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Requirements for Anchoring, Berthing, Towing and Securing to a Buoy

Category 2

AMENDMENTS ISSUED SINCE PUBLICATION

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Revision Note

This Issue of this Standard has been prepared to incorporate changes to text and presentation. The technical content has been updated in line with current practice.

Historical Record

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DEFENCE STANDARD 02–117 (NES 117)

REQUIREMENTS FOR ANCHORING, BERTHING, TOWING AND SECURING TO A BUOY

ISSUE 2

This Defence Standard is
authorized for use in MOD contracts
by the Defence Procurement Agency and
the Defence Logistics Organisation

Published by:

Defence Procurement Agency,
An Executive Agency of The Ministry of Defence,
Directorate of Standardization,
Kentigern House,
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Glasgow, G2 8EX.

SCOPE

1. This Defence Standard defines the equipment, associated and structural requirements for HM Surface Ships and Submarines (excluding vessels covered by Lloyds Register of Shipping) for anchoring, berthing, securing to a buoy, towing or be towed.

FOREWORD

Sponsorship

1. This Defence Standard is sponsored by the Defence Logistics Organisation (DLO), Ministry of Defence (MOD).
2. Any user of this Def Stan either within MOD or in industry may propose an amendment to it. Proposals for amendments that are not directly applicable to a particular contract are to be made to the publishing authority identified on Page (i), and those directly applicable to a particular contract are to be dealt with using existing departmental procedures.
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4. No alteration is to be made to this standard except by the issue of an authorized amendment.
5. Unless otherwise stated, reference in this standard to approval, approved, authorized and similar terms means by the MOD in writing.
6. Any significant amendments that may be made to this standard at a later date will be indicated by a vertical sideline. Deletions will be indicated by 000 appearing at the end of the line interval.
7. This Def Stan NES has been reissued because of Technical Updates.

Conditions of Release

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13. When standard are incorporated into MOD contracts, users are responsible for their correct application and for complying with contractual and any other statutory requirements. Compliance with an Def Stan does not of itself confer immunity from legal obligations.

Categories of Naval Defence Stanadrd

14. The Category of this Naval Defence has been determined using the following criteria:

    a. Category 1. If not applied may have a *Critical* affect on the following:

    Safety of the vessel, its complement or third parties.

Operational performance of the vessel, its systems or equipment.

b. Category 2. If not applied may have a *Significant* affect on the following:

Safety of the vessel, its complement or third parties.

Operational performance of the vessel, its systems or equipment.

Through life costs and support.

c. Category 3. If not applied may have a *Minor* affect on the following:

MOD best practice and fleet commonality.

Corporate Experience and Knowledge.

Current support practice.

Related Documents

15. In the tender and procurement processes the related documents listed in each section and Annex A can be obtained as follows:

a.	British Standards	British Standards Institution, 389 Chiswick High Road, London, W4 4AL.
b.	Defence Standards, including	Defence Procurement Agency, An Executive of The Ministry of Defence, Directorate of Standardization, Kentigern House, 65 Brown Street, Glasgow, G2 8EX.
c.	Other documents	Tender or Contract Sponsor to advise.

16. All applications to Ministry Establishments for related documents are to quote the relevant MOD Invitation to Tender or Contract number and date, together with the sponsoring Directorate and the Tender or Contract Sponsor.

17. Prime Contractors are responsible for supplying their subcontractors with relevant documentation, including specifications, standards and drawings.

Health and Safety

Warning

18. This Defence Standard may call for the use of processes, substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use. Where attention is drawn to hazards, those quoted may not necessarily be exhaustive.

19. This Def Stan has been written, and is to be used, taking into account the policy stipulated in JSP 430 MOD Ship Safety Management System Handbook.

Additional Information

(There is no relevant information included)

CONTENTS

1. PERFORMANCE SPECIFICATION

Related Documents: NES 174; see also Annex A.

1.1 Anchoring

a . The design requirement is to use anchors of an acceptable size and weight with maximum holding qualities. The design philosophy for determining the size of the anchor is to incorporate the following conditions:

(1) A steady wind speed of 55 knots and tide of 4 knots, acting simultaneously from directly ahead. The total drag forces to be resisted by the anchoring arrangements are:

(a) Hull drag due to the tide, acting fore and aft (to include appendages and fouling allowance but excluding propeller);

(b) Drag on locked propellers due to the tide, acting fore and aft;

(c) Drag on the above water hull, superstructure and fittings due to the wind acting fore and aft;

(d) The total drag force is to be calculated using the method detailed at Annex D;

(2) A poor holding ground which equates to a ratio of 7:1 for a high holding power anchor:

i.e. $\frac{x}{7}$ = weight of anchor:

Where x is the total drag force determined from Clause D.a (1).

b . Two bower anchors are normally to be provided for anchoring unless otherwise specified in the contract.

c . Anchors shall be chosen from the range given in NES 174.

1.2 Berthing Ropes

a . The design philosophy to be adopted for determining the size of berthing ropes is to incorporate the following conditions:

(1) A steady wind speed of 55 knot directed at a profile area of the vessel at an appropriate angle that would generate the maximum amount of force;

(2) A 4 knot tide running fore and aft or vice–versa longitudinally along the vessel.

b . A safety factor of three is to be used in determining the size of berthing ropes, excluding the springs.

c . All berthing ropes, including springs but with the exception of Spring Hawsers when in use, will be doubled to achieve additional strength to the system.

1.3 Towing Requirements

a . The vessel is to be able to tow a vessel of similar displacement and form in calm water (Sea State 1) at speeds up to 10 knots. It is to be assumed that the vessel under tow is in the same deep condition, six months out of dock in tropical condition and that the two propellers are locked.

2. NATIONAL/INTERNATIONAL REGULATIONS

Related Documents: Anchors and Chain Cable Act 1967, Rules 1970; see also Annex A.

2.1 Anchor and Chain Cable Regulations

a . All anchors, stud link chain cable and associated fittings shall meet all the statutory requirements of the Anchors and Chain Cable Act 1967 (ACCA), Rules 1970.

2.1.1 Certification

a . Following proof testing of anchors, chain cable and accessories, test certificates shall be issued by the Certifying Authorities named in the ACCA 1967, Rules 1970. All tests shall be carried out in the presence of the representative of the Certifying Authority.

b . It is essential that contracts for procurement of this equipment contain a clause stating that the contractor shall be responsible for the provision of test certification in accordance with the ACCA 1967, Rules 1970.

c . Statutory Certification shall be issued for the following items:

(1) Anchors;

(2) Lengths of Chain Cable;

(3) Adaptor pieces;

(4) Swivel and Link Assemblies;

(5) Stopper Assemblies;

(6) Securing to Buoy Shackles;

(7) Joggle Shackles.

2.1.2 Certification Distribution

a . On completion of tests, issued certificates shall be forwarded to the Resident Project Officer (RPO), of the shipyard where the vessel is being built, for insertion in the copy of the Captains Ships Book.

NOTE It is mandatory that Ships Staff retain all original test certificates. No HM Surface Ship or Submarine shall sail without valid test certificates for all items of anchor and chain cable equipment.

3. MILITARY STANDARDS/REQUIREMENTS

Related Documents: BS EN 696; BS 302 Part 2; NES 113 Part 3; NES 171; NES 172; NES 174; NES 175; NES 722; NES 729 Part 5; BR 67; BR 367; SDN 003 502 045; SDN 003 502 046; SDN 003 502 054; see also Annex A.

a . For clarity and completeness, much of the information contained in this section has been taken from Service Drawings and BR 67. For the most up to date information the latest issues of all referenced documentation should be used which may vary from the infomation contained within this section.

3.1 General

a . All equipment shall be supplied as specified in the contract unless otherwise stated. When considered necessary, guidance drawings are to be supplied by the MOD Project Engineer.

b . The contractor is required to submit to the contract sponsor detailed working drawings of the anchoring arrangements prior to commencement of build. Drawings shall be prepared in accordance with the requirements of NES 722.

3.2 Anchoring

a . Anchors shall be chosen from the range given in NES 174.

3.2.1 Stud Link Chain Cable

a . Stud link chain cable is to be chosen from and to be as specified in NES 172. It shall be manufactured for use with lugless joining shackles as detailed in NES 175. The requirements for non–magnetic chain cable and associated equipment shall be in accordance with NES 171.

3.2.2 Cable Length

a . Sufficient cable is to be provided to enable a ship to anchor safely in up to 30 fathoms of water. For deep water anchoring the requirement is 50 fathoms. (This may involve using chain cable from both Port and Starboard as one unit).

b . The amount of cable to be carried in shackles to meet Clause 3.2.3a. of this NES is as follows:

(1) Length of cable (shackles) 1. 5 √d metres (where d is depth of water in metres).

c . If the length of the cable is to be shared between two bower anchors, the length obtained from Clause 3.2.3b. is to be increased by 50% and distributed in the proportion of two thirds on one anchor and one third on the other.

d . An additional full length of cable shall be supplied to both one and two configurated bower anchor vessels. For vessels operating with two bower anchors, the additional full length of cable shall be fitted on the side with the longest percentage length as determined at Clause 3.2.3a of this NES.

e . A ship’s bower cable (her outfit for anchoring) is to be made up of two half–lengths in each of the port and starboard cable arrangements, together with a number of full lengths.

f . The half–lengths are to be inserted together at the outboard end next to the anchor.

g . A full length of cable is 27.5 metres (15 fathoms) and a half–length is 13.75 metres (7.5 fathoms).

h . All lengths of chain cable are to be made up of an odd number of links joined by a lugless joining shackle this is to ensure the correct lay is maintained. See Clause 3.2.6.

3.2.3 Cable Size

a . The size of the stud link chain cable used is a function of the holding power of the anchor.

b . For high holding power anchors (e.g. AC14) the stud link chain cable to be used is determined as follows:

W x 10 x 3 = proof load of chain cable

Where W = weight of the anchor

10 = holding factor of the anchor in good holding ground

3 = factor of safety

c . For normal holding power anchors (e.g. Admiralty Standard Stockless) the stud link chain cable to be used is determined as follows:

W x 5 x 3 = proof load of chain cable

Where W = weight of the anchor

5 = holding factor of the anchor in good holding ground

3 = factor of safety

3.2.4 Lugged Anchor Shackle

a . The chain cable assembly is to be secured to the anchor by a lugged anchor shackle complying with NES 175. For non–magnetic requirements, the shackle is to accord to NES 171. (See Figure 3.1).

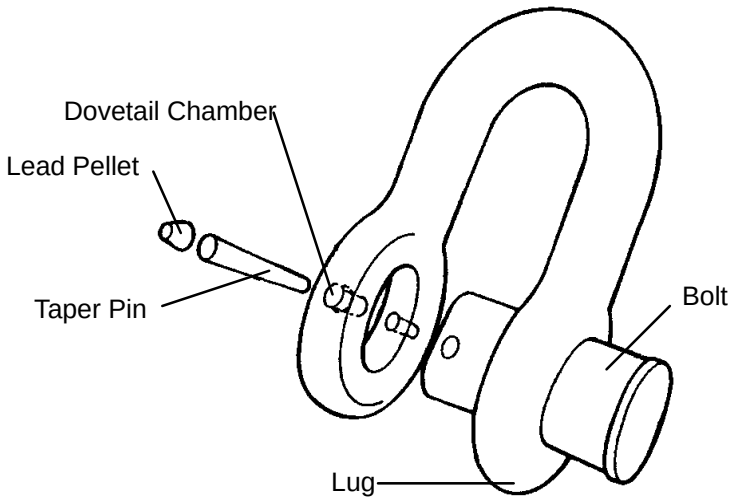


Figure 3.1 Lugged Anchor Shackle

3.2.5 Lugless Joining Shackle

a . A lugless joining shackle is to be used to join two lengths of stud link chain cable which is to pass round a cable holder or gypsy wheel in the same plane as the spindle. Shackles are to be arranged to lie vertically as they pass around a cable holder and horizontally as they pass over the Gypsy of a windlass. This is to ensure that the shackle, which is slightly larger than the common link does not jam or strain when worked around the cable holder or windlass on the wrong shear. Shackles shall be manufactured in accordance with the requirements of NES 171 for non−magnetic items or NES 175. The requirements for non−magnetic shackles shall be in accordance with NES 171. (See Figure 3.2).

