

STAGING AROUND SHIPS AND BOATS IN BUILD AND REPAIR YARDS

INTRODUCTION

1 This document contains internal guidance which has been made available to the public. This guidance is considered good practice (rather than compulsory) but you may find it useful in deciding what you need to do to comply with the law. However the guidance may not be applicable in all circumstances and any queries should be made to the appropriate enforcing authority

2 As an average based over the years 1994-1997, 33 falls from heights in excess of 2m or more have been reported to HSE by ship and boatyards. In the same period this has included 3 fatalities due to falls from heights of 2m or greater.

3 In all places that ships or boats are either built or repaired workers must reach exposed locations in and around vessels. Traditionally, scaffolding and staging techniques have been employed for such purposes. This document summarises the standards of construction and protection that should be in place to prevent the fall of persons from temporary stages (working platforms). This document does not discuss schemes of training for the installation of access equipment.

4 This document addresses 4 types of staging commonly encountered in boatbuilding, shipbuilding and ship-repair:

- (1) independent - built up from the floor of the dry dock or the deck of the ship using tube and fitting or system scaffolding, and which can include proprietary fixed scaffold towers with boards or staging, and mobile scaffold towers;
- (2) cantilevered - using structural steelwork or timber supported from the ship and projecting beyond the line of vertical support;
- (3) guyed lattice towers supporting cantilevered stages; and
- (4) slung - supported on wire ropes fastened to the hull or superstructure, or alternatively constructed from tube and fittings.

5 Typically in boatyards, although not exclusively so, basic types of access are supplemented with fixed geometry or folding trestles, in wood or aluminium, connected with boards or proprietary staging.

ADVICE TO EMPLOYERS

6 The following gives brief advice to employers. More detailed advice is given at paragraphs 7-43.

- (1) All means of temporary access should be erected and installed by persons competent to do so. Employers should be able to give documentary proof of training. Employees and other third parties should be encouraged to carry with them proof of training (see paragraphs 44-45).
- (2) Independent scaffolds should be erected in accordance with BS 59731 (see paragraph 7).
- (3) System scaffolds should be erected in accordance with manufacturer's instructions (see paragraphs 8-9).
- (4) Trestle stages should be used in accordance with paragraphs 10-18 of this document.
- (5) slung stages/scaffolds should be erected in accordance with BS 59742 (see paragraphs 19-31).
- (6) A suitable and safe working platform is provided for all types of work which require access above 2m from ground level. Suitable guard-rails should be provided to prevent the fall of persons and or materials from these places of work (see paragraphs 33-36).
- (7) The materials used in the construction of the stage/scaffold is properly maintained (see paragraph 43).
- (8) Suitable handrails to prevent the fall of persons from an exposed edge should be fitted to working platforms (see paragraphs 33-36).
- (9) Where a risk of a fall exists of less than 2m to ground level, and handrails are not in position, a risk assessment of the need for handrails should be undertaken by the employer (see paragraphs 41-43).
- (10) Employers should take a proactive approach to the provision of edge protection, and where appropriate make use of the provision of fall arrest devices. (This document does not deal with the use of these devices).

EQUIPMENT

Independent staging

7 Independent staging should be erected to the standards described in BS 5973¹. The hull of the ship may be regarded as the facade of a building. There are 2 main differences between an independent scaffold used in construction and independent staging used around ships:

- (1) the staging may be wider in cross section to allow for the shape of the hull. Cross bracing (the equivalent of ledger bracing in construction) is particularly important especially at areas of the hull where there is an overhang, eg at the bow and stern; and
- (2) there are unlikely to be sufficient openings in the hull to allow through-ties to be used. This may be overcome by the use of outriggers, by welded connections to the hull, or by increasing the base area of the staging and/or adding counterbalance to the base.

Scaffold towers

8 This type of staging is often used below the hull, eg for work around the rudder, propellers etc. They are 2 types of tower; fixed and mobile. Problems common to both is the need to ensure they are level; the degree of slope tending to limit the ease of moving a tower manually. When ground conditions are acceptable, such as in dry docks, level floored buildings and reasonable slipway slopes they provide an ideal and cheap solution for short-term maintenance, cleaning and painting.

