BRITISH STANDARD

Code of practice for the safe use of concrete pumps

ICS 91.220

British Standards

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 22, an inside back cover and a back cover.

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Foreword

Publishing information

This British Standard was published by BSI and came into effect on 1 May 2007. It was prepared by Subcommittee B/513/-/8, *Concrete plant*, under the authority of Technical Committee B/513, *Construction equipment and plant and siting*. A list of organizations represented on this committee can be obtained on request to its secretary.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

It should be noted that this code of practice provides the minimum standards necessary for the operation of all types of concrete pumping equipment in addition to any other guidance and legislation that might be appropriate.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

In particular, attention is drawn to the following statutory regulations:

The Health and Safety at Work etc. Act 1974 [1]

The Control of Noise at Work Regulations 2005 [2]

The Control of Substances Hazardous to Health Regulations 2002 [3]

The Lifting Operations and Lifting Equipment Regulations 1998 [4]

The Provision and Use of Work Equipment Regulations 1998 [5]

The Road Traffic Act 1991 [6]

The Construction (Safety, Health and Welfare) Regulations 1996 [7]

The Management of Health and Safety Regulations 1999 [8]

The Manual Handling Operations Regulations 1992 [9]

The Control of Vibration at Work Regulations 2005 [10]

The Work at Height Regulations 2005 [11]

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 [12]

1 Scope

1.1 This British Standard gives recommendations for the safe use of concrete pumping and placing equipment.

1.2 This British Standard is not applicable to plaster and screed pumps. It is not applicable to the construction of the machinery, which is covered by BS EN 12001.

2 Terms and definitions

For the purposes of this British Standard, the following definitions apply:

2.1 admixture
material which is added to concrete to change the properties of the mix

2.2 ball-catcher
device fitted to the delivery end of a delivery pipeline and designed to catch the sponge/rubber cleaning device used for cleaning the delivery line

NOTE In the piling industry, this is commonly referred to as a "blowout basket", "washout basket" and "catch basket".

2.3 banksman
person with appropriate training who directs vehicle movements on site

2.4 boom tip safety device
device fitted to the end of the concrete-placing boom which is attached to the placement hose and which is designed to retain the placement hose if the coupling attaching it to the boom delivery pipeline fails

2.5 competent person
person engaged by the owner who has responsibility for thorough examinations and who has had sufficient experience, instruction and training to enable them to carry out their duties

2.6 concrete
homogenous mix of cement, graded aggregate and water, to which additives might be added

2.7 concrete-placing boom
device to support and position the delivery pipeline

NOTE 1 For the purposes of this standard, the term is applicable to rotary/circular distributors.

NOTE 2 A concrete-placing boom is often an adjunct to the concrete pump, but is not essential in some applications.

2.8 concrete pump
item of plant that works by pistons or a rotary pump and is used for pumping or spraying concrete to the placing position through a delivery pipeline alone or through a delivery pipeline attached to a concrete-placing boom

2.9 delivery pipelines
lines, whether steel or rubber, through which the concrete is conveyed

NOTE These include pipelines, hoses, coupling connectors and any valves inserted in the line. Each element of the pipeline is capable of resisting the likely maximum pressure plus a safety margin exerted by the concrete pump.

2.10 hirer
company, firm, person, corporation or public authority taking the owner's plant on hire, including their successors or personal representatives

2.11 interlock
mechanical, electrical or other type of device, the purpose of which is to prevent the operation of hazardous machine functions under specified conditions (generally as long as a guard is not closed) [BS EN 12100-1]

2.12 lorry-mounted concrete pump
concrete pump that is mounted on a self-propelled lorry

2.13 owner
company, firm or person letting the concrete pump on hire, including their successors, assignees or personal representatives

2.14 placement hose
flexible hose to provide freedom of movement in the final placing of concrete

2.15 receiving hopper
hopper into which the mixed concrete is discharged

NOTE The hopper contains the valve gear for transferring the concrete from the concrete pistons into the delivery line. It might also contain mixer paddles on a revolving shaft. Access doors and an interlocked protective grille are fitted to prevent persons from coming into contact with the moving machinery.

2.16 remote control box
portable control panel, which is connected to the concrete pump by a cable or radio system, allowing the concrete pump operator to operate the machine from a remote position

NOTE The control levers/switches may operate the concrete placing-boom movements, the concrete pump and the vehicle engine.

2.17 safety induction training
instruction given by the principal contractor, owner or hirer/(sub)contractor to communicate the site safety rules, safe access on the site, the location of welfare facilities, etc.

NOTE The provider of the training may determine that the delivery of induction training on the first visit to the site is sufficient but insist on further training if site conditions change significantly.

2.18 signaller
person with appropriate training who gives directions to the concrete pump operator by a recognized code of signals or by verbal communication

2.19 sponge/rubber cleaning device
piece of sponge rubber, usually in the shape of a ball, which is inserted into the delivery pipeline for the purpose of cleaning the inside of the pipelines and is propelled along the delivery pipeline either by the action of the pump (forward or reverse), compressed air or water pressure

2.20 stabilizers
structural members on the concrete pump unit that increase the stability of the concrete pump

NOTE These may also be known as "out-riggers".