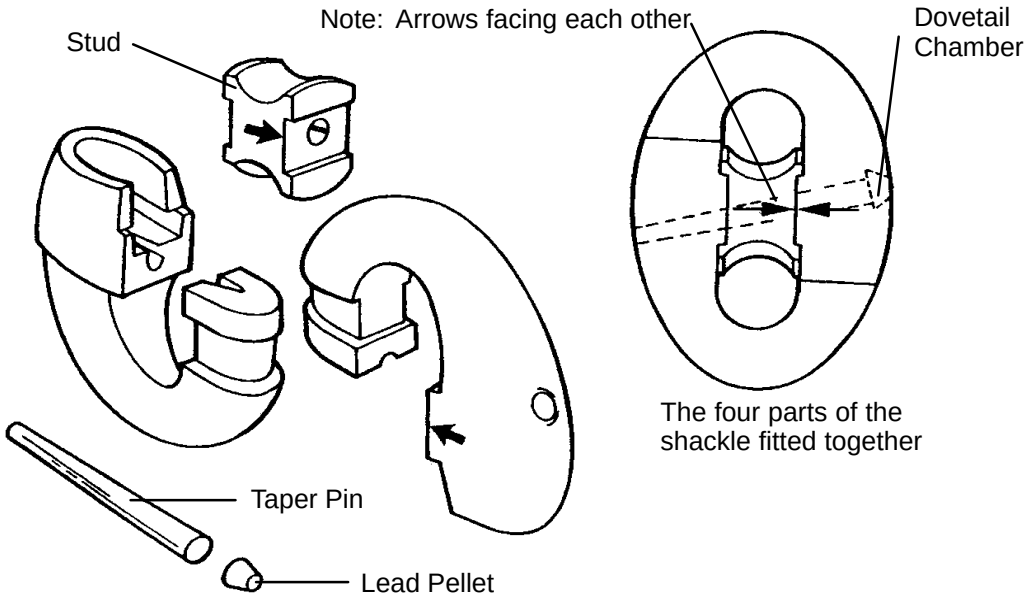


Figure 3.2 Lugless Joining Shackle

3.2.6 Lugged Joining Shackle

a . A lugged joining shackle is similar in form to the lugged anchor shackle and is to be used to connect stud link chain cable to the chain locker clench. Shackles shall be manufactured in accordance with the requirements of NES 175. The requirements for non−magnetic shackles shall be in accordance with NES 171.

3.2.7 Swivel Pieces

a . Two swivel pieces shall be inserted into a chain cable outfit, one abaft the anchor and the other before the cable clench shackle in the cable locker.

b . There are two types of swivel piece, as shown below:

(1) Box Type for use with Cable Assemblies above 28 mm. (See Figure 3.3);
(2) Cup Type for use with Cable Assemblies of 28 mm and below. (See Figure 3.4).

c . Swivel pieces shall be manufactured in accordance with the requirements of NES 175. The requirements for non−magnetic shackles shall be in accordance with NES 171.

Figure 3.3 Box Swivel Assembly

Figure 3.4 Cup Type Swivel Assembly.

3.2.8 Blake Slip (or Riding Slip) and Screw Slip

a . A Blake Slip (see Figure 3.5) is a general–purpose slip. Its primary use is to hold the cable prior to letting go an anchor. It can also act as a preventer, when the ship is riding on the brake of the cable holder or for holding the cable temporarily, so that the inboard part of the cable can be handled.

b . Blake Bottle Screw Slip (See Figure 3.6) differs from the Blake Slip only in that a bottle screw is incorporated in the chain between the slip and the deck clench. The bottle screw enables the anchor to be hove fully home when secured for sea or close home in its hawsepipe prior to the cable being broken at the first lugless joining shackle when work is being carried out on the cable.

c . The size of slips is related to the size of the chain cable, the number of links on a slip is to be either 5 or 7 but can vary to suit a particular chain cable layout.

d . Slips are to be tested to half the proof load of the associated chain cable.

e . Blake Slips and Screw Slips shall be manufactured in accordance with the requirements of NES 175. The Requirements for non–magnetic slips are given in NES 171.

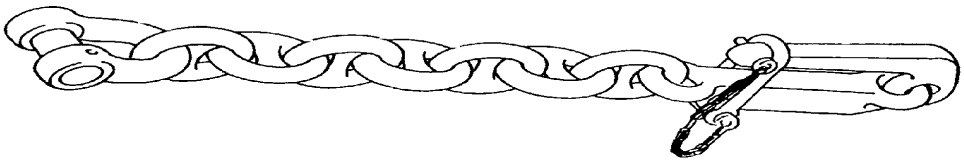


Figure 3.5 Blake Slip

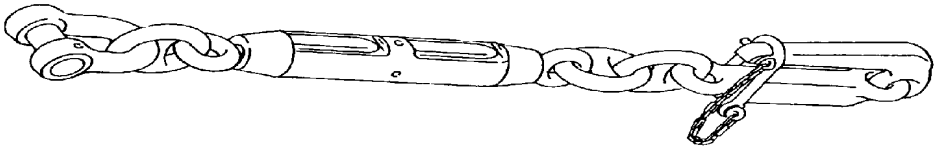


Figure 3.6 Blake Screw Slip.

3.2.9 Compressors

a . In ships with capstan cable holders a compressor may be fitted to take the place of a riding slip. (See Figure 3.7).

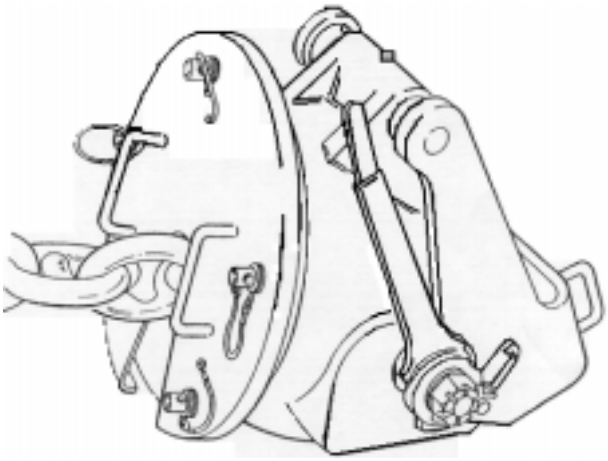


Figure 3.7 Compressor

3.2.10 Guillotine

a . In ships fitted with a windlass e.g. Mine Countermeasure Vessel (MCMV) a guillotine may be fitted to take the place of a riding slip or compressor. (See Figure 3.8).

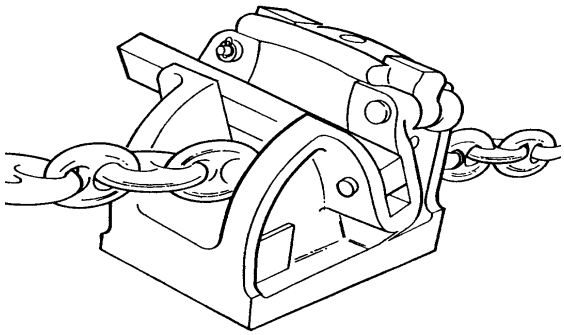


Figure 3.8 Guillotine.

3.2.11 Joggle Shackle

a . To enable a wire rope to be attached to a stud link chain cable link, a Joggle Shackle appropriate to the size of stud link chain cable is to be provided in accordance with NES 175. The requirements for non–magnetic Joggle Shackle shall be to accordance with NES 171. (See Figure 3.9).

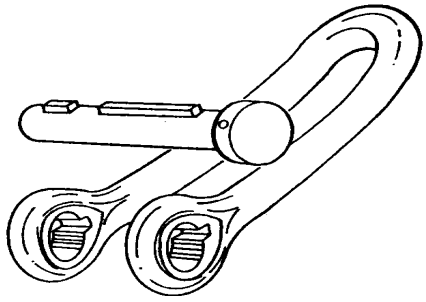


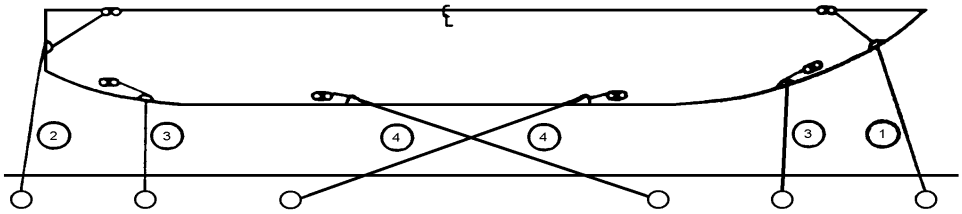
Figure 3.9 Joggle Shackle

3.3 Berthing

a . All berthing hawsers are to be supplied in the same size and construction and are to be manufactured from a polyester and polyethylene man made fibre (Trade name Supermix). The cordage is to be of a manageable size and shall not be greater than 72 mm in diameter. The length of breast ropes is to be 0. 7 times the length of the vessel, whilst the head and stern rope are each to be 1.5 times the length of the breast rope.

b . Spring hawsers are to be supplied manufactured from high modulus polyethylene man made fibre cordage (trade name Steelite). The length of the spring hawser is to be 1½ times the length of the breast rope with a soft eye at one end, for securing to a bollard.

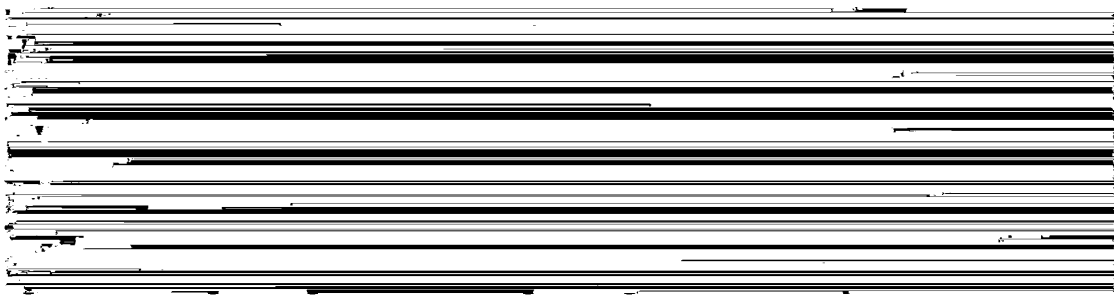
c . The arrangement of Bollards, Fairleads and Berthing Hawsers shall be as shown in Figures 3.10 and 3.11.



(1) Headrope (3) Breastrope

(2) Sternrope (4) Springs

Figure 3.10 Arrangements of Bollards, Fairleads and Berthing Hawsers – (Vessels of 4300 tonne and below)



(1) Headrope (3) Breastrope

(2) Sternrope (4) Springs

Figure 3.11 Arrangements of Bollards, Fairleads and Berthing Hawsers – (Vessels above 4300 tonnes)

3.4 Towing Arrangements

3.4.1 General Requirements

a . The vessel is to be able to tow a vessel of similar displacement and form in calm water (Sea State 1) at speeds up to 10 knots. It is to be assumed that the vessel under tow is in the same deep condition, six months out of dock in tropical condition and that the two propellers are locked.

b . The towing equipment required to tow or be towed shall be in accordance with Figures 3.12, 3.13 and 3.14, which have been reproduced from BR 67 and may not be the most up to date information available. See Clause 3.a .