9 In particular, the following requirements should be satisfied:

- (1) safe access to and from the working platform during construction and use;
- (2) a suitable guard-rail at the working platform (see paragraphs 33-36);
- (3) there should be no gaps in the working platform except where necessary for the access ladder and this opening should be as small as reasonably practicable preferably in the form of a hatch which can be closed when access is not required;
- (4) the tower should be braced in all 4 sides to provide adequate stiffness, and be erected in accordance with good practice by working from within the section of the tower;
- (5) towers should be constructed within the maximum height to narrowest base dimension ratio of 3:1;

- (6) where towers are connected by a lightweight staging, its span/depth ratio should be limited to avoid excessive deflection. Manufacturer's literature and product specification will indicate what these ratios should be; and
- (7) where mobile towers are erected and in use they should be fitted with adjusters to ensure they remain vertical (in plumb) at all times. There should be no persons on a mobile tower whilst it is being moved. Castors must always be locked when the tower is in use and it must never be moved by manoeuvring from the platform.

Trestle staging

10 Trestle staging comprise a simply supported working platform supported on 'A' frames which may be either fixed or folding. They are only intended for light work of short duration, historically finding favour, for example, with painting trades for their ease of erection.

11 Where a trestle staging is used, the height of the working platform should not exceed 4.5m from ground level, and folding trestles should only be used as a single-tier working platform. It is considered safe practice to limit the height of the working platform to a maximum of 66% of the vertical height of the trestle. For example, if the working platform is to be located at the conventional maximum height of 4.5m, then the vertical height of the trestle to preserve this ratio would be 6.75m.

12 Trestles in excess of 3m in vertical height should be rigidly connected to the vessel or otherwise fitted with outriggers to prevent their accidental displacement. Where outriggers are used the ratio of height of trestle to narrowest base dimension should not exceed a ratio of 3:1. If outriggers are of the single tube type they must not be too long. If there is discernible movement it should be corrected. The end of the outrigger should be prevented from moving.

13 Lightweight staging should be used to form the working platform and in turn the staging should only be supported directly off the trestle. Where traditional scaffold batons are used the span width to thickness ratios referred to at paragraph 32 should be adopted.

14 Where trestles are placed on sloping ground the base should be chocked or tied to prevent sliding. The centre of gravity of the loaded trestle should lie in a line directly below its apex.

15 Where practicable, handrails should be fitted to the exposed edge of the working platform (the edge facing away from the vessel). The leading edge of the staging (or facing edge) should be as close as practicable to the hull or superstructure of the vessel (reference Shipbuilding and Ship-repairing Regulations 1960 (SBS Regulations) regulation 24). Where persons sit at the leading edge to do work then the maximum gap width should not exceed 300mm. Ideally this should not exceed one scaffold baton width because, a possibility exists of persons being injured by the fall of materials from this facing edge.

16 Arguments against the use of handrails are largely directed to the effect handrails will have on the stability of the trestle staging in the event of side loading in stopping a fall. If all trestles over 3m in vertical height are erected to prevent accidental displacement then loads imposed on the handrail ought not to increase the risk of an overturn.

17 This means that handrails should be fitted to any working platform 2m or more from ground level. See paragraphs 33-36 regarding advice on handrailing of working platforms.

18 Problems that can arise with trestles include:

- (1) instability if used transversely on slopes;
- (2) instability potential of very high trestles if not tied to boat; and
- (3) poor maintenance/condition of largely home-made trestles, stored mostly outside.

There is a requirement that there should be no instability of the platform.

Cantilevered staging

19 Cantilevered staging supported from lattice towers is dealt with at paragraphs 25-27. The 2 types of cantilevered staging considered here are:

- (1) balanced cantilevers; and
- (2) cantilever brackets.

Balanced cantilevers

20 Balanced cantilevers generally consist of steel or timber sections which project outboard to support planks. These are generally referred to as thwarts. The supports at the pivot point and at the inboard end should be assessed by a competent person. The support at the pivot point will take a significantly greater load than that imposed on the staging.