2.21 trailer-mounted concrete pump
concrete pump that is mounted on a trailer that can be towed

NOTE These may also be known as static concrete pumps, i.e. skid-mounted or fixed units.

2.22 wash-out adapter
short length of pipeline with one end blanked off and a connection for a water/compressed air hose and pressure-relief valve for cleaning purposes

NOTE In the piling industry, this is commonly referred to as a "blowout gun", "blowout chamber", "blowout cannon", "washout gun", "washout chamber" and "washout cannon".

3 Selection of personnel

NOTE The safe operation of a concrete pump relies heavily on the selection of suitable personnel who are competent to carry out the required duties.

3.1 Employers should have a drugs and alcohol policy. Employers should not select anyone whose efficiency is impaired by alcohol, drugs or other influences.

3.2 The concrete pump operator should:

a) be competent;

b) in the case of a lorry-mounted concrete pump operator, be over 21 years of age if driving a concrete pump on the highway;

c) be medically fit, with particular regard to eyesight, hearing and reflexes;

NOTE This recommendation may be relaxed where an individual assessment shows that an operator is able to operate a concrete pump safely.

d) be physically able to operate the concrete pump safely;

e) be able to judge distances, heights and clearances;

f) be adequately trained and certificated for the class of concrete pump which they operate (see Clause **4**);

g) have suitable and sufficient knowledge of the concrete pump and its safety devices;

h) be fully conversant with the duties of the signaller and understand the signals in Annex A;

i) be authorized to operate the concrete pump; and

j) in the case of a lorry-mounted concrete pump operator, be licensed to drive the appropriate class of vehicle.

3.3 Evidence that the operator is medically fit to operate the concrete pump should be obtained at regular intervals not exceeding 5 years.

3.4 If a risk assessment or method statement indicates the need for a signaller, any signaller selected should be competent to:

a) relay signals from the concrete-placing gang to the pump operator;

b) direct safe movement of the concrete-placing boom, if applicable; and

c) give clear and precise verbal instructions using audio equipment, e.g. a two-way radio.

4 Training and certification

NOTE The Health and Safety at Work etc. Act 1974 [1] requires the employer to ensure, so far as is reasonably practicable, that employees receive "such information, instruction, training and supervision as is necessary to ensure" their health and safety at work.

4.1 Training of the concrete pump operator should include:

a) safety awareness;

b) knowledge of the employer's risk assessment;

c) knowledge and use of any personal protective equipment (PPE) provided;

d) safe siting, rigging and de-rigging of the concrete pump in site conditions;

e) operating the concrete-placing boom safely, if applicable;

f) operating the concrete pump;

g) cleaning the concrete pump out;

h) working with delivery lines;

i) basic knowledge of concrete composition;

j) awareness of the dangers of compressed air;

k) working adjacent to overhead power lines;

l) dealing with emergency situations;

m) working with blockages;

n) personal health and safety considerations;

o) pre-driving checks, if applicable;

p) driving the lorry, if applicable;

q) necessary daily and weekly checks and maintenance of the concrete pump; and

r) documentation in relation to the job.

4.2 The training should be to a national recognized standard that is measurable, e.g. the Construction Plant Competency Scheme. The completion of training should be followed by the issue of a certificate of training.

4.3 Concrete pump operator competence can be assessed further by the attainment of a Level 2 National Vocational Qualification for Specialist Plant and Machinery Operations Concrete Pumping.

4.4 Periodic assessments of each concrete pump operator should be carried out by a competent person to verify the maintenance of safe standards and to assess any further training needs.

4.5 Specific training and assessment should be carried out whenever an operator is transferred to a different machine.

4.6 Personnel undergoing training should be adequately supervised.

4.7 The concrete pump operator should always be able to show the owner or site management proof of training.

4.8 The appointed signaller and operator should be instructed on:

a) the use of the code of signals in Annex A;

b) the use of any communications device supplied; and

c) any special risks on the site, e.g. overhead obstructions.

5 Management of the concrete pumping operation

5.1 All concrete pumping pours should be planned to ensure that they are completed safely and that all foreseeable risks have been taken into account. Planning should be carried out by the concrete pour supervisor who has the appropriate experience and knowledge. In cases of repetitive concrete pours, this planning might only be necessary in the first instance, with periodic reviews to ensure that no factors have changed.

5.2 The concrete pump owner should be able to supply a risk assessment to the hirer/(sub)contractor, detailing the generic risks in concrete pumping.

5.3 The risk assessment prepared by the concrete pump owner should include risks from working at heights. Wherever possible, the system of work adopted by the concrete pump owner should avoid the need for climbing on to the bed of the vehicle or static pump (for example, for cleaning or maintenance). If access to the bed of the concrete pump is necessary, then adequate means to gain access should be provided with the concrete pump, unless the work is only done at the concrete pump owner's depot where adequate means of access are always available. Where reasonably practicable, guard rails should be provided to prevent falls from height. Where these measures do not eliminate the risk of a fall, equipment should be provided to minimize the distance and consequences of a fall, for example, by providing fall protection PPE.

5.4 To assist the hirer/(sub)contractor to select the correct model of concrete pump, the concrete pump owner should supply details of the:

a) maximum reach of each concrete-placing boom, both horizontally and vertically;

b) standard equipment carried on a lorry-mounted concrete pump;

c) weights of delivery line, placement hoses, delivery hoses and accessories;

d) maximum likely loadings for each of the stabilizer bases;

e) footprint of the machine with all stabilizers extended;

f) concrete-placing boom configuration; and

g) maximum safe wind speed for the operation of the concrete-placing boom.

