest Drill Rig Safety Issue
Protection against Rotating Parts

• Known as “The Guarding Issue”
• Active in UK since 1999
• UK’s Health & Safety Executive (HSE) called a meeting of the Drilling & Piling industries in April 1999
• BDA & FPS Guidance Aug/Sept 2000
Protection against Rotating Parts

• HSE’s authority was derived from:
• Regulation 11 of **PUWER 98**
• This applies to **Users** of Equipment
• All recent UK Regulations are derived from European Community Directives
• Originally Machinery Directive 98/37/EC (now 2006/42/EC)
Protection against Rotating Parts

- Manufacturing / selling equipment in UK
- Have to comply with:
  - The Supply of Machinery (Safety) Regulations (2008 amended 2011)
- Derived from:
  - Machinery Directive 2006/42/EC
  - Essential Health & Safety Requirements (EHSRs) interpreted by EN Standards
Protection against Rotating Parts

SUMMARY SO FAR

• One Regulation for Users
• Another for Manufacturers / Suppliers
• BUT BOTH DERIVE FROM EUROPEAN MACHINERY DIRECTIVE (which is mandatory on all EU governments)
• And Directive calls up
• EN (ISO) STANDARDS

(Note that EN791 Drill Rig Safety 1995 precedes 1998 and 2006 Machinery Directives)
Protection against Rotating Parts

6.1 REGULATION 11 DANGEROUS PARTS OF MACHINERY

(1) Every employer shall ensure that measures are taken in accordance with paragraph (2) which are effective –

(a) to prevent access to any dangerous part of machinery or to any rotating stock-bar
or

(b) to stop the movement of any dangerous part of machinery before any part of a person enters a danger zone.
Protection against Rotating Parts

- First requirement
- TO PREVENT ACCESS or TO STOP MOVEMENT before people enter danger zone
  (Once entanglement starts it’s too late)
- BUT NEXT REQUIREMENT FOLLOWS
Protection against Rotating Parts

(2) The measures required by paragraph (1) shall consist of -

(a) the provision of fixed guards enclosing every dangerous part or rotating stock-bar where and to the extent that it is practicable to do so, but where or to the extent that it is not, then

(b) the provision of other guards or protection devices where and to the extent that it is practicable to do so, but where or to the extent that it is not, then

(c) the provision of jigs, holders, push-sticks or similar protection appliances used in conjunction with the machinery where and to the extent that it is practicable to do so,

and the provision of such information, instruction, training and supervision as is necessary.

PUWER as amended 2002
Protection against Rotating Parts

• “SHALL” is mandatory (Should, must, can etc. are not)

• “PRACTICABLE” is legal term. If it’s technically possible it shall be done regardless of cost. (Prior to 1998 the words “reasonably practicable” were used.)

• “HIERARCHY” Start at the top and work down
Protection against Rotating Parts
UK History

- 1999 HSE raise the issue
- 2000 BDA & FPS publish guidance
- Guidance allows slow rotational mode
- 2000 – 2006
  - Awareness developing
  - Some contractors take action & fit guards
  - Fears of loss of production, loss of visibility, cost, change in working practice etc.
  - Manufacturers less than supportive
  - Retro fitting the problem
Protection against Rotating Parts
UK History

- March 2004 severe entanglement
- April 2006 HSE prosecute
- £50,000 fine
- Industry wakes up

Driller’s glove
Protection against Rotating Parts
UK History

- 2006 onwards – HSE raise the game
- BDA circulates information and encourages compliance
- More entanglement accidents (abroad as well)
- BDA works with HSE to clarify exact requirements e.g. interlocked guard
- Contractors put pressure on manufacturers / suppliers who respond
- Contractor fears largely disappear (not proven in practice apart from cost)
Protection against Rotating Parts
UK History

• 2009
  - HSE turns the screw more (prohibition notices)
  - Has been a culture change
  - Vertical drilling in open air (all sides agree that it’s interlocked guarding)
  - BDA / HSE

Inclined Drilling
Guidance May 2009
EUROPE (EU countries)

