BRITISH STANDARD

BS 7121-14:2005

Code of practice for safe use of cranes —

Part 14: Side boom pipelayers

ICS 53.020.20

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee, MHE/3, Cranes and derricks, to Subcommittee MHE/3/11, Crane safety and testing, upon which the following bodies were represented:

Association of Lorry-Loader Manufacturers and Importers

CEA — Construction Equipment Association

Construction Confederation

Construction Plant-hire Association

HSE — Health and Safety Executive

Institution of Occupational Safety and Health

Institution of Structural Engineers

Low Power Radio Association

Safety Assessment Federation

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Contents

Foreword

This part of BS 7121 has been prepared by Subcommittee MHE/3/11. It is intended to be used in conjunction with other parts of BS 7121 to ensure, so far as is reasonably practicable, that lifting operations are carried out safely.

The Lifting Operations and Lifting Equipment Regulations (LOLER) [1] and the Provision and Use of Work Equipment Regulations (PUWER) [2] came into force on 5 December 1998. Details of the Regulations, an Approved Code of Practice plus HSE guidance can be found in the HSE books *Safe use of lifting equipment* [3] and *Safe use of work equipment* [4].

BS 7121-1 provides general recommendations for crane types not covered in an additional part of BS 7121. BS 7121-2 covers in-service inspection, thorough examination and, where appropriate, testing for the safe use of all types of crane. This Part covers the safe use of side boom pipelayers. Subsequent parts deal with the specific crane types as follows:

— *Part 3: Mobile cranes;*
— *Part 4: Lorry loaders;*
— *Part 5: Tower cranes;*
— *Part 6: Derrick cranes;*
— *Part 7: Overhead/under-hung travelling and goliath cranes;*
— *Part 8: High pedestal and portal jib dockside cranes;*
— *Part 9: Container handling cranes;*
— *Part 10: Rail mounted cranes;*
— *Part 11: Offshore cranes;*
— *Part 12: Recovery vehicles and equipment;*
— *Part 13: Hydraulic gantry lifting systems.*

When all parts of BS 7121 have been published, CP 3010 will be withdrawn and BS 5744 will be revised to cover manually operated and light cranes only.

The Health and Safety Executive (HSE) commends the use of this British Standard to those who have duties under the Health and Safety at Work etc. Act 1974 [5]. This standard was drawn up with the participation of HSE representatives and will be referred to in relevant HSE publications.

The BS 7121 series has been accepted as representing the consensus of practical experience for safety on cranes.

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 has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and competent people.

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 does not of itself confer immunity from legal obligations.

Attention is drawn to the following statutory regulations:

The Lifting Operations and Lifting Equipment Regulations (LOLER) [1];

The Provision and Use of Work Equipment Regulations (PUWER) [2];

Health and Safety at Work etc. Act 1974 [5];

The Supply of Machinery (Safety) Regulations [6];

The Management of Health, Safety and Welfare Regulations [9];

The Personal Protective Equipment at Work Regulations [10].

Summary of pages
This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 23 and a back cover.

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1 Scope

This part of BS 7121 gives recommendations for the safe installation and use of pipelayers. Subjects covered include selection of pipelayers, planning the lifting operation, thorough examination, operation, as well as safety measures to be taken during the execution of these functions. It also covers the selection and training of personnel involved in the safe installation and use of pipelayers.

In addition a uniform method of calculating, and a test method for validating rated lift capacity as presented in commercial literature for pipelayers is included. The rated lift capacity considers hoist mechanism limits, tipping loads and rope factors.

This British Standard applies to all pipelayers when used in lifting applications as defined in BS EN ISO 6165 and BS 6914-5.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 6911-7, *Testing earth moving machinery — Part 7: Specification for units of measurement and tolerances* [ISO 9248].

BS 6914-5, *Terminology (including definitions of dimensions and symbols) for earth-moving machinery — Part 5: Glossary for pipelayers.*

BS EN 473:2000, *Non-destructive testing — Qualification and certification of NDT personnel — General principles.*

BS EN ISO 6165, *Earth-moving machinery — Basic types — Vocabulary.*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1
employing organization
person or organization who requires a lifting operation to be carried out and is responsible for the safe use of the pipelayer

3.2
pipelayer
self-propelled crawler machine which incorporates pipe laying equipment with mainframe, load hoist mechanism, vertically pivotable side boom and counterweight, and is primarily designed to handle and lay pipes

3.3
side boom
tractor equipment, including boom, load hoist mechanisms and a vertically pivotable side boom, added to a tractor, which is designed to handle and lay pipes and carry pipe laying equipment

NOTE A side boom might have counterweights attached.

3.4
base machine
pipelayer including undercarriage, without equipment or attachments, as described by the manufacturer's specification

3.5
equipment
set of components, boom and counterweights mounted onto a base machine to fulfil the primary design function of a pipelayer

3.6
boom
structural member that supports a load

3.7
counterweight
additional removable mass and its support which is added to increase the stability of a pipelayer

3.7.1
adjustable counterweight
portion of the counterweight that is movable

3.8
attachment
assembly of components that could be mounted on the base machine, or equipment, for a specific use

3.9
component
part, or an assembly of parts, of a base machine, equipment or attachment

3.10
load
external force acting on the pipelayer, including the mass of attaching equipment applied at the load hook

3.11
lift point line
vertical line through the centre of the load hook

3.12
tipping line
<for crawler machines> outer edge of the outer track link rail on the boom side of the machine, see Figure 1

3.13
radius
<for crawler machines> perpendicular distance from a vertical plane passing through the outer edge of the outer track link rail, on the boom side, to a parallel vertical plane passing through the lift point, which is the load bearing surface midpoint of the hook

NOTE This radius for crawler machines is indicated by dimension R1 in Figure 1.