5.5 The concrete pump owner should make reference to a concrete pump hire checklist, such as in Figure 1, to assist the hirer/(sub)contractor to select the correct machine for the job.

5.6 A written safe system of work should be established by the hirer/(sub)contractor and this should be followed for every concrete pumping operation, whether it is an individual pour or a series of pours.

5.7 The hirer/(sub)contractor should include in the safe system of work from the arrival of the concrete pump on site to its departure:

a) a site-specific risk assessment;

b) the preparation of a method statement;

c) the planning of the operation, including sufficient manpower;

d) the selection, provision and use of a suitable, CE-marked concrete pump, concrete-placing boom and delivery lines;

e) the need for additional delivery pipelines in addition to the standard kit carried;

f) the position of the concrete pump and any necessary preparation of the site for its positioning;

g) the site of the pour, taking into account proximity hazards, space availability and suitability of the ground to support the weight of the concrete pump;

h) the provision of properly trained and competent personnel who have been made aware of their relevant responsibilities under the Health and Safety At Work etc. Act 1974 [1];

i) the requirement for all personnel to be able to communicate clearly;

j) adequate supervision by competent personnel;

k) verification that all necessary documentation is valid and available for inspection;

l) prevention of unauthorized use of the concrete pump and placing boom;

m) assurance of the safety of persons not involved in the pumping operation;

n) the provision of a cleaning-out area, taking into consideration all environmental issues;

o) adequate lighting;

p) the provision of a supply of suitable and sufficient concrete of a consistency which is readily pumpable at a sustainable rate; and

q) the provision of an adequate piped water supply at the pump position.

5.8 The concrete pumping operation should be taken to include any necessary preparation of the site.

5.9 The safe system of work should be effectively communicated to all personnel involved in the operation by the concrete pour supervisor.

5.10 Special concrete pumping operations, such as underwater work and work with piling rigs, should be discussed between the concrete pump owner and contractor before the work is carried out.

6 Selection of concrete pumps

6.1 Concrete pumps are available in a number of sizes and pumping capacities. The characteristics of each concrete pump should be considered in relation to the job requirements.

6.2 Points that should be considered by the contractor in requesting a suitable concrete pump include:

a) access to and egress from the site suitable for the size of the concrete pump;

b) sufficient area for the concrete pump's stabilizers to be correctly deployed;

c) the ability of the ground to support the loads likely to be imposed by the concrete pump's stabilizers;

d) the horizontal and vertical distance, required output per hour and quantity to be pumped;

e) underground restrictions, e.g. cellars under pavements and cables close to the surface;

f) overhead obstructions, e.g. cables and structures;

g) the reach of the concrete-placing boom to the most remote point of the concrete pour;

NOTE In the case of lorry-mounted pumps, consideration ought to be given to the optimum concrete-placing boom size for site conditions. Correct selection of the concrete-placing boom will reduce any safety risks.

h) suitable access for the ready-mixed concrete truck to the receiving hopper of the concrete pump;

i) the need for a signaller in circumstances where the operator will not be able to see the delivery end of the pipeline;

j) adequate protection of the permanent works from potential damage by the concrete-placing boom;

k) any special operational requirements or limitations imposed;

l) the need for properly designed support for the additional pipeline, e.g. the effect of load of the attachment of the pipeline to a scaffolding structure;

m) the need for the hirer/(sub)contractor to maintain any hirer-owned delivery line, for which the concrete pump owner has no responsibility; and

n) the conditions of hire, particularly in respect of insurance aspects.

6.3 The concrete pump owner should select the concrete pump to be sent to a site on the basis of the following considerations:

a) **6.2**, items a) to i);

b) the distances to be driven to and from the site by the operator to reduce the road safety risk element;

c) the hours worked by the operators on the previous day and the estimated rest period between jobs; and

d) the need for additional labour, e.g. for delivery pipeline work.

7 Travelling to and from the site

7.1 Lorry-mounted concrete pumps

7.1.1 Employers and employees should consider the journey in the lorry-mounted concrete pump to and from the site as an extension of the place of work.

7.1.2 Sufficient time should be allocated by the concrete pump operator's employer to allow the concrete pump operator to drive to the site without the need to exceed speed limits or take risks on the road in general.

7.1.3 The concrete pump operator should use the time allocated by their employer to ensure that the concrete pump is safe for the road, e.g. by checking the function of the lorry's lights and other essential pre-driving checks.

7.1.4 The concrete pump operator should not take unnecessary risks on the journey, taking care for his own safety and health and that of other road users and others who might be affected by his actions.

7.2 Trailer-mounted concrete pumps and additional placing equipment

Delivery, loading/unloading and collection should be adequately planned between the contractor and the owner.

8 Arrival on site and setting up the machine

NOTE The concrete pump operator is responsible for the correct operation of the concrete pump in accordance with the manufacturer's instructions and within the safe systems of work.