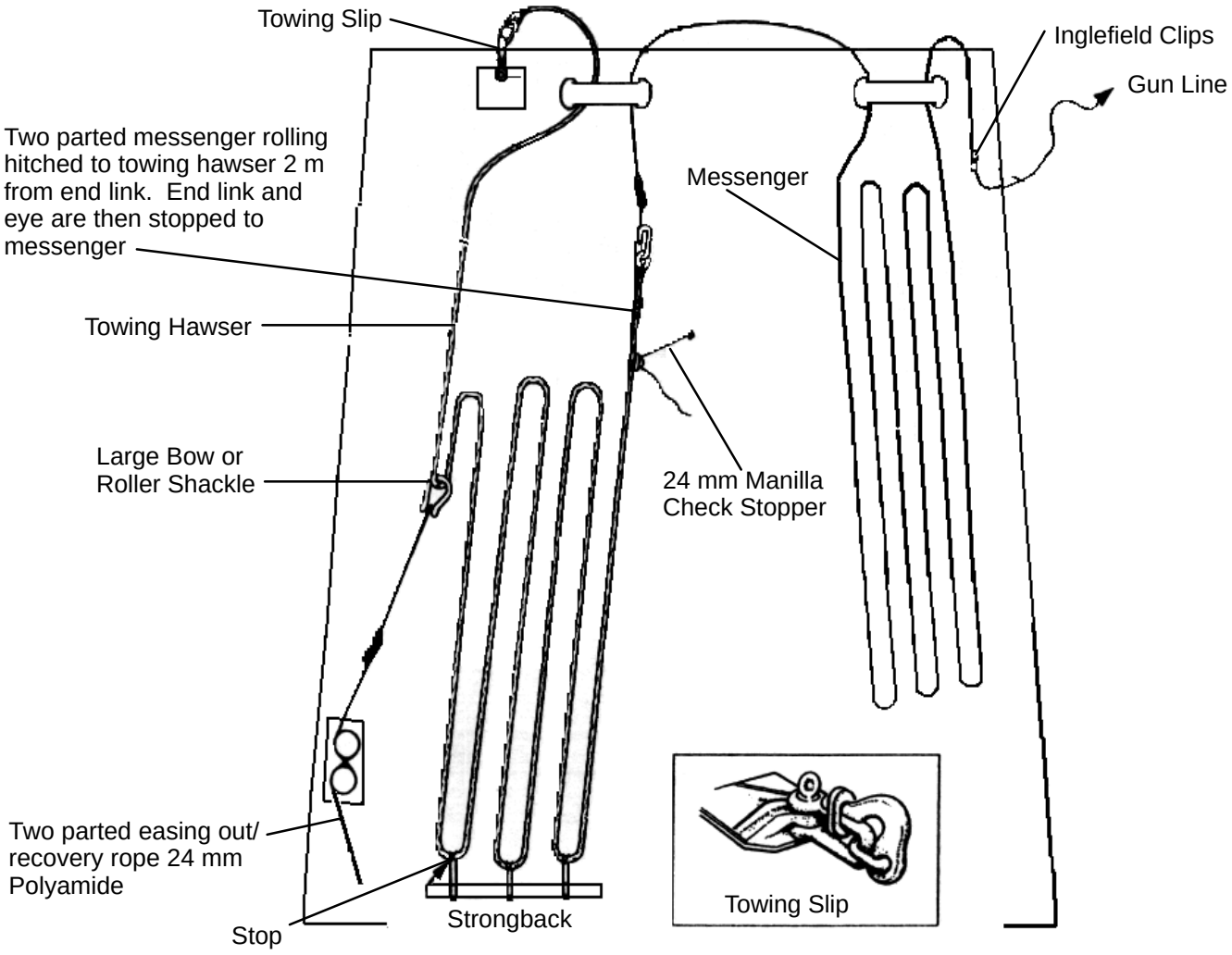


Figure 3.12 Towing Arrangements Aft, (Providing the Tow) – Ships Fitted with Outboard Towing Slip

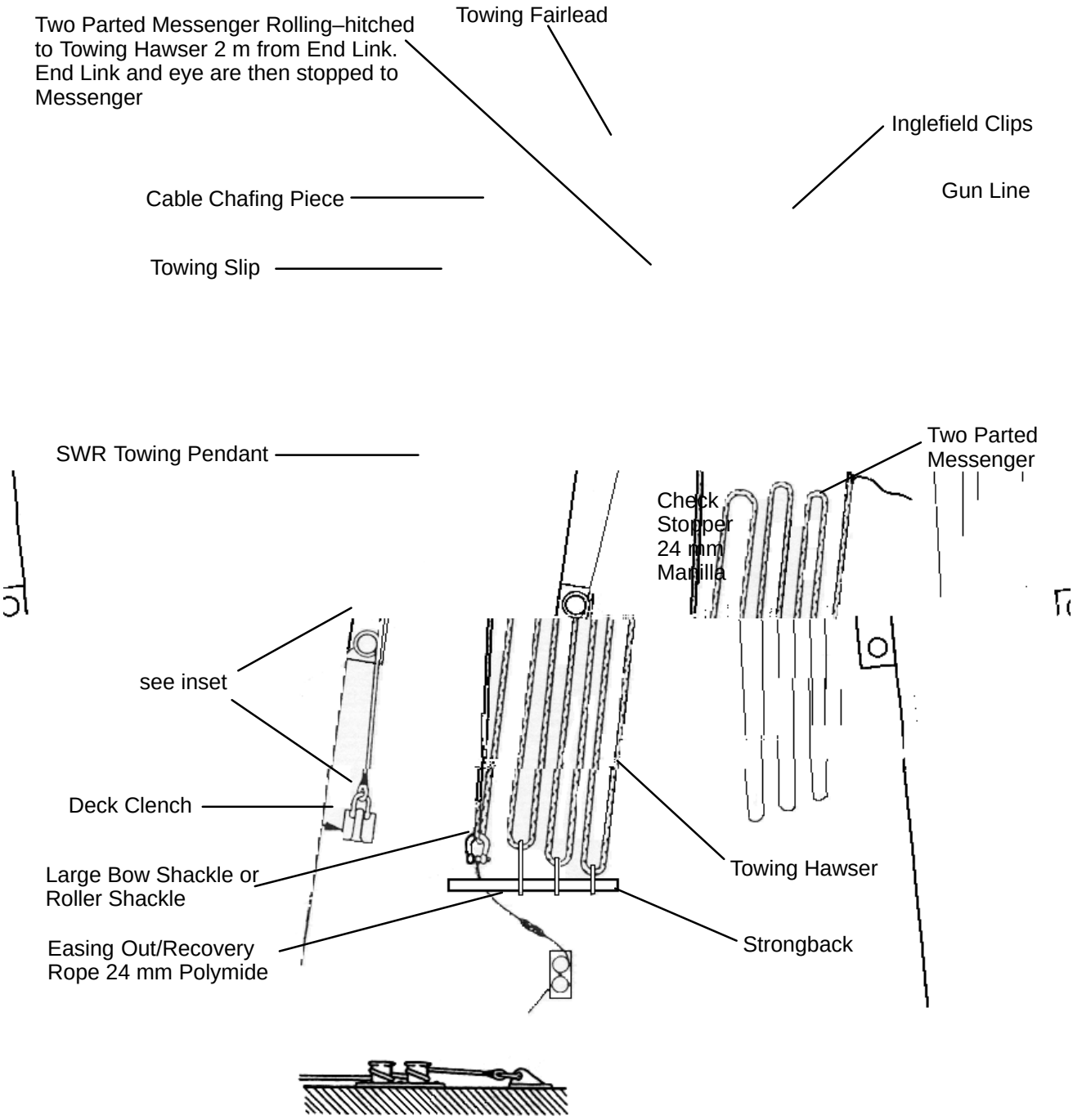
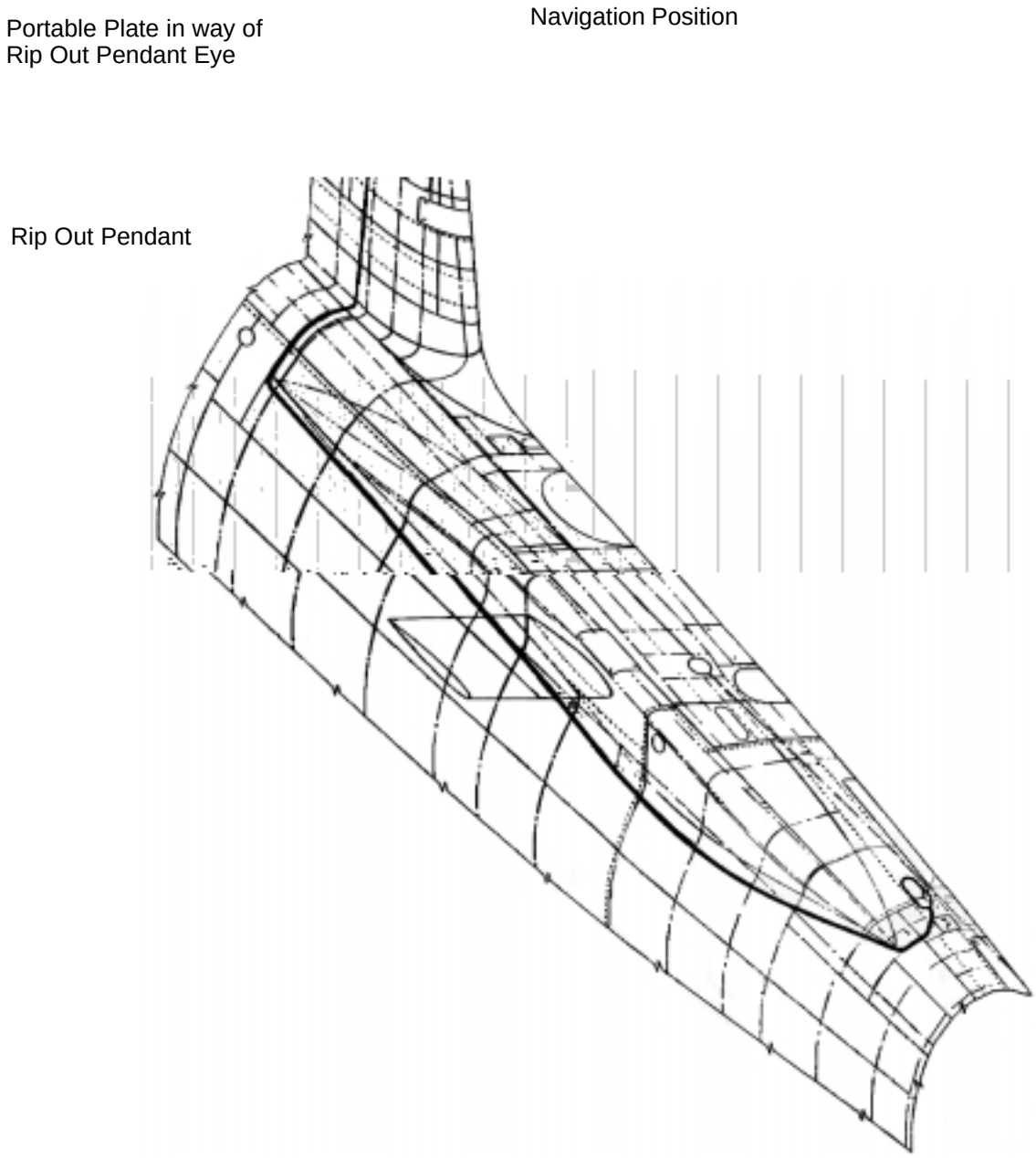


Figure 3.13 Towing Arrangements Aft (Providing the Tow) – Ships Fitted for Bollard and Clench Towing Slip



3.4.2 Towing Hawser and Towing Pendant

a . All vessels are to be supplied with a towing hawser and pendant.

b . The towing hawser shall be manufactured from multi–plaid polyamide rope selected from BS EN 696. The size and length of the hawser shall be defined in the contract and shall have sufficient strength to tow a ship of equal size. Both ends of the hawser shall have a standard NATO towing link fitted. Hawsers and pendants with a rope diameter of 40.5 mm to 48.5 mm shall have links manufactured to SDN 003 502 054 and those with a rope diameter of 65mm shall be manufactured to SDN 003 502 046. Thimbles used in conjunction with the links shall be manufactured to the requirements of SDN 00 350 2045.

c . The towing pendant fitted to a ship with an outboard Towing Slip is for use when the vessel is receiving the tow aft and will enable the connection to the hawser to be made on deck. The pendant shall be manufactured from multi–plaid polyamide rope selected from BS EN 696 and have a standard NATO towing link fitted to each end. The diameter of the rope and the fittings are to be identical to those of the hawser, the length is dependent on the class of ship and shall be defined in the contract.

d . The towing pendant fitted to a ship with the "bollard and clench" towing arrangement is for use when receiving and providing a tow aft. It shall be manufactured from Steel Wire Rope (SWR) with a sliced or ferrule thimble at each end. The SWR shall be selected from BS 302 Part 2 and shall be of comparable strength to the multi–plaid polyamide towing hawser. The length of the pendant is dependent on the class of ship and shall be defined in the contract.