- 28 Countries
- 500 + million people
- 3rd biggest after China and India
- Germany 83 million
- France 63 million
- UK 61 million
- Italy 59 million
- Spain 44 million
EN 791 Drill Rigs – Safety - Revision

• EU Directives state legal objectives
• “Harmonised” EN Standards identify technical means to meet legal objectives
• 3 classes of EN Standard
  - A-type, basic methodology - only 2, of which EN ISO 12100 (2010) is most important
  - B-type, common to all e.g. Noise
  - C-type, specific class of machines e.g drill rigs have EN 791, piling rigs have EN 996
EN 791 Drill Rigs – Safety - Revision

• CEN is European Standards body
• CEN TC 151 (Technical Committee), WG3 (Working Group 3) looks after drilling, and includes WG2, piling)
• Has been revising EN 791 & 996 (Piling)
• France, Germany, Italy, Sweden, Finland, UK + +
• Started revision Feb 2008
• EU Public vote Feb 2014
• 97% acceptance
• New EN Standard April 23rd 2014
• New BS Standard by 23rd October
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• CEN TC 151 (Technical Committee) relationship to BSi

• BSi ‘mirror’ committee is B/513 (Construction equipment and plant and site safety)
• B/513/02 is working group for Drilling, piling and tunnelling
• B/513/02 sent UK Experts to CEN TC 151, WG3

Variously Donald Lamont (HSE); Ian Simpson (HSE); Brian Stringer (BDA); Keith Bolton (FPS); Bob Storey (BSP)
EN 791 Drill Rigs – Safety - Revision

- **EN 16228** Drilling and foundation equipment – Safety (is in 7 Parts)
  - Part 1: Drilling and foundation equipment – Safety – Common requirements
  - Part 2: Drilling and foundation equipment – Safety – Mobile drill rigs for civil and geotechnical engineering, quarrying and mining
  - Part 3: Drilling and foundation equipment – Safety – Horizontal directional drilling equipment (HDD)
  - Part 4: Drilling and foundation equipment – Safety – Foundation equipment
  - Part 5: Drilling and foundation equipment – Safety – Diaphragm walling equipment
  - Part 6: Drilling and foundation equipment – Safety – Jetting, grouting and injection equipment
  - Part 7: Drilling and foundation equipment – Safety – Interchangeable auxiliary equipment
Most contentious issues

- Protection against moving parts
- Stability calculations
- Noise
- Interchangeable auxiliary equipment
- Performance levels – safety functions
EN 16228 Drill Rigs – Safety – Revision

Stability Calculations

- EN791 & 996 Conflict
- EN791 more conservative
- Piling rigs grown taller
- User – greater depth requirement (mast height), less chance of overturning
- Manufacturer – engineering limits, user take more responsibility for ground conditions

TOOK LONG TIME TO RESOLVE
EN 16228 Drill Rigs – Safety – Revision

Noise

• European Outdoor Directive
• Drill Rigs – noise marking only (no limit)
• Moving in direction of noise limits
• Drilling process generates noise
• How to measure?
• Percussive / Rotary Percussive rock test (Part 2)
Interchangeable Auxiliary Equipment

- **Part 7**
  - “includes pile installation and extraction equipment, impact hammers, extractors, vibrators, deep vibrators, static pile pushing/pulling devices, rotary percussion hammers, rotary drilling drives, drill mast equipment such as leaders equipped with a drill stem and gears attached to the boom of an excavator, casing oscillators/rotators”

- **Down Hole Hammers** have to be engraved
- **Could have included** corebarrels etc.
- **Very little written at end of day**

WAS AN AFTERTHOUGHT AND CONFUSING TO DEAL WITH
EN 16228 Drill Rigs – Safety – Revision

Performance levels – safety functions

• A REQUIREMENT TO ‘GRADE’ ALL SAFETY RELATED PARTS OF CONTROL FUNCTIONS
• Is a table in Part 1 to conform to EN 13849-1
• Debates about grade levels for interlocked guards etc.