8.1 On arrival, the concrete pump operator should report to the site office before entering the actual site.

8.2 The concrete pump operator should attend safety induction training as required by the site.

8.3 The concrete pump operator should use only authorized routes across the site. Where possible, site routes should be taken to eliminate reversing. Where this is not possible, the hirer/contractor should supply a banksman to assist with reversing when necessary. The use of CCTV cameras and other visual aids should be considered to reduce the risk of collisions.

8.4 Where appropriate, the contractor should assess the ground conditions and determine its suitability to support the concrete pump.

8.5 The position of the concrete pump should be clear and determined by the contractor prior to the concrete pump's arrival on site, after discussion with the concrete pump owner, bearing in mind the ground conditions, the distance to the concrete pour, suitable access for the concrete delivery lorries, and the working position of the concrete pump operator.

8.6 Overhead cables should be considered when setting up the concrete pump; it is essential that the concrete-placing boom is never positioned where it might touch overhead cables or where electricity might arc to the boom. A safe method of working in the vicinity of overhead cables should be included, if appropriate, in the overall safe system of work.

8.7 The concrete pump operator should verify with the site management the proximity of cranes or other concrete-placing booms, especially when working areas overlap.

8.8 The concrete pump operator should obtain from the site management information about underground voids, e.g. new drainage trenches and manholes, to be avoided when determining the positions of stabilizers.

8.9 The concrete pump operator should verify with the site management that the maximum wind speed at the site is not in excess of the limit specified by the manufacturer for the safe operation of the concrete-placing boom.

8.10 All stabilizers should be correctly deployed in accordance with the manufacturer's instructions; where appropriate, spreader plates of adequate strength and size should be used under the stabilizer base plates to spread the loading from the concrete pump suitable to site conditions.

8.11 The hirer/(sub)contractor should provide suitable level hard standing for the concrete pump to be set up; it should be capable of adequately supporting the loads likely to be imposed on it, in accordance with the maximum load marked on the concrete pump.

8.12 The function of all controls and safety devices should be checked by the concrete pump operator for correct working before pumping commences.

8.13 Guards to all dangerous moving machinery have to be in place at all times while the machine is working.

9 During the pour

9.1 If, in the opinion of the concrete pump operator, there is a risk of injury to themselves or other persons or damage to property or the concrete pump from the operation of the concrete pump or placing boom, the operator should cease immediately and consult with the hirer/(sub)contractor without delay.

9.2 The concrete pump operator should never operate the concrete-placing boom in a position where it might come into contact with live electricity cables or approach them to a point where the electricity arcs to the boom. The concrete pump operator should work to the safety clearance distances as instructed by the hirer/(sub)contractor before work commences.

9.3 The combination of the noise levels from different items of plant might exceed the action levels in the Control of Noise at Work Regulations 2005 [2]. The employer is required by these Regulations to supply the concrete pump operator with appropriate hearing protection and instruction on its use.

9.4 A code of signals should be agreed between the concrete pump operator and a representative of the concrete-placing gang before pumping starts.

9.5 The availability of a remote control box, whether operated by cable or by radio signals, allows the concrete pump operator to select the optimum position from which to operate the pump and boom. This position will vary according to the work in hand. The concrete pump operator should select the position that offers the safest overall position for the job.

9.6 When a remote control box is in use, the concrete pump operator should isolate any other controls on the machine or prevent access to them by unauthorized personnel.

9.7 If the concrete pump operator is required to position themselves where they cannot see the concrete-placing gang, the hirer/(sub)contractor should supply a signaller to give appropriate signals to the concrete pump operator (see Annex A).

9.8 When the concrete pump operator cannot see the concrete level in the concrete pump's receiving hopper, the hirer/(sub)contractor should appoint a person who is competent to monitor the level of the concrete in the receiving hopper and to convey signals to the concrete pump operator when the level is at its safe minimum, as specified by the manufacturer.

NOTE It is not acceptable to hold the driver of the ready-mixed concrete truck responsible for advising the concrete pump operator when the concrete level is low in the receiving hopper.

9.9 The concrete pump operator should at any one time respond only to signals from the appointed signaller, who should be clearly identified, as specified by the site management.

9.10 Until concrete is flowing smoothly out of the end of the delivery hose, whether at the beginning of pumping or when a new load of concrete is being pumped, or when a blockage occurs in the boom delivery line, all personnel should be advised by the signaller to remain clear of the delivery hose and the concrete-placing boom.

NOTE The danger zone is the area around the delivery hose in which the delivery hose can strike out. The diameter of the zone is twice the length of the delivery hose.

9.11 If a blockage occurs during the pour, the concrete pump operator should stop pumping immediately and instruct personnel to move to a safe position before attempting to remove the blockage.

9.12 If the concrete pump operator needs to open the delivery pipeline to clear a blockage, they should first release the pressure inside the delivery pipeline as much as possible, e.g. by reversing the pumping action. They have to treat the delivery pipeline as being pressurized at all times. Appropriate and adequate hand and eye protection should be worn when opening the delivery pipeline.

9.13 The hirer/(sub)contractor should ensure that site personnel **DO NOT** under any circumstance open or attempt to open the delivery pipeline under pressure.

9.14 The hirer/(sub)contractor should ensure that members of the concrete-placing gang are adequately trained in the safe placing of concrete. In particular, they should be aware of the risks associated with the use of placement hoses.