NOTE When placing a thimble into a spliced eye of the pendant, it should be noted that the eye around the thimble should be secured with seizing wire, to enable replacement of the thimble due to elongation, therefore negating the need to totally renew the pendant.

3.4.3 Cable Chafing Piece

a . A forged steel chafing piece shall be supplied to ships fitted for "Bollard and Clench" towing. It shall be fitted between the towing slip and the towing hawser to take any wear of the towing assembly as it passes through the towing fairlead.

b . The breaking strength of the chafing piece shall be greater than the breaking strength of the towing hawser.

c . The length of the pendant and chafing piece is dependent on the class of ship and shall be defined in the contract.

3.4.4 Towing Slips

a . There are two types of towing slips (Figures 3.15 and 3.16), which are provided to enable a tow to be slipped at a moments notice in an emergency. Slips shall be supplied depending on the towing arrangements and shall be manufactured in accordance with NES 175. The requirements for non–magnetic Towing Slips shall be in accordance with NES 171.

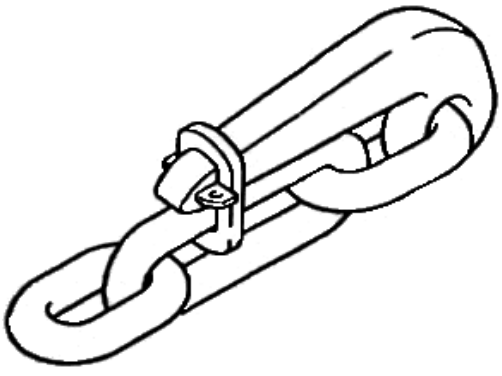


Figure 3.15 – Bollard and Clench Towing Slip

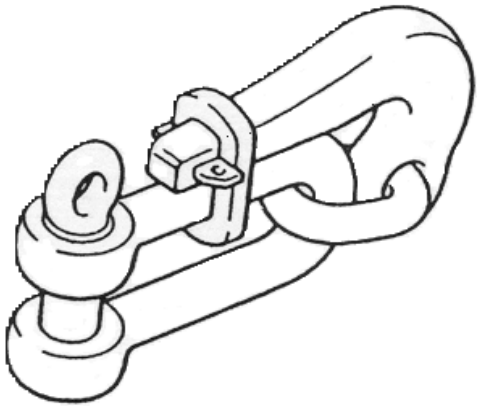


Figure 3.16 – Transom Towing Slip.

3.4.5 Towing Arrangements on Submarines

a . Submarines are only to be equipped to be towed. They are to be fitted with a polyamide braidline–towing hawser, which is for emergency use only.

b . The hawser is to be stowed in a trough in the bows of the submarine. The inboard end of the hawser is to be connected to a slip which can be manually operated from within the submarine. The outboard end is to be spliced to a "Rip Out" pendant manufactured from jacketed "Kevlar". The pendant is to be packed in a recess in the casing extending from the hawser stowage through to the top of the bridge fin on the starboard side. When the pendant is stowed the recess shall be covered with a membrane and tiled or faired over. The outboard end of the pendant is to be fitted with a link and thimble assembly and positioned behind a portable plate in the bridge fin.

c . The size and length of the towing hawser and "Rip Out" pendant shall be defined in the contract.

3.5 Securing to a Buoy

3.5.1 Securing to Buoy Shackle

a . To enable a ship to tie up to a buoy, two Securing to Buoy shackles appropriate to the size of stud link chain cable are to be provided and shall be manufactured in accordance with NES 175. The requirements for non–magnetic shackles shall be in accordance with NES 171. (See Figure 3.17).

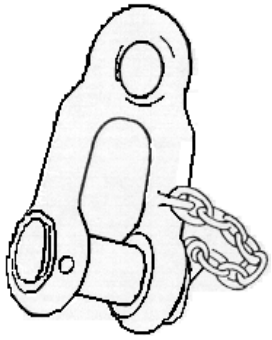


Figure 3.17 – Securing to Buoy Shackle.

3.5.2 Picking–up Rope

a . The picking–up rope shall be either a 73 m or 110 m (dependant on class of vessel) galvanized wire or Supermix rope. It is to be provided to enable the vessel to be hauled close up to a mooring buoy.

b . The picking up rope is to incorporate a wire rope grommet strop consisting of a bow shackle and spring hook, of relative strength, connected as an assembly into a thimble termination of the picking up rope. The opposite end of the picking up rope is to be a soft eye. (See Figure 3.18).

c . The diameter of the picking up rope and associated grommet strops related to the deep displacement of the vessel are detailed in Table 3.1. (One spare picking up rope of the same size and construction is to be provided for use with astern buoys).

d . All SWR shall be manufactured in accordance with BS 302 Part 2.

Deep Displacement (tonne)	Size of Polyester and Polypropylene Rope (Supermix) mm	Size of SWR mm	SWR Grommet Strop (mm)
2000 and below	40	20 (6 x 36)	12 (6 x 36)
2001 to 3000	40	20 (6 x 36)	16 (6 x 36)
3001 to 5000	48	24 (6 x 36)	20 (6 x 36)
5001 to 10000	56	32 (6 x 36)	24 (6 x 36)
10001 and above	64	32 (6 x 41)	24 (6 x 36)

Table 3.1 – Picking up Ropes and Grommet Strops for Hauling a Vessel to a Buoy

Figure 3.18 – Picking up Rope

3.5.3 Braidline Securing to Buoy Bridle

a . A Braidline Securing to Buoy Bridle is to be fitted to ships with a single anchor, and ships with bow domes. It is used to secure to a buoy and still have the bower anchor available for letting go. These bridles shall be made of double braided polyamide, one end of which is to be fitted with a soft eye incorporating either a Securing to Buoy shackle or an adaptor piece (to which a buoy securing shackle can be attached using a lugless joining shackle). The other end of the bridle is whipped and heat fused. A leather gaiter is to be fitted to protect the soft eye from possible chaffing from the adaptor piece and a sliding gaiter is also to be fitted to protect the bridle from chaffing at the bullring or fairlead. Two bridles shall be supplied as appropriate. Current vessels that have two bridles are:

Braided Polyamide Brindle	Buoy Securing Shackle	Class of Ship
0350/251–4431	0263/901424 (see Note below)	Type 22 Batch 3 Type 23 Type 42

3.5.4 Braidline Anchoring Bridle

a . This assembly is to be supplied to ships with a fixed bow dome. It is used to avoid damaging the dome with the cable when the ship is at anchor. It shall consist of the braidline ship to buoy securing bridle, modified by the addition of a 28 mm 6 x 36 galvanised x 7 m SWR pendant. The braidline bridle shall have an adaptor piece as an end fitting. The pendant shall have a hard eye in each end and shall be joined with a lugless joining shackle. The other end of the pendant shall be coupled to a joggle shackle, which, when in use, shall be attached to a bight in the ships cable. This will enable the cable to be veered and the weight transferred to the bridle.

NOTE When placing a thimble into a spliced eye, it should be noted that the eye around the thimble should be secured with seizing wire to enable replacement of a deformed thimble due to elongation, therefore negating the need to totally renew the securing pendant.

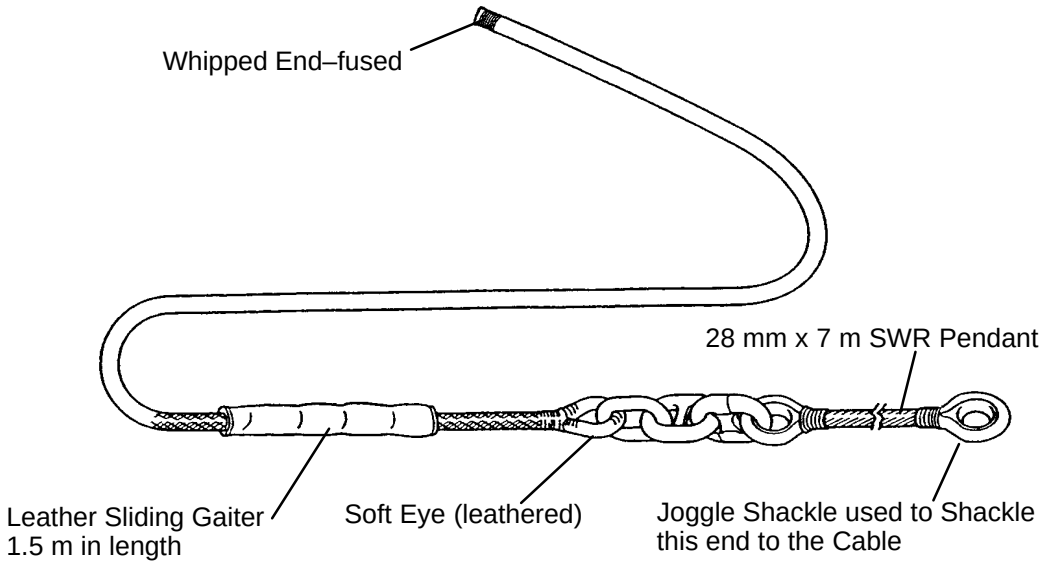


Figure 3.19 – Braidline Anchoring Bridle

3.6 Test and Trials

a . The requirements for anchoring, berthing, towing and securing to a buoy are detailed in the following sections. All items prior to acceptance are to be tested and undergone trials as follows:

3.6.1 Cable Holders, Windlasses and Capstans

a . The requirement for the test of forward cable holders, windlasses and capstans is related to the proof load of the chain cable. The requirements for after berthing winches and capstans are related to the proof load of the berthing ropes. The tests are to confirm that the design requirements as specified in the contract are being met and to establish the efficiency of the holding down bolts, etc.

3.6.2 Harbour and Sea Trials

a . Prior to harbour and sea trials all anchoring, berthing, towing and securing to buoy equipment shall be complete; spare gear shall be on board and stowed; power shall be available; and the sea water main shall be operable.

b . The chain cable is to be cleaned and surveyed as necessary in accordance with BR 367.

c . The anchor and cable arrangements are not to be used for any purpose during the launching of the vessel.

d . The requirements for both harbour and sea trials are covered in NES 113 Part 3.

3.6.3 Clench Plates

a . Clench Plates for use with Blake Slips and Screw Slips are to be sited to allow maximum compatibility with the cable or equipment they are designed for.

b . The Clench Plates shall be tested to 60 per cent of the proof load of the associated chain cable.

c . The cable locker Blake Slip Clench Plate shall be tested to 20 per cent above the proof load of the stud link chain cable. For practical reasons the test is to be applied before the Clench Plate is fitted.

d . The welding of the cable locker Blake Slip Clench Plate to the ship shall be ultrasonically tested in accordance with NES 729 Part 5.

e . The towing clench is to be designed such that when static load tested to the breaking load of the vessels towing hawser, the stress in the material of the towing clench does not exceed 80 per cent of the yield stress for that material. For practical reasons the towing clench is to be tested before installation and the efficiency of the attachment to the ship is to be ultrasonically tested in accordance with NES 729 Part 5.

