

## **Appendix 7: BS EN 16228:2014 Drilling and foundation equipment. Safety**

The new type C standard for drilling rigs and piling rigs is BS EN 16228 (7 parts), published 31 August 2014. The information it contains is applied across the EU to new machines - effectively from November 2014.

BS EN 16228:2014 Drilling & Foundation Equipment - Safety:		Total pages	Clauses relevant to rotational entanglement
Part 1	Common requirements	152	(Clause 5.23)
Part 2	Part 2: Mobile drill rigs for civil and geotechnical engineering, quarrying and mining	25	(Clauses 5.5 & 5.6)
Part 3	Horizontal directional drilling equipment (HDD)	33	(Clauses 5.10.3, 5.12, 5.13)
Part 4	Foundation equipment	12	(Clauses 1 & 5.4)
Part 5	Diaphragm walling equipment	16	-
Part 6	Jetting, grouting and injection equipment	14	-
Part 7	Interchangeable auxiliary equipment	22	-

Appendix 3 of this operational guidance outlines the main types of piling and drilling equipment covered by the standard and which parts of the standard are applicable to each type.

Note that although BS EN 16228 parts 2 - 4 are short documents they do contain clauses that disapply the Part 1 guarding specification to certain types of rig and arrangement. Interpretation of the BS needs care. The original was not written in English and the translation lacks finesse in places. If necessary, Construction Sector can help. The text and appendices of this Operational Guidance have been written to align with the harmonised standard. Listed below are issues to be aware of in the Standard relating to prevention of entanglement:

### **Part 1: Common requirements**

- Specifies guarding of drill strings and augers on rigs where the drafting committee agreed that entanglement is foreseeable.
- Allows operation in restricted operating mode (ROM) when guards need to be open to allow e.g. rods or auger sections to be added. This applies to rotating/moving parts that are up to 2.5m above the ground/work platform. (See Appendix 4 section on moveable interlocked guards for more information).
- Allows guard removal and operation at full speed in special situations – e.g. restricted space where guard or proximity device would interfere. It specifies that operating position must be out of reach distance (i.e. not

applicable to most mini rigs), controls must be hold to run, warning signal to show special mode active, additional pressure sensitive device to be fitted (e.g. trip wires or pressure activated mats - the latter not common in UK at present as they require gang to place and look after them). Note that HSE expects designers and contractors to design layouts and select method, sequence and plant to avoid situations where guards need to be removed so far as practicable.

- Recognises that proximity guards (known as ‘Sensitive Protective Devices’) are a developing technology that may become more common on drilling and piling rigs. ROM must apply during close approach, and restart of full speed operation must require a control action once personnel have moved out of the range of the proximity device.

### **Part 2: Mobile drill rigs for civil and geotechnical engineering, quarrying and mining**

- Note that Part 4 is not applied to rotary rigs doing foundation work where rods/auger sections are added during drilling - these are placed under part 2 with respect to guarding against entanglement.
- Part 2 tends to apply to drill rigs with a drill torque (power) of less than 35kN/m. This is intended to include all high speed drill rigs.
- If rotary head (that rotates the drill string) is greater than 1600mm above ground then only drill string needs to be enclosed. The guard should extend from max 500mm above ground (or max 200mm above top of clamps/jaws) and extend to min 1600mm above ground/adjacent working platform.
- Jumbo rigs and underground pre-armouring rigs are exempt from guarding but during fitting/rigging of drill string should use restricted operating mode (ROM) as per other machines. Extension of the drill string in use should be by mechanised rod handling process. Pre-armouring rigs should be remote control operated. Jumbo rigs should have motion detectors fitted to halt rotation before danger area can be reached unless the operator has a clear view of the rotating drill. Where elevating access cages are fitted the drill string rotation should be interlocked to prevent cage use/approach during rotation. (Where an elevating access cage is to be used a written safe system of work should be provided by the user. This should include that people will not be in the access cage while drilling is underway.)

### **Part 3: Horizontal directional drilling equipment (HDD)**

- Part 1 guarding specification disapplied - apart from restricted operating mode (ROM) section
- Part 1 ROM specification modified to allow ROM drill feed speed of up to 20 metres/minute.
- Machine layout, barriers or guarding must prevent access to rod/pipe handling system or area during rotation including or access into pipe path.
- Manufacturer is not responsible for guarding of rotating drill string from the edge of the machine (break out clamps) into the ground (nor in reception area where drill emerges from ground).

- A portable, wireless immobilisation system (emergency stop) to be sited with personnel working at the reception area. This should halt both rotation and feed and require a reset action by the reception gang before the machine operator can recommence work.
- Within operators zone of influence (visible working area while seated) no unguarded rotating drill should be within 1050mm of the operator (Note: interpretation difficulty - can be measured from operator's spine while seated). Rotating parts closer than 1050mm to have a side guard which is at least 350mm high or extends to the top of the drill if this is higher.
- Primary control of drill should be hold to run unless the drill rods/pipes are added automatically.
- Operator seat should be interlocked to ensure driver is in operating position.

Note - Part 3 is very specific in places and may appear to allow some parts of the drill string to be unguarded. In general, either personnel should not be in areas where the rotating drill is unguarded (system of work) or guards should be fitted. Directional drill rigs have moving clamps and feed mechanisms that also create crush zones unless the combination of safe by design, guards and systems of work are matched. Following break through on long drives a separate machine may be installed at the reception end to allow back reaming. This will also need rotating parts etc. to be guarded.

#### **Part 4: Foundation equipment**

- Part 4 applies only to rigs with a drill/auger input torque exceeding 35kNm. These tend to be larger, heavier duty foundation machines.
- Part 4 is not applied to rotary rigs doing foundation work where rods/auger sections are added during drilling - these rigs are placed under part 2 with respect to guarding against entanglement. Therefore most mini rigs are not in scope of part 4.
- This distinction allows a blanket disapplication of the guarding specification to some larger rigs (see section on bored piles in Appendix 3). This applies when: the auger is driven by a kelly bar; a rotating auger cleaner travels along the auger; an auger guide needs to be opened to allow the drilling head to descend to ground level (with the rider that rotational speed should be less than 30 rpm). This effectively exempts CFA rigs from the Part 1 guarding specification.
- Other rotary piling rigs should be fitted with guards but restricted mode slow rotation or inching is not specified. The guard should start no greater than 750mm above ground level and extend to at least 1600mm above ground level. The specification is that moveable guards should have a locking device (i.e. interlock, padlock or tool tight fastening)

#### **Parts 5 - 7**

These do not involve equipment where there is a drill string or borehole auger entanglement issue. Any rotating parts (e.g. material feed augers) should be guarded to normal standards.

Note that guarding specifications and exemptions need to be matched with suitable systems of work and procedures.

The new standard will require EU manufacturers to catch up with the guarding requirement the UK has already imposed. It should remove many of the difficulties UK operators experienced when buying new equipment.

Whilst the new standard does not apply retrospectively to older machines it will apply to rigs that are refurbished for sale or on hire. With respect to drill/auger guarding this should not present suppliers with any difficulty as the existing UK approach previously agreed with the industry can continue.