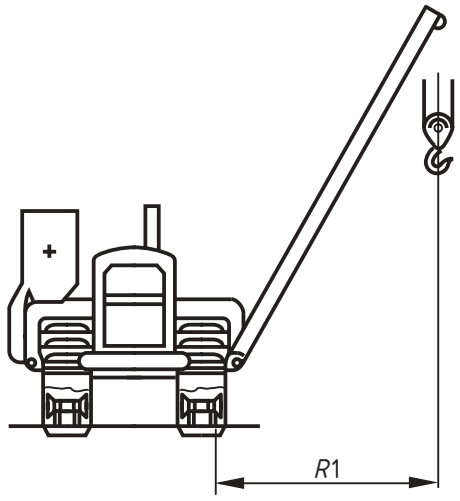


Figure 1 — Dimension R1 for a crawler machine

3.14
moment acting to overturn machine
product of a force acting on a machine through the lift point line and the radius

3.15
moment acting to resist overturn of machine
product of the mass of the machinery and the distance from the centre of gravity to the tipping line

3.16
measured balance point
<for crawler machines> moment acting to overturn the machine at a specific radius that does not cause any track roller on the track opposite the boom side to lift more than 6 mm from the track link

3.17
tipping load
vertical load applied at the load hook at a specific radius, which achieves the balance point

3.18
rope
wire rope used for the boom support or load line

3.19
rope factor
rope breaking strength divided by rope load

3.20 draw works

3.20.1
mechanical draw works
drums and mechanical drive systems that operate the boom position and the load hoist lines

3.20.2
hydraulic draw works
hydraulic pumps, motors, valve lines and cylinders, that position the boom and operate the hoist line

3.21 hydraulic pressure

3.21.1
working circuit pressure
nominal pressure applied to the specific circuit by the hydraulic pumps

3.21.2
holding circuit pressure
maximum static pressure in a specific circuit limited by a relief valve pressure that is measured at a flow no greater than 10 % of rated flow

3.22
lift mechanism lift capacity
maximum load that can be lifted at the load hook by a force generated by any combination of mechanical or hydraulic power to the draw works and/or hydraulic cylinder(s) at a specific draw radius without exceeding any of the following limits:

— tipping load;
— hydraulic working or holding circuit pressure in any circuit;
— rope factor in either load or boom hoist line.

NOTE Some of the possible combinations of power to the lift mechanism include:

a) mechanical draw works power to the load;
b) hydraulic draw works power to the load and boom hoist line;
c) mechanical power to the draw works for the load hoist line and hydraulic cylinder(s) for the boom hoist line;
d) hydraulic cylinders for the boom hoist line.

3.23
mechanical draw works lift capacity
lift capacity obtained by applying mechanical power to the load and boom hoist draw works without exceeding tipping load or rope factor

3.24
hydraulic lift capacity
lift capacity obtained by applying working circuit pressure to the hydraulically actuated draw works and/or lift cylinder(s) without exceeding the holding circuit pressure in any circuit

3.25
rated lift capacity
maximum load that can be raised without exceeding the rated tipping load lift capacity

NOTE The rated lift capacity is also known as "rated lift mechanism lift capacity" or the "rated rope factor lift capacity" see **4.1**.

4 Lift capacity determination procedure

4.1 Machine preparation

All lift capacity determinations should be made either with adjustable counterweights fully extended or with variable ballast configurations, for example ballast retracted, ballast not fitted. All lifting operation specifications tested should be shown on the test certificate and machine. See **4.11** and **9.3.6**.

4.2 Tipping load test

The tipping load test is carried out for all permitted counterweights and counterweight positions. A live test weight (freely suspended load) should be used in the tipping load test.

4.3 Test site

The lift capacity determination test site should consist of a concrete, steel or equally firm surface and should be level to within 1 %. The test site should be secured, to prevent access by unauthorized persons, and of sufficient area to enable the test to be carried out without endangering personnel.

4.4 Test equipment

The following test equipment with tolerances in accordance with BS 6911-7 should be available.

a) Sufficient freely suspended weights. The weights should either be of known mass or a calibrated weighing device should be available to determine the mass of the weights.

b) Means to measure the radius distance.

4.5 Test conditions

The test should be conducted under the control of a competent person.

The pipelayer should be thoroughly examined in accordance with Clause **8** before the test to determine whether it is in a suitable condition to withstand the loads applied during testing.

The manufacturer's operating instructions (but not duty charts) for the pipelayer and the test equipment should be followed at all times.

After load testing, a thorough examination should be undertaken by a competent person to determine whether the pipelayer has withstood testing without signs of structural change that could affect its safety, such as:

a) cracking;

b) permanent deformation;

c) paint flaking;

d) loosening of or damage to structural connections.

4.6 Test load

A test load, sufficient to cause the pipelayer to attain the measured balance point at approximately the maximum radius, should be lifted at an intermediate radius position. With the load kept as close to the ground as possible, the pipelayer should be boomed out slowly until the measured balance point is achieved. The radius should be measured.

The test should be repeated with different loads applied, to enable the radius to be measured at the balance point for two intermediate positions and approximately the minimum radius position.

4.7 Test results

The results of the test should be recorded and the record should also show the make, model and serial number of the pipelayer, together with the length and identification number of the boom. A graph showing the measured radius at the corresponding load should be drawn, this graph shows the maximum lift capacity. A graph should then be drawn showing 0.714 times the load at the corresponding radius. This graph shows the maximum load that the pipelayer can lift at various radii within the stability requirement [i.e. safe working load (SWL) due to stability].

NOTE See Annex A for an example of a lifting capacity chart.

4.8 Rope factor

The SWL of the pipelayer should not cause the ropes to be loaded beyond one fifth of their ultimate strength in accordance with the rope manufacturer's specification.

4.9 Winch pull

It is essential that the SWL of the pipelayer does not cause the winch to be loaded beyond the maximum line pull permitted by the winch manufacturer.

4.10 Safe working load of the pipelayer

The SWL for the pipelayer is the lesser value given by the SWL for stability, SWL due to rope factor and SWL due to winch pull. The graph produced in accordance with **4.7** should also show the SWL for the pipelayer, see Annex A.

4.11 Duty chart

From the graph showing the SWL for the pipelayer a duty chart should be produced. The duty chart should have legible letters and figures such that at each specified machine configuration and radius positions the rated capacity can be clearly identified.

The data and information provided in the duty chart should include, but not necessarily be limited to the following.

a) The established rated lift capacities at stated radii.

b) Number of parts of line (hoist and boom).

c) Boom length.

d) Counterweight amount and position.

e) The standard the pipelayer is rated in accordance with.

NOTE Annex B gives an example of a duty chart for a 583(H) pipelayer.

5 Hoist mechanism

On boom hoist winches driven by a friction clutch (i.e. non-hydraulic machines) a positive locking device to prevent inadvertent lowering of the boom should be provided. Where possible, an automatic means to stop the boom motion when the maximum permissible height is reached should also be provided.

When the load hoist mechanism has power operated brakes for controlling loads without continuous mechanical linkage between the actuation and braking means, an automatic means should be provided that prevents the load from falling in the event of a loss of power.

Hoist drums should be set up with the specified rope capacity with recommended rope size and reeving to operate the boom and hook within the range of boom lengths, operating overhang and vertical lift recommended by the manufacturer, with no less than three full wraps of rope remaining on the drum during operation.