_USERS WANTED HIGHER GRADES_
Protection against moving parts

“Where access to moving parts directly involved in the drilling and piling process is foreseeable during normal operation of the machinery, safeguards shall be selected from the following:

— Fixed guard or;
— interlocking movable guard with or without guard locking or;
— sensitive protective devices, e.g. electro-sensitive protective equipment or pressure sensitive devices or;
— a combination of the above.”
Protection against moving parts

• “When the interlocking movable guard is opened, the rotation and feed functions together with any associated moving parts identified with residual risks shall stop. Restarting with an open interlocking movable guard shall only be possible in restricted operating mode”

• “Restricted operating mode shall comprise:
  — A rotational speed of not more than 30 rpm or “inching mode” that is no more than half a revolution per activation in the danger zone and;
  — a feed speed of not more than 15 m/min, or “inching mode” that is no more than 10 cm feed stroke per activation, in the danger zone and;
  — “hold-to-run” control for rotation function and;
  — “hold-to-run” control for feed function and;
  — an indicator informing the operator and crew that the restricted operating mode is on.

When hold to run controls for rotation are released the rotating parts shall stop in less than half a revolution.”
Protection against moving parts

- Fixed, Interlocking Movable Guards and “Restricted Operating Mode” are familiar to us in UK

BUT THE STANDARD ALLOWS

- Sensitive protective devices
- Special protective mode for specific circumstances
- Exemptions in Part 2 (Drill Rigs)
Protection against moving parts

• “Sensitive protective devices shall detect foreseeable access to the rotating parts danger zone, during any dangerous movement. When the sensitive protective device is activated, the rotation and feed functions together with any moving parts identified with residual risks shall stop.”

• EN 12100-1 “equipment for detecting persons or parts of persons which generates an appropriate signal to the control system to reduce risk to the persons detected. The signal may be generated when a person or part of a person goes beyond a predetermined limit – e.g. enters a hazard zone – (tripping) or while a person is detected in a predetermined zone (presence sensing), or in both cases”

ARE WE STILL ALLOWING TRIP WIRES? ITS NOT CLEAR.
“e.g. electro-sensitive protective equipment or pressure sensitive devices”
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• Are these Protective Devices?
  (See EN ISO 12100-1 for definition)

- Emergency stop
- Toggle switches
- Trip wires
- Pressure plates
- Multiple E stops
Protection against moving parts

- “Special protective mode for specific circumstances”
  - Where circumstances are foreseen by the manufacturer that specific applications/positions/orientations where the use of safeguards (guards and protective devices) is not possible (e.g. confined spaces, limited working areas, work close to obstacles or structures), a special protective mode shall be installed to operate without guards and sensitive protective devices disabled.”

- “Rotation and feed controls shall be hold-to-run; rotation and feed can operate at normal speed; a warning signal (visual and/or audible) shall be activated when the special protective mode is selected; additional pressure sensitive devices shall be fitted.”

THIS IS OPEN TO ABUSE BY USERS WHO COULD TAKE OFF GUARDS AND DISABLE PROTECTIVE DEVICES
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Protection against moving parts

- **Exemptions in Part 2 (Drill Rigs)**

- Underground pre-armouring machine

- Drill Jumbo

*HOWEVER ADDITIONAL SAFEGUARDS E.G. MOTION DETECTORS ETC. TO BE FITTED*
Protection against moving parts

THE FUTURE?

- Digital cameras configured to detect movement
- Defines dangerous working area
- When people enter:
  - drilling immediately stops
  - safety procedure activated (rotation/feed slow mode)
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WHAT NEXT?

• Manufacturers to use EN 16228 from April / October 2014
• BS EN 791 / 996 withdrawn by Oct 2014
• Europe sorted – What about the world?
• Currently no ISO Standard

• Vienna Convention EU – ISO Co-operation
• Proposal at May 2014 ISO/TC 195 China meeting (Secretary & Convenor are CEN !!)
THANKS FOR LISTENING
NOW OPEN FOR QUESTIONS