3.6.4 Eyeplates

a . Two eyeplates are to be fitted in close proximity to the hawsepipe for use with the anchor strop, which will act as additional security for the anchor when it is stowed in the hawsepipe.

b . The minimum Safe Working Load (SWL) for each eyeplate shall be equal to the weight of the anchor. When selecting the eyeplate to be fitted, the size of the anchor strop shall be taken into account.

3.7 Preservation of Cable and Associated Equipment.

a . Prior to chain cable being placed in the cable locker, the chain and all associated equipments shall be coated with a “Fluid Film Type “A” Lubricant Rust Preventer” NATO Stock Number (NSN) 0475−225−1556 or any other approved equivalent.

4. DESIGN REQUIREMENTS/GUIDANCE

Related Documents: BS EN 10025; BS MA 12; BS MA 19; BS 729; BS 3100; BS 3468; BS 7079 Part A1; NES 155; NES 719; NES 763; NES 774; NES 791 Part 3; BR 67; see also Annex A.

a . For clarity and completeness, much of the information contained in this section has been taken from Service Drawings and BR 67. For the most up to date information the latest issues of all referenced documentation should be used which may vary from the infomation contained within this section.

4.1 Anchoring Arrangements

a . The anchoring arrangements for HM Surface Ships and Submarines are as shown in Figures 4.1, 4.2, 4.3, 4.4 and 4.5, which have been reproduced from BR 67 and may not be the most up to date infromation available.

b . Some modern warships have specified a commercial design anchoring arrangement. These assemblies shall comply with the Rules and Regulations of Lloyd’s Register as follows:

(1)	Rules for Ships	Part 3	Chapter 13;
(2)	Naval Ship Rules	Volume 1	Part 3, Chapter 5;
(3)	Special Service Craft	Volume 3	Part 3, Chapter 3.

4.1.1 Mock–Ups

a . When specified in the contract, a full size mock−up of the ships forward end shall be built for the first−of−class. This is to demonstrate that the anchor can be housed satisfactorily in its stowage.

4.1.2 Materials

a . All materials used in the construction and manufacture of the structure(s) and equipment(s) detailed in this NES shall meet the requirements as specified in the contract.

b . Any new improved materials should be examined for suitability and, if approved by the sponsor, considered for use.

4.1.3 Chequered Plating

a . Galvanized 10 mm chequered plating complying with the requirement of BS EN 10025 Grade S275 shall be fitted on the deck in way of the chain cable runs, and elsewhere as required, to take the rub of the cable.

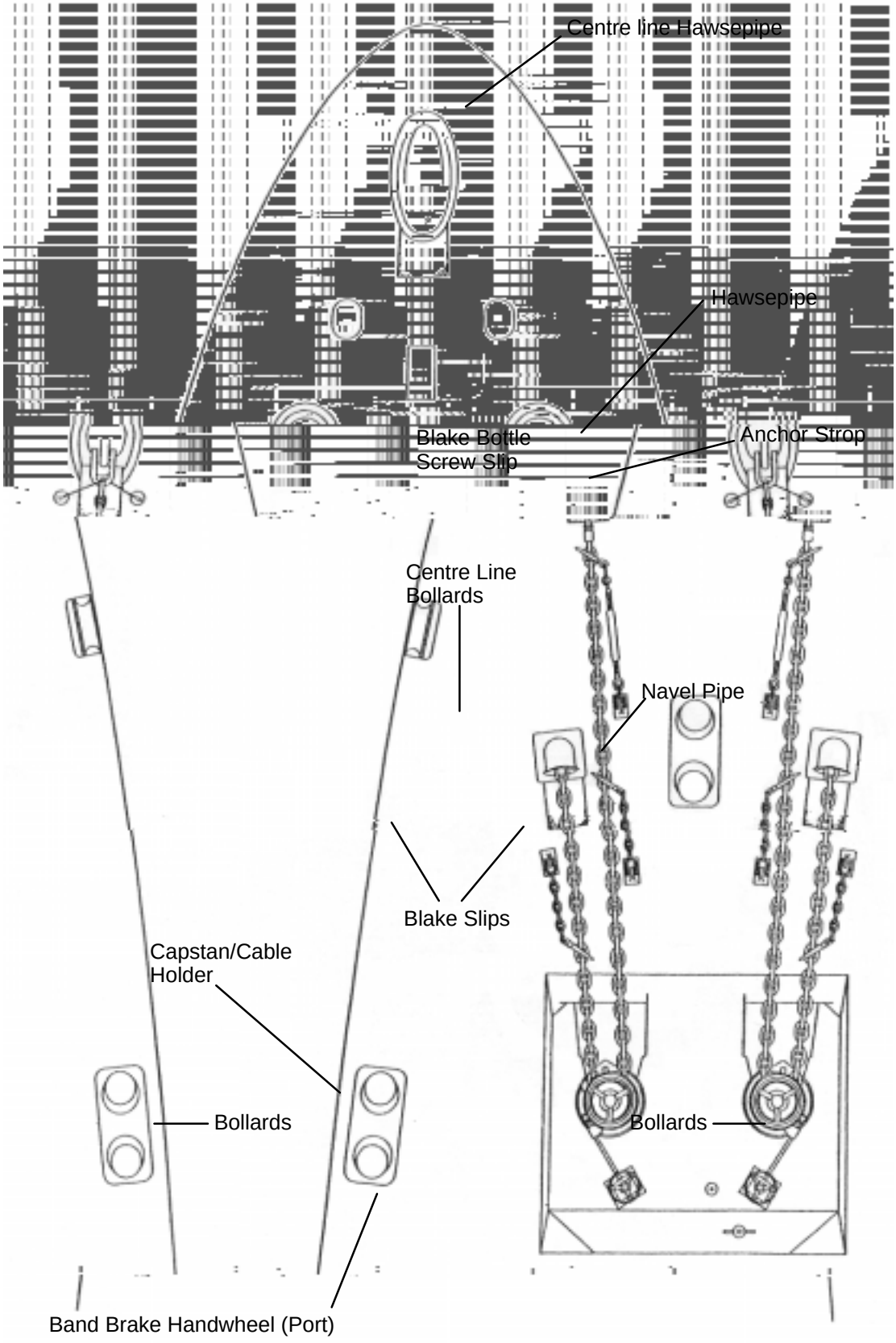


Figure 4.1 – Traditional Cable Deck Layout

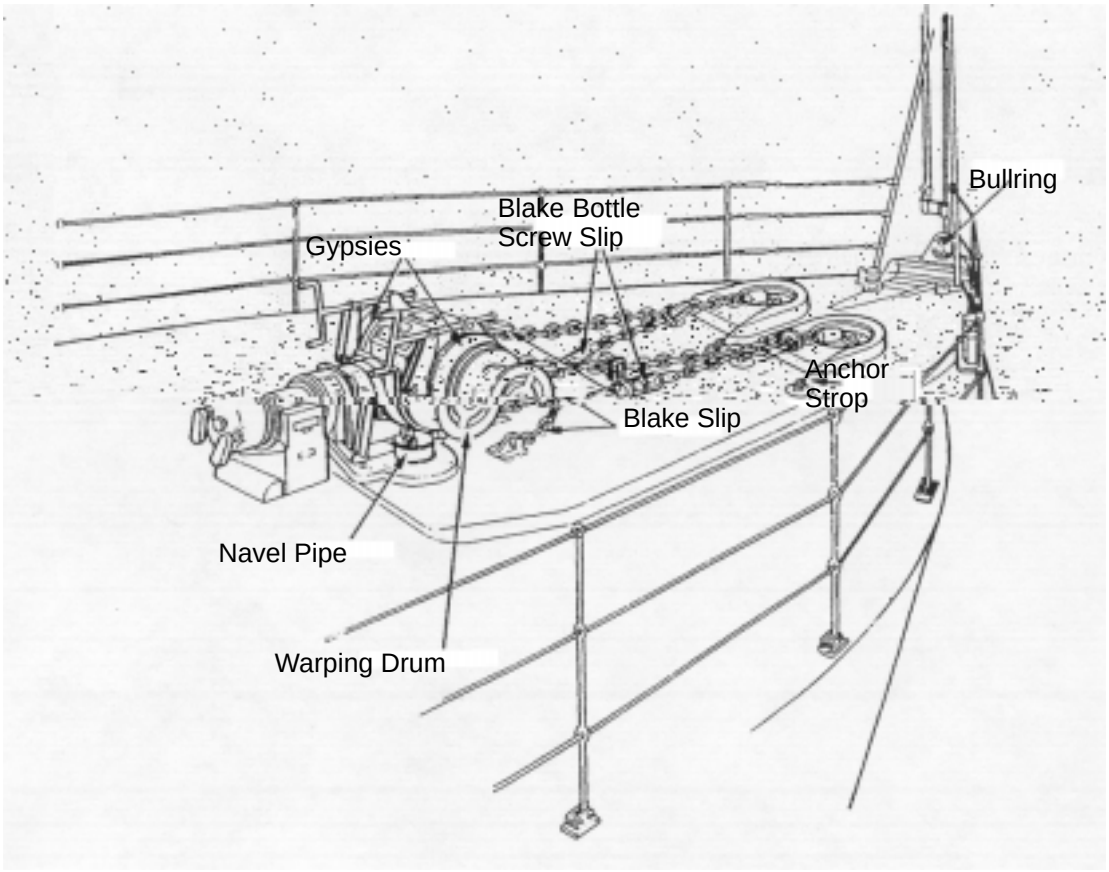


Figure 4.2 – Typical Minor Warship Forecastle Layout

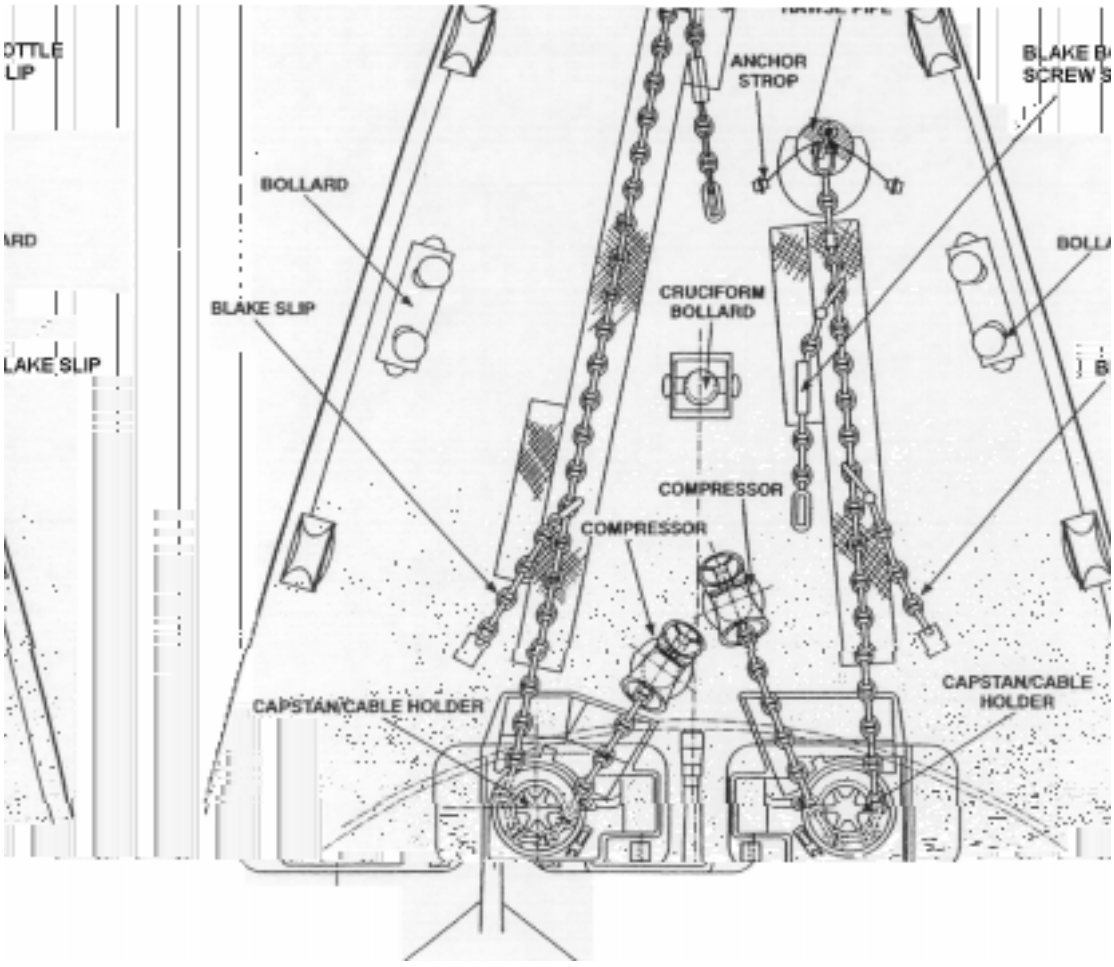


Figure 4.3 – Anchor and Cable Arrangement for Ships Fitted with a Bow Sonar – (Type 23 Frigate)