9.15 Members of the concrete-placing gang should wear, as a minimum, a safety helmet, safety footwear, impervious gloves/gauntlets, suitable eye protection and high visibility clothing.

9.16 For the purpose of moving a flexible delivery hose lying on the ground, a rope should be tied around it near to the delivery end.

9.17 Arrangements should be made to extract exhaust fumes when the concrete pump is operating inside a building.

9.18 If the concrete pump has to be left unattended, the operation of the boom and pump should be isolated.

9.19 The maximum length of end hose to be suspended from the end of a concrete-placing boom is specified by the manufacturer and should not be exceeded.

9.20 Concrete should be prevented from falling out of the delivery pipeline when the concrete-placing boom is being manoeuvred over personnel or property; where necessary and practicable, a device should be fitted to prevent this.

9.21 The concrete-placing boom should never be used as a means of hoisting equipment unless it is so designed and operated to BS 7121.

NOTE Such operations are governed by The Lifting Operations and Lifting Equipment Regulations [4].

9.22 Securing pins should be fitted to all pipeline couplings to prevent them from opening accidentally.

9.23 The hopper grille should be in position at all times during the pumping operation.

9.24 If the lorry-mounted concrete pump has to be moved on site, the concrete-placing boom should always be folded to the travelling position. The only exception to this recommendation would be a procedure laid down by the machine manufacturer that allows otherwise. Any procedure endorsed by the equipment manufacturer should be strictly adhered to as laid down in their operating instructions, as the risk of the machine turning over is greatly increased. However, the safest and accepted procedure is to return the boom to its folded travelling position whenever the machine is to be moved.

9.25 The concrete pump operator should comply with the site's traffic management arrangements.

9.26 The hirer/(sub)contractor should ensure that alterations in the site traffic management arrangements necessitated by the presence of the mobile concrete pump and concrete-mixer lorries are adequate and implemented.

9.27 Site managers should ensure that ready-mixed concrete trucks do not wash out their chutes into the receiving hopper of the concrete pump.

10 Work with delivery lines

10.1 The hirer/(sub)contractor should provide adequate resources to assist the concrete pump operator in handling pipelines and accessories.

10.2 Pipelines and couplings should be selected by the concrete pump operator/hirer in accordance with the anticipated pressure in the delivery line.

10.3 The concrete pump operator/hirer should carry out regular inspections of the delivery pipelines in accordance with a planned maintenance schedule to ensure that they are fit for continued use. Recommendations for inspections are given in Annex B.

10.4 The concrete pump operator/hirer should check that all horizontal and vertical pipelines are adequately supported.

10.5 The concrete pump operator/hirer should check that all couplings are in good order and correctly fitted with a good seal and a securing pin, where applicable.

10.6 Before a delivery pipeline is fitted to a scaffold, the hirer/(sub)contractor should confirm that the scaffolding is designed and constructed to take the extra loading to be imposed. Purpose-made fixings should be used to attach the delivery pipeline to the scaffold.

10.7 Where personnel and/or vehicles are required to pass over delivery lines, then suitable ramps should be provided.

10.8 On occasion, it will not be feasible, practicable or even possible to clean out the delivery pipeline by the conventional method of reversing the pump with the use of a sponge cleaning-ball. Such situations include exceptionally long delivery lines, the use of fast-setting concrete, very hot weather, and when the concrete pump has broken down. It might be necessary in these circumstances to use compressed air or alternative methods (see **10.9**).

10.9 Compressed air to clean out a delivery pipeline should only be used where there is no practical alternative.

The operation should be carried out by a minimum of two suitably trained personnel, who should remain on-site until the end of the operation.

a) Personnel involved in the cleaning operation should wear protective clothing, a safety helmet and eye protection, and preferably a full face visor of the appropriate grade.

b) The hirer/(sub)contractor should establish effective communications with site personnel and should ensure that all personnel stand clear of the delivery line, particularly at the discharge end.

c) The delivery pipeline should be fully supported and secure.

d) All flexible hoses should be removed from the delivery line.

e) There should be no bends in the final 25% of the delivery line, unless the delivery pipeline is properly secured.

f) A ball-catcher attachment should be fitted to the discharge end of the delivery pipeline to catch the sponge/rubber cleaning device, which could otherwise be expelled with great force. The ball-catcher should be such as to allow excess concrete to be expelled.

g) The maximum output from the compressor should not exceed the pressure rating specified by the manufacturer.

h) Compressed air should be introduced into the delivery pipeline through a purpose-made washout adapter, designed for the purpose and equipped with an air entry control valve and at least one emergency pressure release valve.

i) The compressed air should be introduced **gradually**, sufficient only to move the sponge/rubber cleaning device steadily along the delivery line.

j) A competent assistant should follow the progress of the sponge rubber cleaning device while the concrete pump operator controls the ingress of compressed air. By tapping steel pipelines with, for example, a hammer, the assistant can establish which pipelines have been emptied. Other methods of following progress could include observing pressure gauges.

NB The assistant should stay away from the end of the delivery line.

k) As the sponge/rubber cleaning device progresses and the resistance of the concrete decreases, the flow of air introduced into the delivery pipeline should be reduced by the concrete pump operator.