Hoist drums should provide a first wrap rope pitch diameter of not less than ten times the nominal diameter of the rope.

Boom and load hoist sheaves should have a pitch diameter of not less than ten times the nominal diameter of the rope used.

When using the manufacturer's specified rope reeving and with rated lift capacity suspended:

a) the boom hoist mechanism should be capable of raising and lowering the boom, stopping motion, and, without control movement, holding the load stationary;

b) the load hoist mechanism should be capable of raising and lowering the load, stopping the load, and, without control movement, holding the load stationary.

A guard should be fitted over the hoist rope to protect the operator. The guard needs to be of sufficient strength to protect the operator in the unlikely event of the hoist rope breaking, but it is essential that it does not impair the operator's vision or their operation of the machine.

6 Rated and radius capacity indicators

6.1 Rated capacity indicators

At present it is not normal practice to fit rated capacity indicators to pipelayers as they do not provide the correct information for safe operation.

6.2 Radius capacity indicator

6.2.1 *General*

A radius capacity indicator should be fitted to a pipelayer, showing the radius of the machine at any given time and the rated capacity corresponding to that radius.

6.2.2 *Controls*

All controls on the pipelayer should be marked to indicate their function and effect of movement.

6.2.3 *Safe working load*

A chart showing the SWL should be displayed so that it is available to the operator from the operating position.

The chart should specify the operating positions/conditions to which the SWL applies.

The SWL should be presented so that the driver only has to take into account the masses of non-fixed load attachments, and does not need to calculate the SWL capacity. See Annex B for an example of a pipelayer duty chart.

6.2.4 *Residual risks*

Safety signs/hazard pictorials to warn of residual risks should:

a) alert persons to an existing or potential hazard;

b) identify the hazard;

c) describe the nature of the hazard;

d) explain the consequences of potential injury from the hazard;

e) instruct persons about how to avoid the hazard.

Safety signs located on the pipelayer should either be near to the location of the hazard or the control area to prevent the hazard.

The number of safety signs should be kept to a minimum because overuse can reduce their effectiveness.

7 Marking of pipelayers

NOTE Attention is drawn to the Supply of Machinery (Safety) Regulations [6] which require that pipelayers and other equipment acquired after 1 January 1995 are CE marked and supplied with a Declaration of Conformity together with the supporting technical documentation.

Pipelayers should be permanently and legibly marked with the appropriate general decals or information.

Signs or written warnings only stating "Danger" should not be used.

Markings, signs and written warnings should be readily understandable and unambiguous, particularly regarding the function(s) of the machine to which they relate.

Readily understandable signs or pictograms are preferred to written warnings.

Written warnings should be in the language(s) of the country in which the machine is intended to be used and in the primary language(s) of the operators.

8 Thorough examination of pipelayers

8.1 General

The implementation of LOLER [1] provides the opportunity for competent persons to specify either a "specified period" or an "examination scheme" approach to thorough examination, both of which can include testing. However, a scheme of thorough examination is not appropriate for pipelayers so should not be used.

8.2 Specified period of thorough examination

Pipelayers should be subject to a thorough examination by a competent person at least once every 12 months. After carrying out the thorough examination the competent person should specify when the next thorough examination is to be carried out, which may be less than but not more than 12 months.

8.3 Provision of facilities and services

The employing organization should ensure that facilities or services which are required by the competent person to carry out the thorough examination are provided. These could include the following.

a) Appropriate area (see **4.3** for overload testing), cordoned off to prevent access by persons not directly involved in the examination.

b) Operator for the pipelayer.

c) Person(s) to remove covers or open up parts of the pipelayer.

d) Preparation, e.g. cleaning or other process, of parts or areas of the pipelayer for examination or NDT.

8.4 Rectification of defects

Where the competent person identifies defects affecting the continued safe use of the pipelayer, or specifies a timed replacement of components etc., the employing organization should ensure that these defects are rectified.

NOTE Normally the owner of the pipelayer is responsible for carrying out the work but the employing organization is responsible for ensuring that the pipelayer is not used until the defects are rectified.

8.5 Preparation for thorough examination

Prior to thorough examination the pipelayer should be cleaned by appropriate means, e.g. pressure washed, to remove all spoil/dirt that would otherwise conceal the structure or mechanisms and prevent an effective examination. The examination should be carried out in a logical sequence, for example top to bottom, to ensure that nothing is overlooked.

8.6 Items to check at the specified period thorough examination

8.6.1 Visually examine the crawler tracks for wear and adjustment.

8.6.2 Visually examine the pipelayer structure, including the chassis, for signs of damage, distortion, cracking and corrosion.

8.6.3 Visually inspect all bolts and fastenings to check that they are not coming loose.

8.6.4 Visually examine all pipework on the machine for corrosion, damage, leakage, security and fretting.

8.6.5 Visually examine all hydraulic cylinders for leakage, corrosion on the rods and alignment. Visually check end fixings for wear, security and lubrication.

8.6.6 Visually examine the structure and boom of the machine for corrosion, damage, cracks and distortion.

8.6.7 Visually examine all pivoting joints on the boom and attachments of the machine for wear, corrosion, security and evidence of lubrication.

8.6.8 Visually examine all ropes to determine whether they are of the size and type specified in the manufacturer's instructions and reeved in accordance with those instructions. Pay particular attention to the end terminations.

NOTE Guidance on wedge and socket anchorages for wire ropes is available in HSE Guidance Note PM 46 [7].

8.6.9 Visually check whether all pulleys/sheaves and drums are free from damage and wear, whether the rope fits correctly on them and they are effectively lubricated. Check whether all idler pulleys/sheaves turn freely and that all guards are undamaged and in place.

8.6.10 Visually examine the whole length of the ropes for signs of wear, damage, broken wires and corrosion. The use of vernier callipers and a watchmaker's eyeglass greatly assists this examination. Particular attention should be paid to those portions that regularly pass around pulleys/sheaves.

8.6.11 Visually inspect the braking mechanisms for wear, damage and adjustment and check whether it is in accordance with the manufacturer's instructions.

8.6.12 Check any means of access for completeness and security of ladders, walkways and hand rails/hand holds.

8.6.13 Visually check whether the fixings and restraint for the operator's seat, where fitted, are all in place and secure.

8.6.14 Check whether all control levers are marked with their function and mode of operation.

8.6.15 Visually examine the hooks, their attachments and safety catches for wear, fretting, distortion, corrosion and security.

8.6.16 Check whether there is a chart displayed showing the rated lift capacities for the machine for all operating conditions (boom lengths, counterweights etc.).