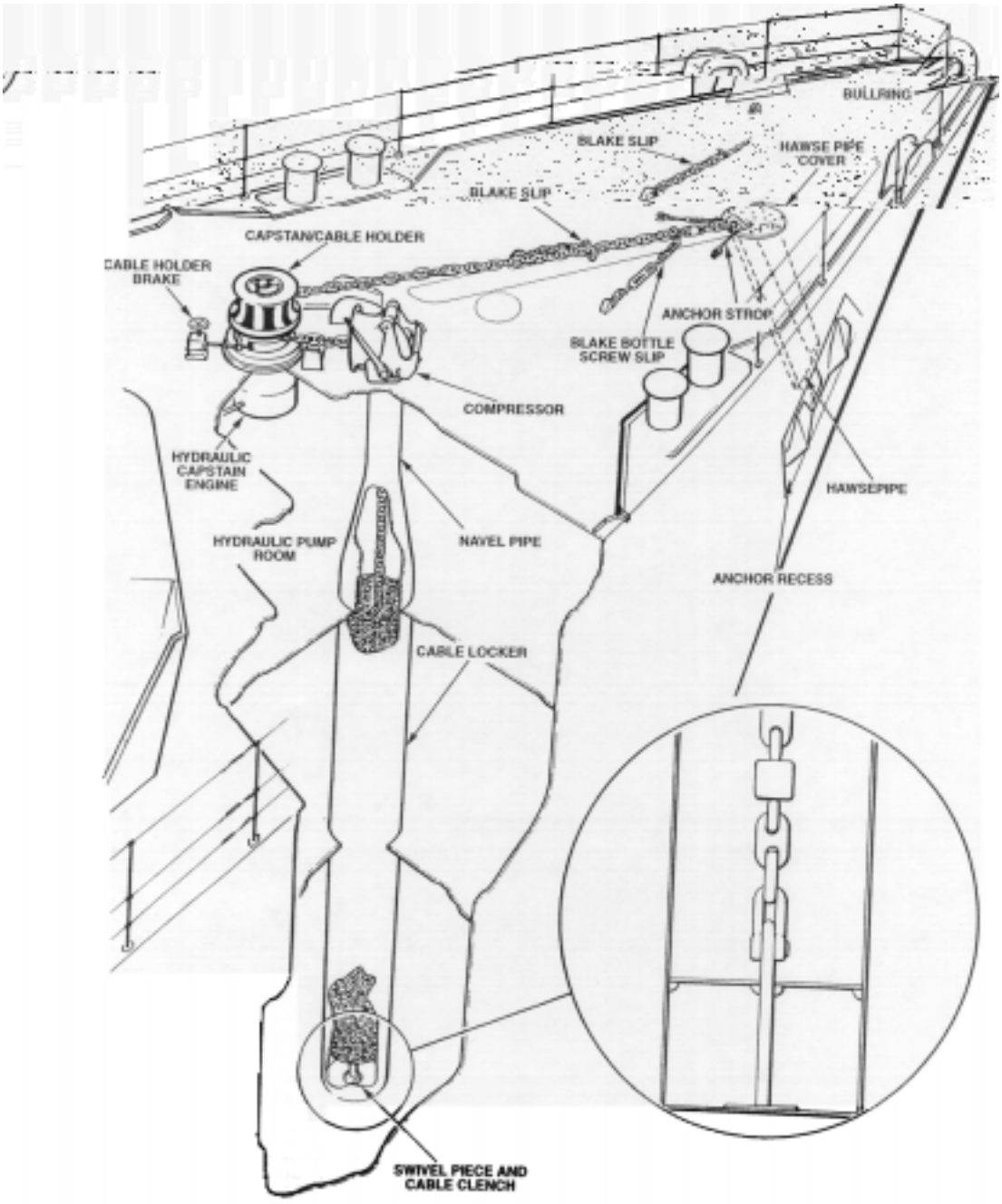


Figure 4.4 – Anchor and Cable Arrangement of a Type 42 Destroyer Showing Typical Cable Stowage

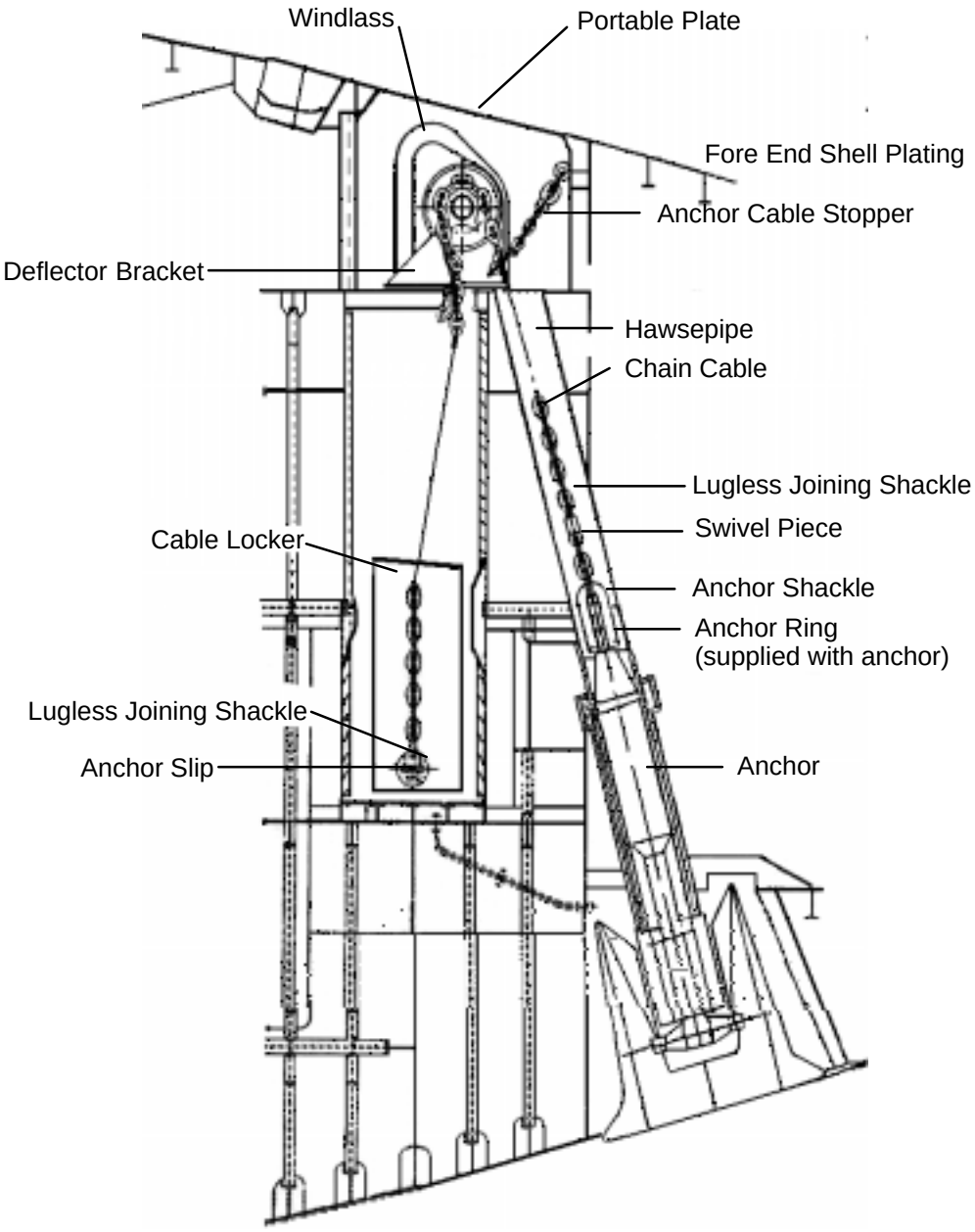


Figure 4.5 – Typical Anchor and Cable Arrangement for Submarines

4.2 Hawespipes

a . Hawespipes are to be fitted in accordance with the requirements of this NES and as confirmed by the forward end mock–up.

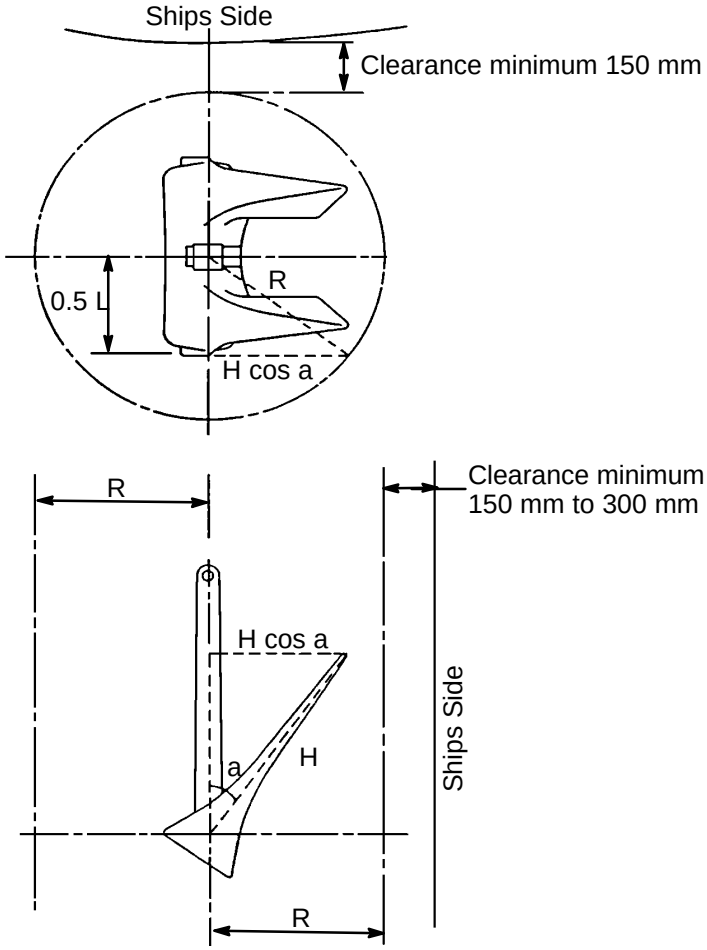
4.2.1 Siting

a . The siting of the hawsepipe for conventional bower anchors is dependant upon the shape of the forebody and the bow contour of the vessel. However, consideration must be given to the following:

(1) The hawsepipe position relative to the cable holder/windlass is to be of sufficient distance to ensure a satisfactory arrangement of ‘Stoppering’ the cable. It must not be too great to allow excessive whipping of the cable as it is being run out;

(2) Sufficient clearance between the anchor flukes in the most critical position and other underwater bow contours. (See Figure 4.6);

(3) The length of the hawsepipe is to be such that the lugged anchor shackle just protrudes through the deck and lays horizontal. (See Figure 4.7);



L = Length of Anchor Head
H = Height of Anchor Flukes from centre line of turning shaft.
a = Maximum opening angle between Flukes and Shaft.