NOTE A way of achieving this is to shut off the flow of air altogether as the assistant approaches the final 25% of the delivery line.

l) Air should be exhausted via the emergency valve whenever the speed of the discharge of concrete becomes too rapid.

m) The delivery pipeline should be considered to be pressurized during the cleaning process and no couplings should be loosened or removed unless the pressure in the delivery pipeline has been released and this has been confirmed by the site competent person.

11 Pumping special concretes

11.1 Many forms of concrete exist beyond the standard mixes that can be pumped. The nature and properties of the concrete can have serious consequences for the concrete-placing boom and for the concrete pump operator. Each should be considered as a special case.

11.2 Chemicals added to the concrete and their likely effects on pumpability should be considered by the hirer/(sub)contractor and the concrete supplier.

NOTE The hirer/(sub)contractor is required by the Control of Substances Hazardous to Health Regulations 2002 [3] to assess the risks to the health of the concrete pump operator and give the operator information and advice on the risks and the protective measures necessary.

11.3 The density of special concretes should be considered. When very dense concrete, e.g. that containing heavyweight lead shot, is to be pumped, the concrete-placing boom manufacturer's recommendations should be followed.

11.4 Foamed concrete and air-entrained concrete can be compressed in the delivery line, particularly if there is a blockage or partial blockage. The pump operator should ensure that all pressure is dissipated from the delivery pipeline before it is opened.

12 Cleaning out the machine and delivery lines

12.1 Cleaning out a concrete pump and its concrete-placing boom is a specialist operation, which is to be left to the concrete pump operator.

If the concrete pump operator requires assistance when cleaning out the delivery line, this has to be carried out under supervision.

12.2 Lorry-mounted concrete pumps generally carry their own supply of water for cleaning the concrete-placing boom pipelines and hopper. However, in cases of more than one pour, it might be necessary for the site to provide a water supply. Trailer or skid-mounted concrete pumps need a separate water supply or bowser.

12.3 The cleaning process involves the deposit of some residual concrete on the site. The concrete pump should be washed out only in the area designated by the hirer/(sub/main)contractor.

12.4 Before working in the receiving hopper, the concrete pump operator should always switch off the engine and remove the keys, vent the hydraulic pressure and ensure that the agitator control lever is in the neutral position.

NOTE There are variants of this system.

13 Leaving the site (lorry-mounted concrete pumps)

13.1 Before leaving the site, the concrete pump operator should ensure that the concrete-placing boom is properly stowed, that all equipment is securely loaded and that all out-riggers are retracted and secured. A qualified banksman should be made available to supervise exit of the lorry-mounted concrete pump from site.

13.2 Concrete should not be carried in the receiving hopper on the highway.

13.3 Before every journey, the vehicle tyres should be checked for damage, cuts, nails or screws in the tread and material trapped between twin wheels.

14 Personal protective equipment

14.1 The concrete pump operator is likely to be exposed to a variety of working conditions; the majority of these cannot be avoided.

Accordingly, suitable PPE conforming to the appropriate British Standard has to be issued to the concrete pump operator.

14.2 The personal protective equipment worn by the concrete pump operator may include:

a) a safety helmet;

b) safety footwear;

c) overalls;

d) eye protection;

e) ear defenders;

f) fall protection equipment;

g) high visibility clothing conforming to BS EN 471;

h) impervious gloves or gauntlets;

i) barrier cream; and

j) waterproof clothing.

14.3 Concrete pump operators should not be charged for PPE.

14.4 PPE should be replaced by the employer as necessary.

14.5 Other PPE should be supplied when a risk assessment deems this necessary.

15 Concrete pump examination and testing

15.1 A concrete-placing boom is not an item of lifting equipment as defined in the Lifting Operations and Lifting Equipment Regulations 1998 [4]. The examination of concrete-placing booms is specified in BS EN 12001.

The Provision and Use of Work Equipment Regulations 1998 [5] require that a concrete-placing boom is inspected "at suitable intervals to ensure that health and safety conditions are maintained and that any deterioration can be detected and remedied in good time".

15.2 A concrete-placing boom should be thoroughly examined:

- every 500 operating hours or 20 000 m^3, respectively, but
- at least once a year

by a competent person who has the necessary knowledge and experience to carry out that duty.

15.3 A concrete-placing boom should be thoroughly examined by a competent person following repair. Substantial alterations should only be made with the express approval of the manufacturer, and these should be recorded on a supplement to the master record sheet, as specified in BS EN 12001.

15.4 A certificate of thorough examination should be issued by the competent person following each thorough examination; a copy should be made available for viewing on the machine.

15.5 Certificates of thorough examination may be stored in any way appropriate to the owner of the machine, i.e. in paper format, electronically, etc.

15.6 The safe working load of the machine, i.e. the maximum length of delivery hose full of concrete to be suspended from the concrete-placing boom, should be clearly marked on the machine and shown on the certificates of thorough examination. Any other conditions, e.g. the deployment of stabilizers, should be noted on the certificate.

15.7 Following the thorough examination given in BS EN 12001:2003, Annex B, the record should be retained for a period of at least three years to prove a regular inspection regime.

15.8 The manufacturer of the concrete pump or the competent person appointed to examine it may specify a more frequent examination period because of the machine's age, its condition or its operating conditions, etc.