8.6.17 Functionally test all controls for smoothness of operation and to determine whether they are free from wear and other damage.

8.6.18 Check whether warning signs and other important manufacturer's instructions are present and readable.

8.6.19 Operate the machine to check whether all motions operate smoothly and effectively without excessive play. The load lifting attachment should not drop excessively after the motion has been stopped and all limiters and safety devices should operate correctly.

NOTE Regulation 9 of LOLER [1] requires that on completion of a thorough examination a certificate is issued. See Annex C for an example of a report of thorough examination.

9 Testing

9.1 General

Thorough examination of a pipelayer includes testing. This can take many forms including functional testing, performance testing, non-destructive testing (NDT) and overload testing.

The competent person should decide when a test is necessary and determine the most appropriate method of carrying it out.

It is important therefore that the competent person takes account of the instructions and other relevant information provided by the manufacturer or other appropriate specialist.

9.2 Non-destructive testing (NDT) techniques

During thorough examination of the equipment the competent person might consider it to be appropriate to apply NDT techniques to assess the integrity of components. These techniques can assist in the detection of any material cracks or defects that might grow in service and ultimately lead to failure.

BS EN 473 contains guidance on qualification and certification of NDT personnel and, unless the operator is working to a detailed written procedure, they should be qualified to Level Two in accordance with BS EN 473:2000.

The three most common types of NDT used are as follows.

— *Magnetic particle examination*
In this technique a magnetic field is induced in the area under examination whilst the surface is flooded with ferrous particles suspended in a liquid. Any cracks or defects cause a discontinuity in the magnetic field which in turn causes the ferrous particles to cluster over the defect indicating its presence by a dark line. This technique is only suitable for magnetic materials (most structural steels and some stainless steels) and only detects surface defects and large defects just below the material surface.

NOTE Further guidance is given in BS EN ISO 9934, PD 6513 and BS EN 10228-1.

— *Dye penetrant*
In this technique the surface of the material is flooded with a liquid dye which penetrates into any surface cracks or defects. After a specified period the dye is cleaned off and the surface sprayed with an absorbent "developer" which draws the dye from any defects indicating the presence of the defect. The technique is often employed on non-ferrous materials such as aluminium alloys, but can only locate surface defects.

NOTE Further guidance is given in BS EN 571-1 and BS EN 10228-2.

— *Ultrasonic examination*
In this technique pulses of high frequency sound waves are transmitted from the surface of the material into its interior. Any defects or discontinuities cause the sound waves to be reflected back to the surface where they can be detected and, by measuring the time delay from the time of transmission, an estimate of the defect's depth below the surface can be made. The technique can be used for a wide range of materials and detects both surface and subsurface defects. However, it requires both a skilled operator and specialist equipment and would normally be carried out by a specialist firm.

NOTE Further guidance is given in BS EN 583-3.

9.3 Overload testing

9.3.1 *General*

The objective of overload testing a pipelayer is to demonstrate whether it is stable and structurally sound and fit for the use for which it was designed. Every pipelayer should be overload tested prior to first use for this reason.

Pipelayers should be overload tested at least once every four years and after undergoing major repair or modification.

9.3.2 *Pipelayers which have been altered or repaired*

Following any alteration or repair that could affect the stability of a pipelayer, tipping load testing should be carried out in accordance with Clause **4**.

Following any alteration or repair that could affect the strength of a pipelayer, overload testing should also be carried out so that all parts of the machine affected by the repair are subjected to the test loads in accordance with Clause **4**.

9.3.3 *Thorough examination prior to overload testing*

9.3.3.1 Prior to overload testing the competent person should determine by thorough examination with a pipelayer in motion and at rest whether it is:

a) free from any defect that would preclude it from safely handling the test load;

b) in the correct configuration and condition according to the manufacturer's instructions;

c) equipped with sufficient falls of rope for the load under consideration.

9.3.3.2 The amount of ballast present and its disposition should be checked to determine whether it is in accordance with the manufacturer's instructions.

9.3.3.3 The mass of all ballast should be on record and, where not marked on the ballast, the mass should be confirmed.

9.3.3.4 All safety switches, for example over hoist, lowering limit, derricking limit, should be checked for correct operation.

9.3.3.5 Lifting accessories should be thoroughly examined before the test and the competent person should determine whether the slinging arrangements are safe.

9.3.4 *Overload test site conditions*

Careful consideration should be given to the condition of the site where overload tests are to be conducted. The recommendations provided in the operating instructions for the pipelayer relate to operations within the rated capacity and more stringent requirements apply when loads are being applied for the purpose of testing.

Provision should be made to prevent persons who are not directly involved in the testing from gaining access to the site.

The ground should be well consolidated and capable of withstanding the loads applied to it. There should be no hidden dangers such as cable ducts, drains, pipes, back-filled areas, cellars or other subterranean weaknesses. Pipelayers should not be tested in the vicinity of overhead power lines (see BS 7121-1:1989, **9.3.2**).

The site should be of sufficient area and have unrestricted overhead clearance to allow the unobstructed movement of the pipelayer and load throughout its test movements, for example sprag or turn.

It is preferable that tests are not conducted over high risk areas, for example a public highway, railway or occupied buildings. If due to the requirements of usage this is unavoidable, arrangements should be made with the appropriate authorities.

9.3.5 *Thorough examination after overload testing*

After overload testing a thorough examination should be undertaken by a competent person to determine whether the pipelayer has withstood testing without signs of structural damage that could effect the safety of the pipelayer, such as:

a) cracking;

b) permanent deformation;

c) paint flaking;

d) loosening of or damage to structural connections.

The examination should also confirm whether all mechanisms function correctly and are free from defect, and if the pipelayer is safe for further use.

9.3.6 *Test certificate*

After completion of every test a certificate should be issued.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. An example of a test certificate is given in Annex D.

10 Management of lifting operations

10.1 Safe system of work

A safe system of work should be established and followed for lifting operations whether it is an individual lift or a group of repetitive operations.

The safe system of work should include:

a) risk assessment;

b) planning of the operation;

c) preparation of a method statement;

d) selection, provision and use of suitable pipelayers and equipment, including:

1) maintenance;

2) inspection;

3) examination, and testing if required;

e) preparation of the site, if required, and making due allowance in the capacity of the pipelayer for any slopes;

f) provision of properly trained and competent personnel aware of their statutory responsibilities;

g) supervision by properly trained and competent personnel with authority;

h) ensuring that all reports of thorough examination, test certificates and other documents are available;

i) preventing unauthorized movement or use of the pipelayer at all times;

j) consideration for the safety of persons in the danger zone but not involved in the lifting operation.