Figure 4.6 – Clearance between Flukes and Bow Contours

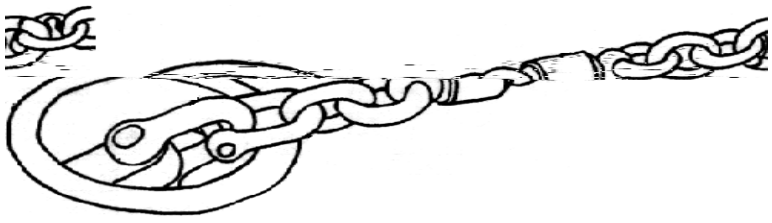
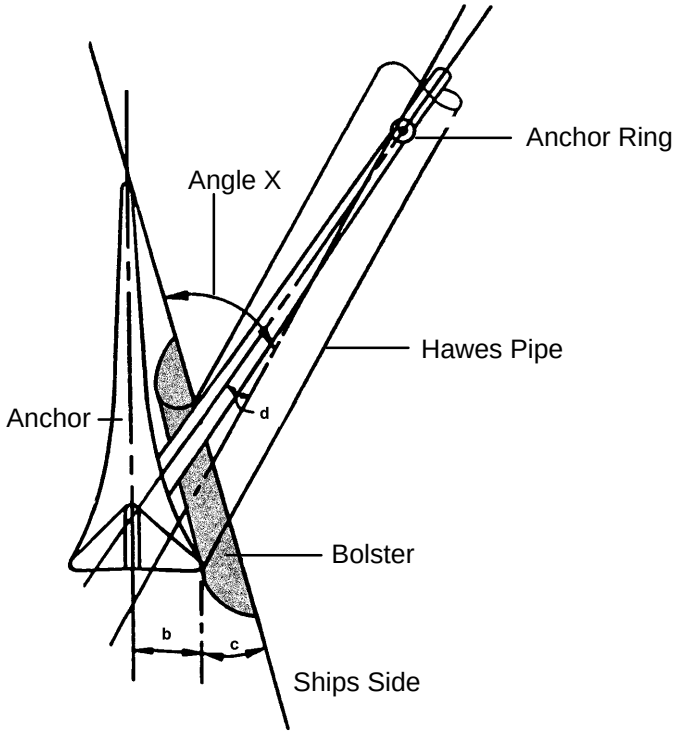


Figure 4.7 –Lay of Anchor Shackle

(4) The minimum angle between the centre line of the hawsepipe and the plane determined by the shell planting surrounding the hawsepipe is defined as the stowing angle and is expressed as follows:



Angle X = a + b + c – d =
- Stowed angle. Angle between centre line of hawsepipe and outside of shell plating.
- a = Maximum opening angle between flukes and anchor shank.
- b = Angle determined by side outreach of anchor.
- c = Angle determined by height of bolster.
- d = Angle between centre line of anchor shank and centre line of hawsepipe.

Figure 4.8 – Angle between Hawsepipe CL and Shell Plating

b . To achieve the correct stowing angle X, an adjustment to the ship lines may be necessary.

c . It should not be necessary to turn the anchor on the swivel when the flukes are pointing against the vessel as the anchor is to be self–stowing.

d . The requirements for minimum clearance to bow contour and anchor stowing position (see Figure 4.6 and Figure 4.8) will limit the vertical angle, between the centre line of the hawsepipe and the line determined by the actual shell flare, to between 70 degrees and 120 degrees. (See Angle ‘B’ in Figure 4.9b).

e . Alternatively, the siting of hawsepipes for vessels with bow sonar systems are to have an arrangement similar to those shown in Figure 4.3.

Figure 4.9a

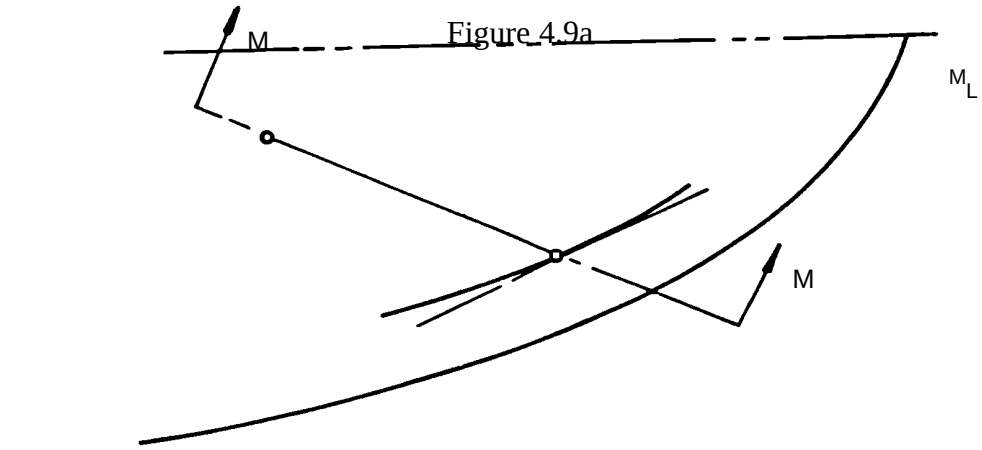


Figure 4.9b

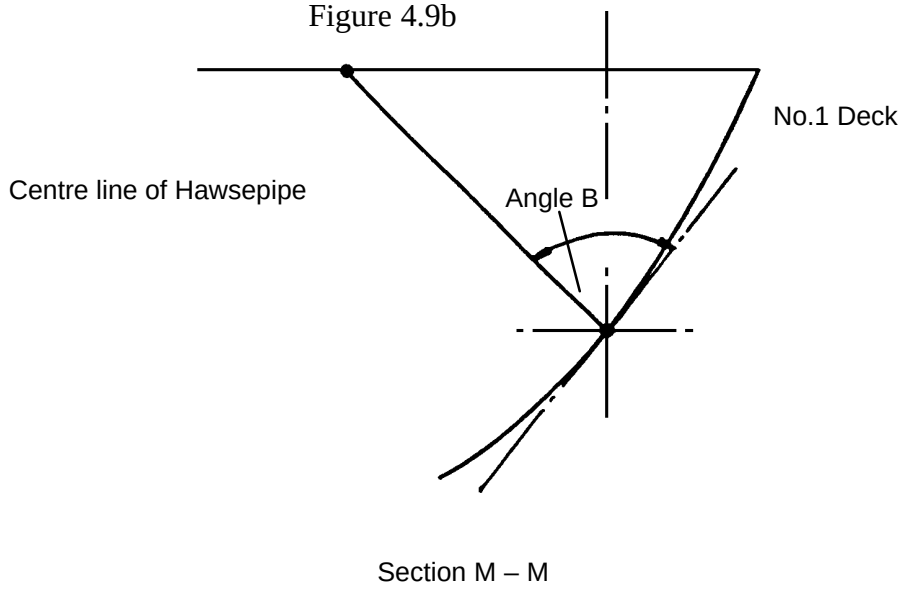


Figure 4.9 – Angle Between Hawsepipe Centre Line and Shell Flare

4.2.2 Size

a . The diameter of the hawsepipe shall be 12 times the diameter of the chain cable.

b . Hawsepipe mouths shall be well rounded and, in way of possible leads of cable, shall have a radius of not less than six times the diameter of the chain cable.

4.2.3 Bolsters

a . Segmental shape bolsters shall be fitted at each end of the hawsepipe with a width not less than three times the diameter of the cable.

4.2.4 Material

a . Bolsters shall be cast from steel complying with BS 3100 Grade A4 and connected by a watertight mild steel tube manufactured from 'B' quality steel complying with the requirements of NES 791 Part 3.

b . Bolsters and Hawsepipes with a non–magnetic requirement are to be manufactured out of Ni–resistant austenitic Sg cast iron complying with BS 3468 Grade S2C.

4.2.5 Shell Plating

a . Shell plating in way of the hawsepipes shall be flush and of adequate thickness with special stiffening to meet the strength requirements as prescribed in NES 155.

4.2.6 Hawsepipe Gratings

a . The gratings are to fit snugly around the chain cable at the inboard end of the hawsepipe and secured by vice headed bolts tapped into the bolster. Care must be taken that the holes do not penetrate the full depth of the bolster.

b . Gratings shall be manufactured from mild steel and galvanised in accordance with BS 729.

4.2.7 Cable Washing Facilities

a . Cable washing facilities are to be provided by three equally spaced sea water jets per hawsepipe, situated between one third and half the length of the hawsepipe below deck level.

b . Cable Washing arrangements are to be installed in accordance with Figure 4.10 and NES 719. The arrangement shown is for a two hawsepipe configuration. Only one side of the arrangement would be required for a single hawsepipe configuration.

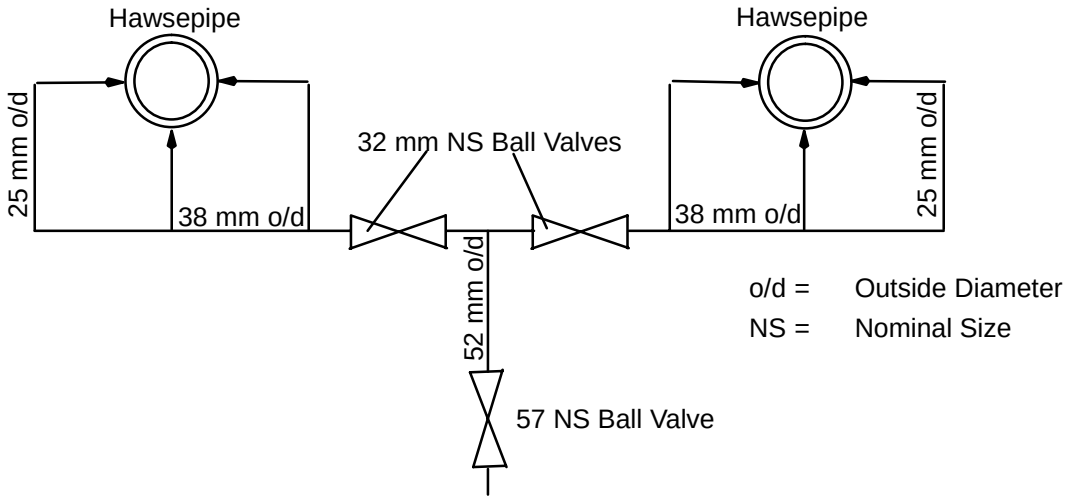


Figure 4.10 – Arrangement of Hawsepipe Cable Washing Facilities

4.2.8 Recessed Anchor Stowage

a . Recesses are to be of sufficient size and shape to allow the anchor to be stowed without any part of the head or flukes protruding outside the recess.

b . Unless otherwise specified in the contract, recessed anchor stowages are to be fitted to reduce the effect of spray, avoid anchor damage in heavy weather and to give a fair line with the shell plating.

c . The angle of the recess backplate must meet the requirements of Clause 4.2.1(4).

d . Vessels with a bow sonar system shall have an arrangement consistent with that shown on Figure 4.3.