15.9 Inspections should be completed by the concrete pump operator on a weekly basis at least, and by mechanical staff carrying out routine services. A written record of the inspections should be retained and be available at all times for examination.

15.10 If a used concrete-placing boom is sold, the current certificate of thorough examination and its EC declaration of conformity (where applicable) should be supplied to the buyer.

16 Maintenance

16.1 As with all machinery, good maintenance of a concrete pump is paramount to safety. Road safety and on-site safety have both to be considered when planning a maintenance system. A good defect reporting and repair system is also vital.

16.2 The concrete pump owner should carry out regular inspections of the concrete pump and vehicle to ensure that they are fit for use. Maintenance and inspection schedules should correspond to those required by the Vehicle and Operator Services Agency (VOSA).

16.3 Any defect that, in the opinion of the concrete pump operator, would affect the safe operation of the concrete-placing boom and its supporting structure and vehicle should be recorded on the daily and weekly maintenance checklist and handed to a manager immediately.

NOTE Any defects affecting vehicle safety in respect of Road Traffic Act [6] requirements have to be reported immediately to the maintenance department.

16.4 Defects of a minor, non-safety related nature should be recorded on the daily and weekly maintenance checklist. They should be recorded weekly until the defects have been repaired.

16.5 A programme of servicing the vehicle, the concrete-placing boom and its supporting structure and the concrete pump should be devised as a part of a preventative maintenance system. The period between services may be determined by the manufacturer or the owner of the machine and may be based on mileage, the number of hours worked or a period of time.

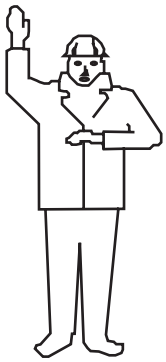
16.6 The braking system should be serviced and tested at least every six months.

16.7 Maintenance and service records should be retained for at least three years to prove a regime of regular maintenance.

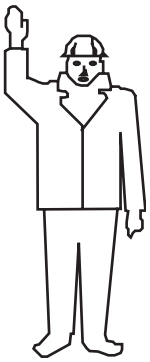
Figure 1 **Example concrete pump hire check list**

1	Date of hire	
2	Name of contractor	
3	Address of site	
4	Insurance cover	
5	Boom size required	
6	Adequate space on site in which to set up machine, i.e. room for deployment of stabilizers	
7	Site visit required	
8	Site contact name	
9	Site telephone no.	
10	Concrete supplier and mix details	
11	Concrete supplier and telephone no.	
12	Time required on site	
13	m^3 of concrete to be pumped	
14	Special requirements: • Linesman • Extra pipelines/compressor/water supply • Spark arrester • Cash sale	
15	Provisional or confirmed booking	
16	Overhead power cables	
17	Order number	
18	Wash out area	
19	Priming material for grouting delivery pipelines	
20	Risk assessment/method statement in place	
21	Type of pour, e.g. floor slab and wall.	

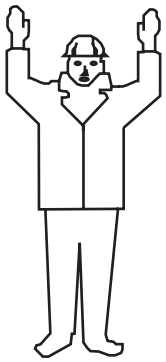
Annex A (normative) Recommended signals



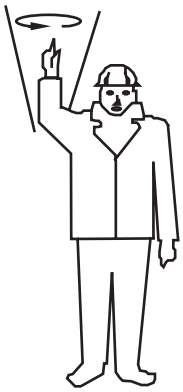
Start pumping



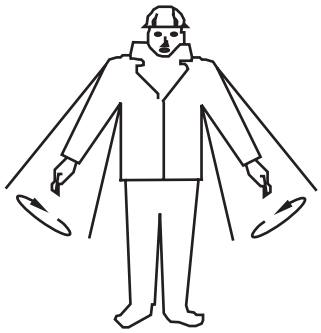
Stop pumping



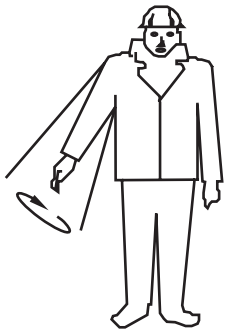
Emergency stop



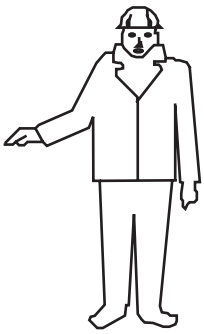
Raise the boom



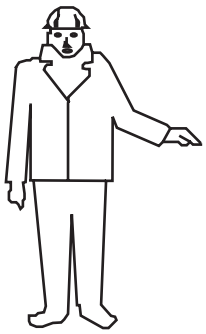
Lower the boom slowly



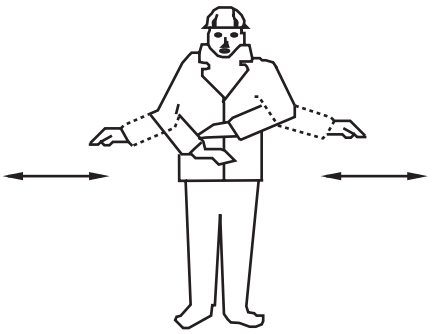
Lower the boom



Slew left



Slew right



End of pour

Annex B (normative) Inspection of delivery lines

B.1 Steel delivery lines

B.1.1 Steel delivery pipelines may be either single wall or double wall. Double wall thickness pipeline consists of an outer layer which provides the necessary strength for pressure containment, and an inner layer of increased hardness which provides improved resistance to wear.