Safe systems of work should effectively be communicated to all parties concerned.

10.2 Control of the lifting operation

In order to implement the safe system of work effectively, one person should be appointed to have overall control of the lifting operation to act on behalf of the employing organization requiring the load to be moved.

NOTE Provision of an appointed person does not lessen the legal responsibility of the employing organization for ensuring safety. The appointed person may have other duties and need not be an employee of the employing organization.

The appointed person should have sufficient training and experience to enable them to carry out all their duties competently.

10.3 Planning of the lifting operation

The appointed person should plan all lifting operations to ensure that they are carried out safely and that all foreseeable risks are taken into account.

NOTE For repetitive or routine operations, planning might only be necessary in the first instance, with periodic reviews to ensure that no factors have changed.

Planning of the lifting operation should include:

a) the load, its characteristics and the method of lifting;

b) the selection of an appropriate number and capacity of pipelayers for the operation;

c) the selection of lifting accessories, including taking into account the mass of the accessories on the total load of the pipelayer(s);

d) the position of the pipelayer(s) and load before, during and after the operation;

e) present and foreseeable environmental conditions at the site that could entail interruptions to the operation.

10.4 Method statement

The appointed person should prepare a method statement, including a step-by-step description of the safe system of work for the entire lifting operation.

The method statement should include:

a) the schedule of responsibilities;

b) full details of the make, model and configuration of the pipelayers;

c) details of ancillary equipment;

d) details of the lifting equipment;

e) the name of the appointed person;

f) the name of the supervisor (who might be the appointed person);

g) a complete plan including the sequence of the operation.

NOTE 1 This list is not exhaustive and in some circumstances further information might be required.

During preparation of the method statement the appointed person should consult with any persons with specialist knowledge and experience to ensure that all hazards that might be caused by, or to, the pipelayers are taken into consideration.

The method statement should give details of the steps to be taken to eliminate danger to personnel not involved in the lifting operation, and if required, to prevent entry into the danger zone.

NOTE 2 Pipelayers are used in a wide variety of locations. On large pipeline projects, a number of different lifting operations can be carried out each day (from basic to complex).

10.5 Contract lifting operations

The employing organization may enter into a contract with a contractor to undertake the lifting operation on their behalf. If so, the employing organization should be satisfied that the contractor has the necessary competence to carry out the lifting operation.

The parties should ensure they have:

a) an understanding as to whom provides an appointed person;

b) an agreement that the employing organization provides accurate information on the location of all services (drains, pipelines, cables etc.);

c) dealt with the issue of responsibility of maintenance.

NOTE The employing organization may hire a pipelayer and operator from a pipelayer owner without entering into a contract with the pipelayer owner to carry out the lifting operation. In this case, the employing organization would obtain the personnel and expertise to comply with this part of the standard from another source.

11 Selection and duties of appointed persons

11.1 General

When selecting and assessing an appointed person the employing organization should take into account the variety and complexity of the operation, as well as all the problems that could arise from proximity hazards and environmental causes. The appointed person should be notified formally in writing of their appointment. The appointed person should be given authority to carry out the duties involved, including consulting others with specialist knowledge and experience, and should be able to delegate duties and tasks for any part of the safe system of work to suitably qualified individuals.

11.2 Duties of appointed persons

The duties of appointed persons for pipelaying operations can vary according to the complexity of the operation. The duties for a basic lift are simpler and less demanding than for a unique lift. An appointed person employed for a basic lift might not be deemed suitably trained or experienced for a more complicated unique operation, and another appointment could be required.

11.3 Basic lift

A basic lift is considered to be the handling and laying out of individual pipes or the handling and lowering in of straight sections of line pipe that do not involve more than two pipelayers. The handling of associated equipment and accessories might also be considered a basic lift.

If the mass of the load(s) can be simply established, and there are no hazards or obstructions within the area of the operation, then the duties of the appointed person should include the following.

a) Establishing the mass of the load. This can be by a reliable source of information, weighing the load, or calculation (with allowance for possible inaccuracies).

b) Selection of the pipelayer(s), based on the mass of the load, including the hook block and any lifting tackle, the maximum height of the lift and the maximum radius required. The rated capacity of the pipelayer should be specified on the duty chart derived from testing and not the manufacturer's duties chart, or from the current report of thorough examination issued by the competent person.

c) Consideration of the location of the operation.

d) Ensuring the pipelayer(s) has been thoroughly examined (including testing where appropriate), inspected and checked before use.

e) Ensuring that a system for reporting defects is in place.

f) Selecting appropriate lifting accessories, including their method of attachment to the load, and any protection used to prevent damage.

g) Ensuring that lifting accessories are thoroughly examined, inspected and checked before use.

h) Briefing all persons involved in the lifting operation to ensure that the safe system of work described in the method statement is understood.

i) Ensuring that there is a supervisor designated to direct personnel and that the operation is carried out in accordance with the method statement.

The appointed person and supervisor should be aware of the limits of their knowledge and experience concerning lifting operations, and when conditions exceed these limits, further advice should be sought.

11.4 Complex lift

A complex lift is considered to be the handling and lowering in of welded pipestrings into a trench (lower and lay), handling and lowering pipes with additional auxiliary equipment and lifts that involve two or more pipelayers.

The handling and lowering in of prefabricated section or river crossings might also be considered a complex lift.

If the lifting operation requires more than one pipelayer to lift the load then the appointed person should ensure, in addition to the duties listed in **11.3**, that:

a) the mass of the load is known;

b) the proportion of the mass taken by each pipelayer throughout the lifting operation is known accurately to within ±5 %;

c) the pipelayers are compatible in lifting characteristics, with sufficient margins within the rated capacity of each pipelayer to allow for any additional dynamic loading that could be transferred from one pipelayer to another during movement of the load. If the appointed person is satisfied that all factors that can induce loads into each pipelayer are accurately known the pipelayers may be used up to their SWLs. If all factors cannot be accurately evaluated, an appropriate down rating of at least 20 % should be applied to each of the pipelayers.

NOTE This value does not include the 10 %, which is added for the tolerance in pipe wall thickness, see Table E.1;

d) the suitability of the ground is investigated to withstand the forces applied during the lifting operation, and taking into account the effect of pipelayers standing in close proximity to each other, including dynamic effects for example, vibration.

11.5 Supervision

Each lifting operation with pipelayers should be properly supervised to ensure the operation is carried out safely.

The supervisor should control the operation and direct the movement of the pipelayers.