21 The inboard ends of the thwarts must be prevented from lifting. This may be achieved by either:

- (1) a timber prop to the deck above; or
- (2) steel brackets properly welded to a bulkhead; or
- (3) lashing with wire rope to a suitable strong point on the deck below.

Additional support may be provided by wire ropes fastened to the outboard ends of the thwarts from a suitable strong point above.

Cantilever brackets

22 Cantilever brackets may be fastened to the hull or superstructure to provide support for the staging. They should be designed and fabricated by competent persons and should be clearly marked with their designed capacity, eg 'maximum spacing 1.5 m'.

23 Connection to the ship may be by bolts of the prescribed size and class or by a welded joint of the designed type and size made by a competent welder. Care should be taken if the brackets being used are in aluminium. Welding procedures may need to be very carefully controlled.

24 This type of staging should only be used for access and not for the storage of materials.

Guyed lattice towers supporting cantilevered thwarts

25 This form of staging consists of steel lattice towers resting on bases at the bottom of the dry dock. These towers should be designed and constructed by competent persons. It is important that the bases are chocked to ensure that the tower is vertical and the vertical loads are evenly transferred.

26 The stability of this type of staging is reliant on guy ropes to resist any horizontal forces. These ropes should be constructed of wire. The recommendations given for wire ropes regarding factor of safety, termination, packing etc, should be followed (see slung staging at paragraphs 28-31). The design of the lattice tower will govern the width of working platforms which can be supported and also the spacing of the towers.

27 Timbers used for the cantilever thwarts and also for the staging should be carefully selected and sized in accordance with BS 5268³.

Slung staging

28 If conventional scaffold tube and fittings are used, the guidance given in BS 5973¹ should be followed.

29 The wire rope used to support slung staging may impose twisting forces on the platform. Planks should therefore be adequately nailed to thwarts and where necessary ropes (wire or fibre) should be used to hold the platform rigidly in its required position. In order to prevent the wire rope moving along the thwart it should be secured in position by:

- (1) fastening the wire rope to the timber using 2 round turns of wire around the timber and securing the end with 2 bulldog clips. Timber blocks should be nailed to both sides of the wire rope to prevent slippage; or

- (2) passing the wire rope through a hole drilled in the centre of the thwart, then forming 2 round turns around the timber and securing with 2 bulldog clips; or
- (3) bolting an eye bolt through the thwart and fastening the wire rope to it using a shackle, thimble and 2 bulldog clips.

30 Nails hammered into the thwarts and bent over are not acceptable.

31 When calculating the required size of wire ropes, shackles, eye bolts etc, due allowance should be made for the angle of the support rope from the vertical. A factor of safety of 6 is recommended for the wire rope and a factor of safety of 2 is recommended for lifting points. The imposed load on the staging adopted in these calculations should not be less than 0.75 kN/m². These calculations should be made by a competent person.

Scaffold boards

32 All timber boards used for platforms should be inspected by a competent person before being used. Any sections which show signs of abuse, damage or decay should be discarded. The recommended maximum spans for scaffold boards which comply with BS 2482⁴ are given in BS 5973¹ table 3 which is reproduced below. Spans greater than 3.25m are not recommended. If they are necessary they should be designed in accordance with BS 5268³.

Maximum Span of Boards

Nominal Thickness mm	Max. Span m	Min Overhang mm	Max. Overhang mm
38	1.5	50	150
50	2.6	50	200
63	3.25	50	250

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Requirements for guard-rails: exposed edge protection

33 Guard-rails should be positioned at exposed edges to prevent so far as is practicable the fall of persons. At a height of 2m or more this should be considered as an absolute requirement. At a height of up to 2m it should be considered as best practice.

34 The guard-rail, barrier, or other means of exposed edge protection should be of sufficient strength and rigidity to prevent a person falling from that exposed edge. It should be firmly positioned to ensure that it is not capable of accidental displacement. The materials to which it is fixed should be of sufficient strength and suitable for the purpose of supporting the handrail. It is unlikely that simply

supported lengths of timber tied into position with ropes will be suitable for this purpose.