B.1.2 In the case of single wall lines, the wall thickness of the pipeline may be checked using an ultrasonic gauge or similar non-destructive technique. Pipelines should be rejected if the thickness falls below the manufacturer's recommended minimum thickness.

B.1.3 In the case of double wall pipeline, ultrasonic gauges do not normally provide an accurate measurement of wear, and the pipeline has to be broken down into its individual lengths and the thickness measured from the ends using suitable metrology equipment. The thickness should be compared with the manufacturer's recommended minimum thickness and rejected if it falls below it.

NOTE The maximum wear in a pipeline normally occurs within the first 300 mm of either end of the pipeline due to turbulence of the concrete following the joint. Annex C provides a maintenance card on pipeline wall thickness pressure.

B.2 Bends

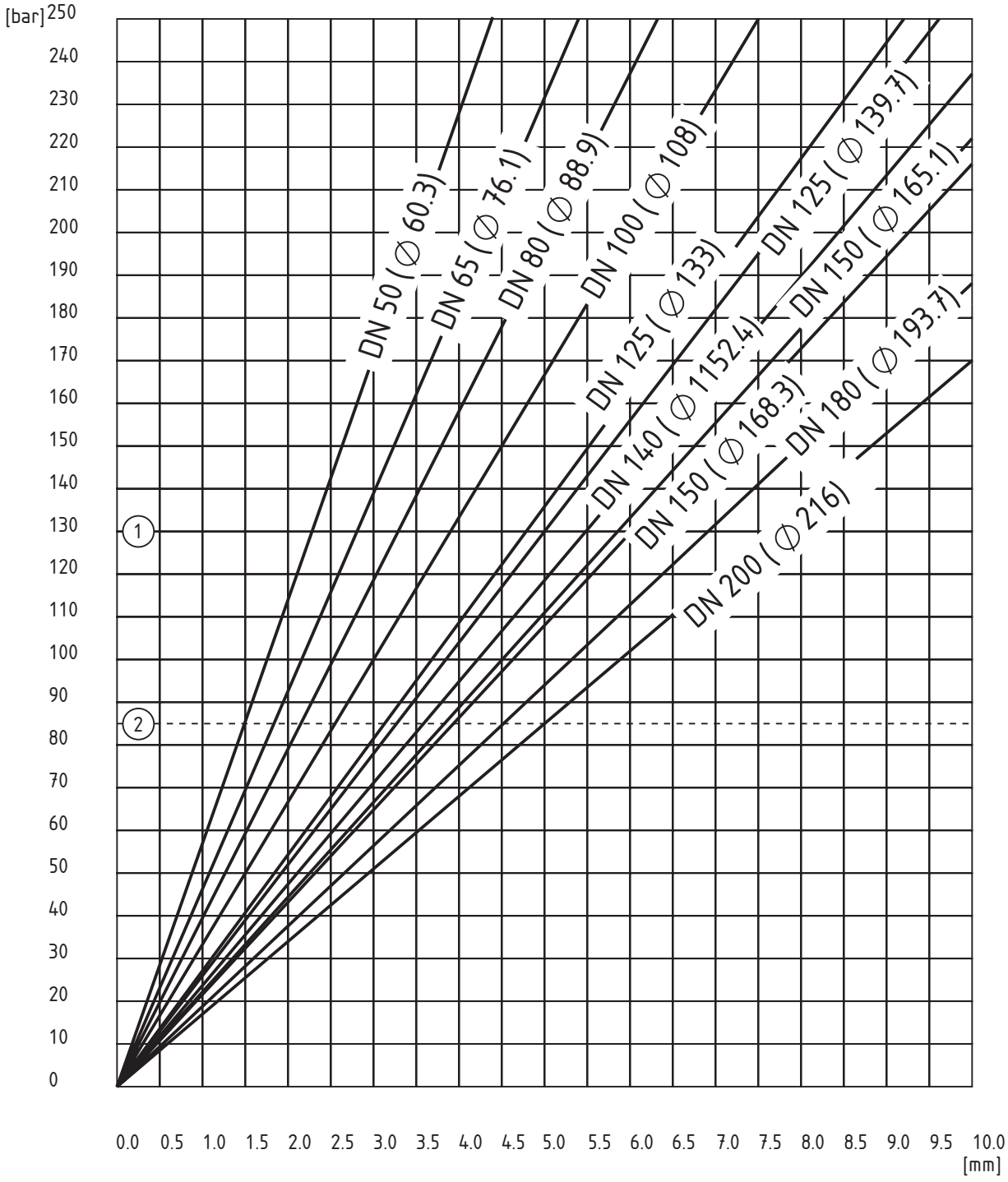
Pipeline bends cannot easily be checked for wear using measurement techniques. Wear can be estimated by comparing the weight of a used bend with that of a new bend of similar size.

B.3 Flexible pipelines

Flexible pipelines should be inspected visually inside and out. If any steel reinforcement wires are visible, then the pipeline should be immediately replaced.

NOTE Failure of flexible pipeline is often as a result of the pipeline being forced into too tight a radius.

Annex C (informative) Pipeline wall thickness pressure – Maintenance card



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