The appointed person should designate one person to act as the supervisor for a lifting operation. The supervisor should be fully briefed on the safe system of work as described in the method statement. The supervisor should have the authority to stop the lifting operation and report back to the appointed person for further guidance if they consider that it would be unsafe to continue.

12 Selection and minimum attributes of personnel

NOTE See Clause **11** for the selection of the appointed person.

12.1 Selection of personnel

Personnel who are considered to be competent to carry out all duties required should be selected to carry out the lifting operation. Records of training and experience of personnel should be consulted to assist in selection of suitable personnel.

NOTE 1 Guidance on training of operators and signallers can be found in HSE Guidance Note GS 36 [8].

Persons responsible for selection of personnel should check that they are efficiently organized to ensure good teamwork. Personnel should be instructed not to work under the influence of alcohol, drugs or other impairments to efficiency. All personnel undergoing training should be supervised by appropriate personnel.

NOTE 2 Attention is drawn to The Management of Health, Safety and Welfare Regulations [9] regarding the employment of young persons.

12.2 Minimum attributes of personnel

All personnel should be:

a) competent to perform the tasks required of them;

b) trained and/or successfully assessed;

c) able to present a record of training and assessment;

d) physically able to carry out the work.

12.3 Supervisor

The supervisor should be:

a) authorized to carry out the duties listed in **13.1**;

b) fully conversant with the duties of all persons involved in the lifting operation;

c) able to give clear, unambiguous instructions to all other members of the team;

d) able to assess danger to the lifting operation from changed circumstances on site, and call a halt to the operation so that the appointed person can be consulted if necessary.

12.4 Pipelayer operator

The pipelayer operator should be:

a) trained in the safe use of pipelayers and on the specific machine to be used;

b) capable of assimilating and applying the information contained in the duties charts and the manufacturer's instructions;

c) trained and competent to carry out the daily and weekly inspections listed in Annex F and appropriate maintenance, including completion of the appropriate reports;

d) able to resist pressures from other persons to carry out unsafe operations;

e) able to take action to avoid dangerous situations, including stopping operations.

Evidence that the operator is medically fit to drive a pipelayer should be obtained at not more than 5 yearly intervals.

12.5 Slinger

The slinger should be:

a) capable of checking the lifting accessories are in good condition and correctly attached;

b) capable of initiating and directing the safe movement of the pipelayer and load in accordance with the signalling method illustrated in Annex G.

12.6 Maintenance personnel

Maintenance personnel should be capable of:

a) maintaining the specific model of pipelayer to be used, in accordance with the manufacturer's instructions;

b) following the safe system of work, including any permit to work systems.

13 Duties of personnel

NOTE In some circumstances it might be appropriate for one person, other than the pipelayer operator, to undertake more than one of the duties described in this clause. See Clause **11** for recommendations regarding the duties of the appointed person.

13.1 Supervisor

The supervisor should direct and supervise the lifting operation, ensuring that the operation is carried out in accordance with the method statement. The supervisor should be competent and suitably trained and should have sufficient experience to carry out all relevant duties.

The supervisor should have sufficient authority to stop the lifting operation if they consider it dangerous to proceed.

13.2 Pipelayer operator

The pipelayer operator should operate the pipelayer in accordance with the manufacturer's instructions and within the safe system of work.

The operator should only respond to signals from the supervisor, who should be easily identified (see **15.2**), to carry out the operation.

13.3 Maintenance personnel

Maintenance personnel should maintain the pipelayer in a safe condition. Maintenance personnel should carry out all necessary maintenance in accordance with the manufacturer's maintenance manual and within the safe system of work (see **10.1**).

14 Selection of pipelayers

Pipelayers are available in many forms and the various characteristics of these should be considered in relation to the requirements of the lifting operation. After deciding the type of pipelayer and other overall requirements, a pipelayer that can safely perform the planned lifting operation should be selected.

The following should be taken into account when selecting a pipelayer.

a) Masses, dimensions and characteristics of the loads.

b) Operational speeds, radii, heights of lifts and areas of movement.

c) Site, ground and environmental conditions (wind, ice, snow etc., or restrictions arising from existing services, overhead power lines etc.).

d) Space available for pipelayer(s) travelling and operation.

e) Any special operational requirements or limitations imposed.

Economic factors can influence the choice of pipelayer, but it is essential that the pipelayer operates in accordance with the safe system of work.

In complex lifting operations, the recommendations given in **11.4** apply. The number of pipelayers required for complex lifts should be calculated in accordance with Annex H.

15 Safety

15.1 General

The person or organization with overall control of the place of work and the employers of personnel involved in the lifting operation are responsible for safety during lifting operations. For responsibility to be effectively discharged, the appointed person should be given sufficient authority to ensure that appropriate safety systems are in operation.

The following safety matters relating to lifting operations should be taken into consideration.

a) Use, maintenance, repair and renewal of safety equipment.

b) Instruction of, and allocation of responsibilities to, various personnel in relation to the equipment.

Personnel not directly involved in the lifting operation should be kept clear of the area. Loads should not be carried or suspended over occupied areas.

15.2 Identification of the person directing pipelayer movements

The person directing pipelayer movements, the Supervisor, should easily be identifiable to the pipelayer(s) operator, for example by wearing high visibility clothing. When choosing appropriate high visibility clothing, backgrounds, type of illumination and other relevant factors should be taken into account.

15.3 Personal protective equipment

The appointed person should ensure that:

a) personal protective equipment that is appropriate for the conditions of the location is available (for example, helmets, safety boots, safety spectacles, ear defenders etc.);

NOTE Attention is drawn to the Personal Protective Equipment at Work Regulations [10].

b) equipment is inspected before and after use, and maintained in good working order or replaced, as appropriate;

c) a record of inspection and repairs is maintained, as appropriate.

Certain protective equipment, for example helmets, can deteriorate with age and should be renewed in accordance with the manufacturer's instructions. Damaged safety equipment should be replaced immediately.