35 The main guard-rail or other means of protection should be at least 910mm above the exposed edge from which a person could fall. There should be intervening guard-rails with no more than a 470mm horizontal gap between guard-rails. Therefore, it is unlikely that a single handrail will offer sufficient protection. Guard-rails may be checked by pulling firmly at the centre of a span and at a post. There should be no discernible movement.

36 Fibre ropes should not be used as a means of providing exposed edge protection (hand-railing). Where wire ropes are used there should be readily available a suitable means of re-tensioning them in the event of them becoming slackened. Where there is more than 100mm of deflection the wire is not sufficiently tensioned.

Requirements for working platforms

37 The surface on which the staging is stood should be able to support it with safety. It should not be possible to accidentally displace the staging. Reasonably practicable means of achieving this are by the use of through-ties, box ties, welded attachments, or designing the staging to be self-supporting. There should be sufficient space on the platform to allow the free passage of persons along it. There should be no gaps in the boarding which will give rise to injury, and there should not be a risk of slipping or tripping.

Requirements for walkways

38 A common feature in all categories is the need for external access, and for this to be stood on a slope (except for dry docks). Generally, on all types of access equipment the working platform should be horizontal in respect to the vertical standards. This does not prohibit a sloping walkway so long as it is properly constructed and complies with criteria to reduce the possibility of slipping as in BS 5973¹.

39 The maximum slope of plain boards should be one vertical to 4 horizontal. Where the slope is steeper than one vertical to 4 horizontal, stepping laths should be attached to the scaffold batons to provide grip (the laths themselves should not form a tripping hazard).

Requirements for the provision of toe-boards

40 It is advised that all working platforms are fitted with toe-boards to prevent the fall of any material or object from the working platform.

HEALTH AND SAFETY LEGISLATION

41 The Management of Health and Safety at Work Regulations 1992 (MHSW Regulations) require an assessment of risks of the activities associated with the provision of access equipment, with a view to establishing what needs to be done to ensure a safe system of work. An assessment of risk is a careful examination of how people could be potentially harmed through work and consideration of whether enough precautions have been taken or should more be done to reduce risks.

42 In order to eliminate these risks, it may be necessary to consult other legislation. The guiding principle is that where duties overlap, compliance with the more specific regulation will normally be sufficient to comply with the general requirement of the MHSW Regulations. Commonly, though not exclusively, this will include the Provision and use of Work Equipment Regulations 1992 (PUWER), under which scaffolding is defined as work equipment, and the SBS Regulations.

43 Both the SBS Regulations and PUWER place a duty on all employers to ensure that items of staging/scaffolding equipment provided to their employees are suitable for the use for which they are provided. This means its initial integrity, the place where it is used, and the use it is put to. Access equipment should be suitably erected, used, and maintained to ensure safety (PUWER, regulation 6(1) and SBS Regulations, regulations 16-17). Part of a system of ensuring good maintenance is the inspection of staging/scaffolding and keeping records of these inspections. Suitable timings for inspection are:

- (1) before first use;
- (2) weekly thereafter; and
- (3) after adverse weather or high winds.

TRAINING

44 Training is a matter of major importance. Where necessary operators should be formally trained and instructed in the safe erection and use of access equipment. The training should be adequate for the circumstances in the ship or boatyard.

45 It is impossible to lay down detailed requirements as to what constitutes adequate training in all circumstances. In considering the extent of the training that will be necessary in a particular case, the shortfall between existing competence and that required should be evaluated and corrected.

REFERENCES

Reference No	Publication	Paragraphs
1	BS 5973: 1993 <i>Code of practice for access and working scaffolds and special scaffold structures in steel</i>	6(2), 7, 28, 32, 38
2	BS 5974: 1990 <i>Code of practice for temporarily installed suspended scaffolds and access equipment</i>	6(5)
3	BS 5268: Part 2: 1996 <i>Structural use of timber. Code of practice for permissible stress design, materials and workmanship</i>	27, 32
4	BS 2482: 1981 <i>Specification for timber scaffold boards</i>	32

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