15.4 Use of personal protective equipment

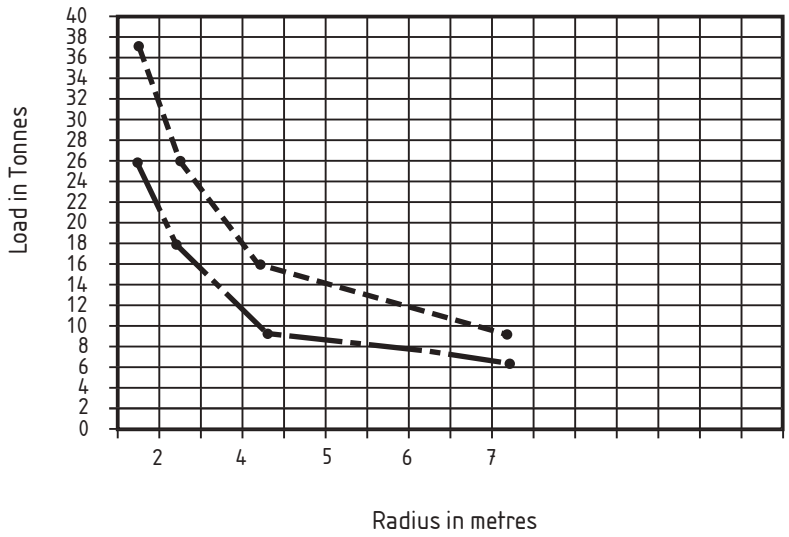
All personnel working on, or in the vicinity of the pipelayer(s) should be made aware of requirements relating to their personal safety and to the use of the personal protective equipment provided.

Personnel should be instructed in the correct use of the appropriate personal protective equipment provided and should be requested to use it.

NOTE Attention is drawn to the Personal Protective Equipment at Work Regulations [10].

Annex A (informative)
Lifting capacity chart

Figure A.1 shows a lifting capacity chart for a caterpillar 583 pipelayer fitted with a 28 foot boom.



Key

Tip test load
SWL

Figure A.1 — Lifting capacity chart for caterpillar 583 pipelayer fitted with 28 foot boom

Annex B (informative)
Example duty chart for 583(H) pipelayer

MACHINE SERIAL NUMBER	
OWNERS IDENTIFICATION NUMBER	
JIB LENGTH	8.25 M
NUMBER OF PARTS OF LINE	HOIST 6 NO BOOM 5 NO
NUMBER OF COUNTERWEIGHTS	THIRTEEN
COUNTERWEIGHT POSITION	FULLY EXTENDED
RATED IN ACCORDANCE WITH	BS 7121-14
RADIUS *m*	SAFE WORKING LOAD *tonnes*
2	26.4
4	13.3
6	8
7.5	6.5

Annex C (informative)
Report of thorough examination of pipelayers

Lifting Operations and Lifting Equipment Regulation 1998 (Regulation 9)

1 Employer ***(and or plant owner)***

2 Address

3 Address at which the examination was made

4 Description of machine
Distinguishing Number
Makers Name
Year of Manufacture
Safe Working Load

5 Nature of Examination ***(i.e. 9(1), 9(2), 9(3)(a)(i), 9(3)(a)(ii), 9(3)(a)(iii), 9(3)(a)(iv))***
Particulars of any test ***(see attached)***

6 Identification of any part found to have a defect, which is or could become a danger to persons

State descriptions of the defect and any repair renewal or alteration required to remedy the defect either immediately or within a specified time

7 Other defects and remedies

8 Date of last thorough examination

9 Latest date by which the next thorough examination must be carried out

10 Date of thorough examination

11 I certify that the above equipment was thoroughly examined (unless otherwise stated) and, subject to any remedial action to defects noted on this report, which are or could become a danger to persons, the equipment is safe to operate.

Name and Address of Competent Person
Signature Date
Qualifications

12 Name and Address of Person authenticating report if different to 11
Signature Date

13 Date of Report

Annex D (informative)
Certificate of test

Model:…….

Serial No……..

Boom Length……..

Counterweight…….and position……..

Parts of line (boom and hoist)……..

Attachments (e.g. rear winch)……..

Overhang (m) Tipping Load (Te) Rated Lift Capacity (Te)

…….

…….

…….

Annex E (informative)
Pipe lengths and mass table

Table E.1 — Mass per 12 m length of bare, painted or resin coated steel pipe

	3 m proximity pipe (7 bar to 70 bar)		In ground pipe (7 bar to 70 bar)		Station pipe work (7 bar to 70 bar)		Sleeving pipe (7 bar to 70 bar)	
Pipe nominal size mm	Wall thickness mm	Mass tonnes	Wall thickness mm	Mass tonnes	Wall thickness mm	Mass tonnes	Wall thickness mm	Mass tonnes
15	—	—	3.73	0.02	3.73	0.02	—	—
25	—	—	4.55	0.04	4.55	0.04	—	—
40	—	—	5.08	0.07	5.08	0.07	—	—
50	—	—	5.54	0.09	5.54	0.09	—	—
80	—	—	5.49	0.14	5.49	0.14	—	—
100	11.91	0.36	4.78	0.15	6.02	0.19	—	—
150	11.91	0.55	5.56	0.27	7.11	0.34	—	—
200	12.70	0.78	6.35	0.40	8.18	0.51	—	—
250	12.70	0.98	6.35	0.50	8.74	0.69	—	—
300	12.70	1.17	7.14	0.67	9.52	0.90	—	—
400	14.27	1.66	8.74	1.03	10.31	1.21	—	—
450	15.88	2.07	9.52	1.26	11.91	1.57	—	—
600	17.48	3.06	9.52	1.69	14.27	2.51	—	—
750	19.05	4.19	11.91	2.64	15.88	3.51	—	—
900	19.05	5.05	12.70	3.39	15.88	4.22	—	—
1 050	19.05	5.91	14.27	4.45	17.48	5.43	—	—
1 200	—	—	—	—	—	—	12.70	4.54
1 400	—	—	—	—	—	—	14.27	6.95

NOTE 1 The density of steel is assumed to be 7 850 kg/m^3.
NOTE 2 For coal tar coated pipes add 15 % to the values given.
NOTE 3 For plastics clad pipes add 10 % to the values given.
NOTE 4 For ERW (electric resistance welded) pipes use the masses shown for in ground pipe.

Annex F (normative)
Operator daily and weekly checks

The operator should carry out the daily and weekly maintenance as listed in Table F.1.

Table F.1 — Operator maintenance checks

Daily checks	Weekly checks
Check engine oil level for leaks	Check air filter for condition and cleanliness
Check hydraulic oil level and check for leaks	Check air filter housing, connections and mounting bolts for security
Check hydraulic hoses, rams and joints for oil leaks, condition and security	Check battery condition and security
Check cooling system condition and radiator level and check for water leaks	Check alternator for security and fan belt condition
Check fuel level and check system for leakage	Check exhaust system and inlet manifold stud nuts for security
Check transmission oil level and check for leaks	Check gasket joints of final drive cases for condition and leakage
Check boom and hinge pins for security and condition	Check wire ropes for condition and fixings and lubricate
Check boom winch brake and clutch operation, condition and security	Check track shoe bolts for tightness and security
Check hoist winch brake and clutch operation, condition and security	Check track rollers and end cap bolts
Check wire ropes for condition and fixings	Equalizer bar and mounting bolts for security
Check wire rope pulleys for condition and security	Grease all points
Check hook block sheaves and safety clip for condition and security	
Check counterweight frame and hinge pins for condition and security	
Check counterweight hydraulic rams and hoses for condition and leakage	
Check steering, clutch and brake operation and condition	
Check operating levers and linkage for function, condition and security	
Check safety decals for cleanliness and condition	
Check warning lights for condition and operation	
Check working lamps (if fitted) for operation and condition	
Check stop control operation and condition	

WARNING It is essential that the operator does not attempt to repair any defects. If any defects are found the pipelayer should be stopped immediately and made secure, and the defect reported to the supervisor.

Annex G (normative)
Signals

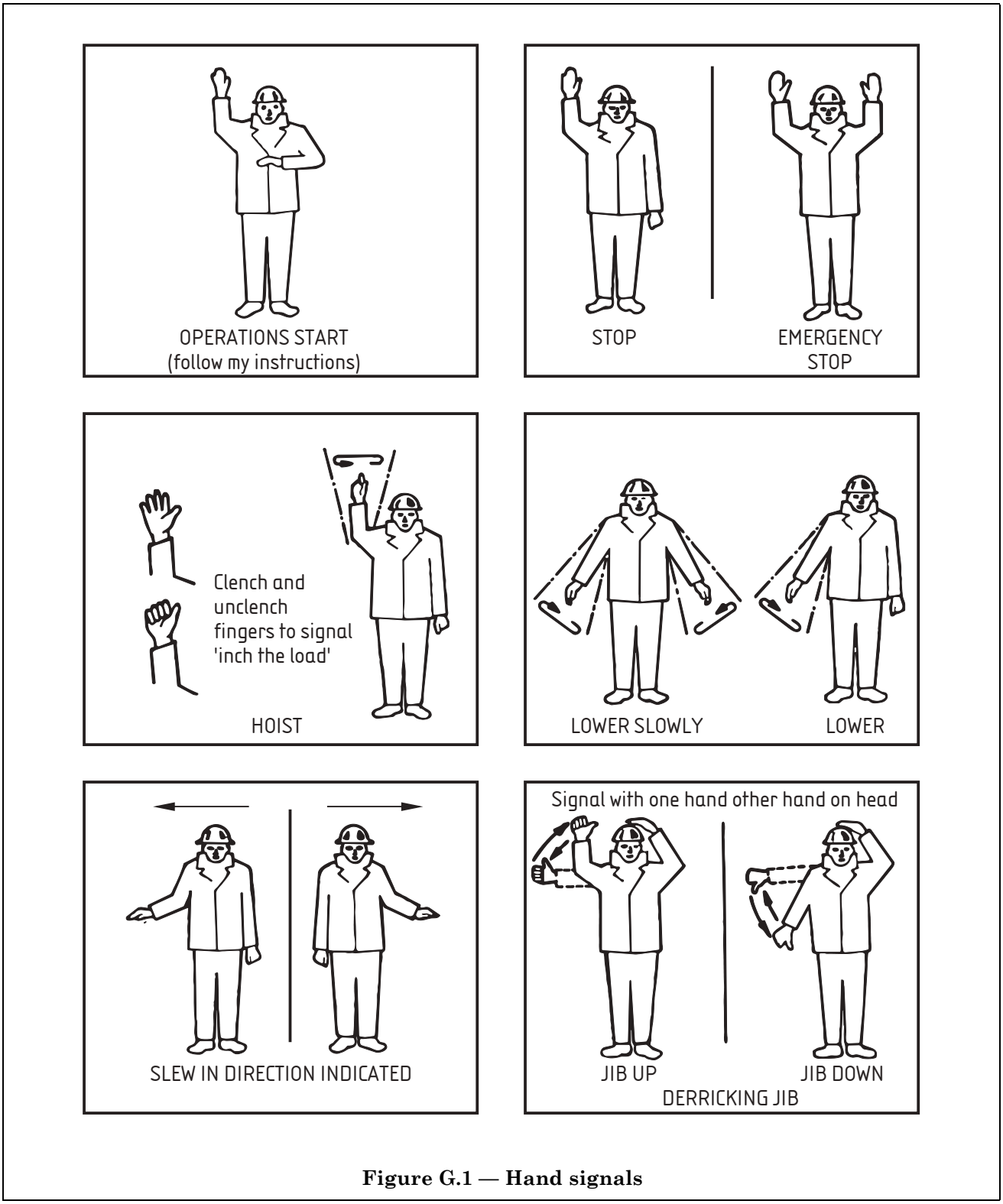


Figure G.1 — Hand signals

Annex H (normative)
Calculations for complex lifts

The following should be used for calculating the number of pipelayers required for lower and lay operations.

It is generally assumed that 120 m of the pipe string needs be lifted off the skids to afford the lower and lay configuration.

Pipelayers should be spaced at given distances, with the first pipelayer lifting at 7.5 m in from the end of the pipe string, so that overstressing of the pipeline does not occur during lifting and lowering.

Individual pipelayers work at a given lifting radius during the operation. This is generally between 2 m and 5 m, therefore, the SWL calculation for individual machines should be based on the worst-case scenario of 5 m of radius.

The following examples are for 36 inch coated line-pipe, using Caterpillar 583 pipelayers.

Light Wall (12.7 mm thickness)

EXAMPLE 1 Calculating the pipe mass over 120 m.

Using the table in Annex E calculate the mass for 120 m.

10 lengths at 3.39 tonnes is equal to 33.9 tonnes.

EXAMPLE 2 Calculating the SWL of pipelayer.

Using the lifting capacity chart shown in Annex A determine the SWL at 5 m.

Caterpillar 583, at 5 m of radius is equal to 10.4 tonnes per machine.

EXAMPLE 3 Down-rating of pipelayer [see **11.4** c)].

Subtract 25 % from SWL of pipelayer.

10.4 tonnes minus 25 % safety factor is equal to 7.8 tonnes per machine.

EXAMPLE 4 Determining the number of pipelayers required.

Divide the total mass of 33.9 tonnes by 7.8 tonnes, which determines the number of machines required.

39.9 tonnes divided by 7.8 tonnes is equal to 5 machines.

A further machine should be added to the required number to accommodate the shuffling up process.

Machines should be spaced at approximately 24 m centres.

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