4.3 Stem Hawsepipe and Bullring

a . A stem or centre line hawsepipe or bullring, similar to Figure 4.11, is to be fitted to give a fair lead when the ship is secured to a buoy or being towed.

b . The diameter shall be 12 times the diameter of the chain cable. This will permit the working of 2 bridles, picking up rope and associated fittings. Bullrings are to be fitted with a radius of curvature, on which the chain cable may lie, of not less than four times the diameter of the chain cable.

c . A fairlead is to be located either side of the stem hawsepipe or bullring for use with Picking up Ropes.

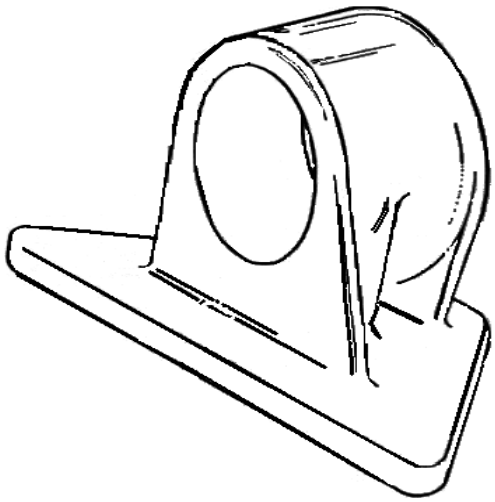


Figure 4.11 – Typical Bullring

4.4 Naval Pipes

4.4.1 General

a . Naval pipes, for the passage of chain cable to and from the cable locker(s), is to be fitted to extend from the cable deck to the inside of the cable locker.

b . The casting at the bottom of the naval pipe is to be well rounded and fitted with a bell mouth.

c . In order to maintain a uniform stowage, the naval pipe is to be positioned over the centre of the cable locker.

4.4.2 Material

a . Unless specifically stated otherwise, naval pipes are to consist of a top and bottom casting manufactured from steel complying with BS 3100 Grade A4, interconnected by a watertight mild steel tube.

b . Naval pipes with a non−magnetic requirement are to be manufactured from Ni−resistant austenitic Sg cast iron complying with BS 3468 Grade S2C.

4.4.3 Size

a . The upper surface of the casting at the forecastle deck level is to be rounded with a radius of curvature on the line of the chain cable with a maximum radius of three times the diameter of the chain cable.

b . The diameter of the navel pipe is to be eight times the diameter of the chain cable.

4.5 Cable Locker

4.5.1 General

a . The cable locker must be positioned as low as practicable in the ship to ensure that there is sufficient drop to stow the complete outfit of stud link chain cable by overcoming the weight on deck between the cable holder and naval pipe. See Figure 4.4.

4.5.2 Construction

a . Both port and starboard lockers are to be self–stowing. The optimum diameter of, for example a circular locker is 26d, where d is the diameter of the chain cable.

b . A portable flat of perforated plating is to be fitted approximately 0.75 m above the bottom of the locker to form a drainage sump.

c . A means of access into the sump is to be provided together with drainage arrangements for the removal of mud and water.

4.5.3 Volume

a . In assessing the volume of the locker, only two–thirds of the height of the locker is to be assumed effective.

b . The required volume is $0.002309d^2$ cubic metres per 150 fathoms of cable stowed, where d is the diameter of stud link chain cable in millimetres.

c . To allow for rough stowage, the volume of a locker stowing 60 mm diameter chain cable and below is to be increased by one third; for lockers stowing cable greater than 60 mm diameter the increase is to be 40 per cent.

4.5.4 Preservation

a . The structure inside the boundaries of the cable locker is to be abrasively blasted and zinc sprayed in accordance with the requirements of BS 7079 Part A1, NES 763 for HM Surface Ships and NES 774 for Submarines.

4.6 Berthing Arrangements

4.6.1 Bollards and Fairleads

a . The size of bollards and fairleads fitted for berthing and towing are to be related to the specific load requirement determined for berthing and towing hawsers.

b . The number of bollards and fairleads fitted is dependent on the size of the ship and in accordance with Figures 3.10 and 3.11 and as Table 4.1, although some modern warships will have specified berthing arrangements to a commercial design.

Vessels Displacing 4300 tonne and below		Vessels Displacing above 4300 tonne	
Fitting	Position	Fitting	Position
1 Double Bollard	Centre line Forward	1 Double Bollard	Centre line Forward
1 Double Bollard	Centre line Aft	1 Double Bollard	Centre line Aft
4 Double Bollard	Port and Starboard	6 Double Bollard	Port and Starboard
6 Fairleads	Port and Starboard	8 Fairleads	Port and Starboard

Table 4.1 – Position of Bollards and Fairleads

c . Bollards shall be selected from the range detailed in BS MA 12 and fairleads from the range detailed in BS MA 19.

d . All bollards and fairleads are to be of the same dimension and form throughout the vessel. Each related bollard, fairlead and mechanical operating system is to have a logical alignment with each other, allowing for hawsers to be worked with a fair lead with no acute nips.

e . Bollards are to be fitted 300 mm inboard of the deck edge and in accordance with the contract documents.

f . Fairleads are to be fitted (a) at the deck edge; (b) 3 metres forward or aft of the associated bollard; (c) in accordance with the contract; and (d) in accordance with Figure 4.12.

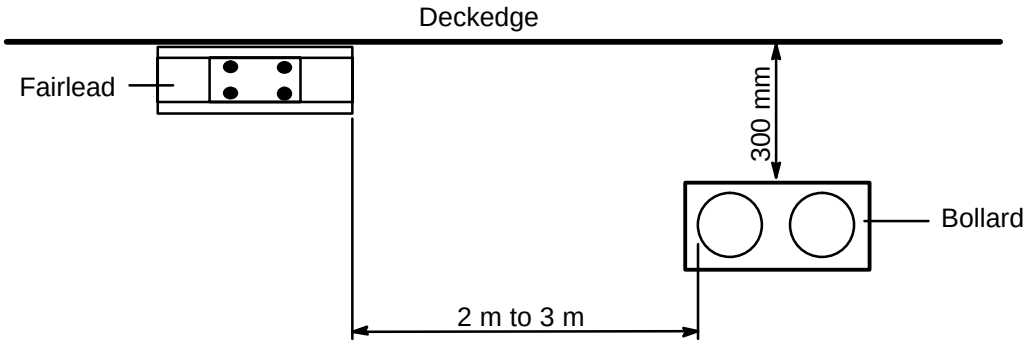


Figure 4.12 – Relative Position of Bollard and Fairlead

5. CORPORATE KNOWLEDGE AND EXPERIENCE

Related Documents: There are no related documents in this Section.

5.1 Spare Equipment

a . Spare associated stud link chain cable equipment requirements will be detailed in the contract but in principle should be one for each type of item.

5.2 Blake Slip Position

a . When positioning clench plates for securing blake slips they are to be in line with the cable run.

ANNEX A.

RELATED DOCUMENTS

A1. The following documents and publications are referred to in this NES:

ACCA 1967	Anchors and Chain Cable Act 1967, Rules 1970
BS EN 696	Fibre ropes for general purposes (Polyamide)
BS EN 10025	Hot rolled products of non alloy structural steels
BS MA 12	Specification for welded steel bollards
BS MA 19	Specification for panama – Type bollards
BS 302	Stranded steel wire rope: Part 2: Specification for ropes for general purposes
BS 729	Specification for hot dip galvanized coatings on iron and steel articles
BS 3100	Specification for steel castings for general engineering purposes
BS 3468	Specification for austenitic cast iron
BS 7079	Preparation of steel substrates before application of paints and related products: Part A1: Visual assessment of surface cleanliness
JSP 430	Ship Safety Management System Handbook: Volume 1: Policy and Guidance on MOD Ship and Equipment Safety Management
NES 113 (Def Stan 02–113)	Requirements for Mechanical Handling Part 3: Anchor Capstans, Capstans and Cable Holders
NES 155 (Def Stan 02–155)	Requirements for Structural Practice in Steel HM Surface Ships: Part 2: Requirements for Survey and Repair of Steel HM Surface Ships
NES 171 (Def Stan 07–209)	Requirements for Copper Based Alloy Stud Link Anchor Cables and Associated Equipment
NES 172 (Def Stan 07–210)	Requirements for Forged Steel Stud Link Chain Cable Grades 1, 2 and 3
NES 174 (Def Stan 07–212)	Requirements for Ships and Mooring Anchors
NES 175 (Def Stan 02–113)	Requirements for Equipment Associated with Forged Steel Chain Cable
NES 719 (Def Stan 02–719)	Sea Water Systems for HM Surface Ships
NES 722 (Def Stan 02–113)	Requirements for the Preparation Identification and Management of Drawings
NES 729 (Def Stan 02–722)	Requirements for Non–destructive Examination Methods Part 5: Ultrasonics
NES 763 (Def Stan 07–251)	Preservation and Painting of Compartments in HM Surface Ships
NES 774 (Def Stan 07–252)	Requirements for the Preparation and Painting of Submarines

NES 791 (Def Stan 02–791)	Requirements for Weldable Structural Steel: Part 3: 'B' Quality Steel Plates and Section
BR 67	Admiralty Manual of Seamanship
BR 367	Manual of Anchor, Chain Cable and Associated Equipment (In course of preparation. When published shall supersed BR 367 Parts 1 and 2)

A2. The following drawings are referred to in this NES:

SDN 003 502 045	Thimble for Nylon Towing Hawser
SDN 003 502 046	Link for Nylon Towing Hawsers (65 mm Rope)
SDN 003 502 054	Link for Nylon Towing Hawsers (40.4 mm to 48.5 mm Rope)

ANNEX B.

ABBREVIATIONS AND DEFINITIONS

B1. For the purpose of this NES the following abbreviations apply:

ACCA	Anchors and Chain Cable Act
BR	Book of Reference
BS	British Standard
DLO	Defence Logistics Organisation
DPA	Defence Procurement Agency
ITTC	International Towing Tank Conference
MCMV	Mine Countemeasures Vessel
MOD	Ministry of Defence
NATO	North Atlantic Treaty Organisation
NES	Naval Engineering Standard
Ni	Nickel
NSN	NATO Stock Number
RPO	Resident Project Officer
SDN	Standard Drawing Number
SWL	Safe Working Load
SWR	Steel Wire Rope

B2. For the purpose of the NES the following definitions apply:

Blake Slip	A general – purpose slip, which can be used as a presenter, or to hang the cable whilst working on its inboard part. In addition it can be used to secure the soft eye of a wire, which may require quick release.
Bower Anchor	A ship's largest anchors are called bower anchors. They are used for anchoring or mooring and are normally stowed one on each side of the bow in a hawsepipe.
Compressor	A compressor consists of a wedge of steel operated by a lever or handwheel; the wedge can be moved down across the mouth of the navel pipe until it nips a link of cable against the lip. Some ships with fixed bonnets have compressors fitted into the bonnets to take the place of the riding slip.
Guillotine	A guillotine, which can be fitted to take the place of a riding slip or compressor in vessels fitted with a windlass. More common in merchant ships.
Hawespipes	A steel tube which houses the anchor in its stowed position and gives a lead for the cable during anchor work.
Joggle Shackle	Used for attaching a wire rope to a bight of cable.
Navel Pipes	Pipes fitted forward of the cable holders, or are incorporated into the base of the windlass for the passage of the anchor cables to and from the cable lockers.
Screw Slip	These are used for heaving the anchor tight home into its hawsepipe.

Securing to Buoy Shackle	Supplied for securing tne ships bridle or cable to tne buoy shackle or reducing link. Can be used with either lugged or lugless shackle.	
Stoppering	Cordage:	To temporarily relieve tne strain on a rope by winding another rope around and masking it fast to an eyeplate or other fixture.
	Chain Stopper:	This is used for wire hawsers only and is similar to a cordage stopper except that it consists of a length of chain.
Swivel and Link Piece	Swivel and Link assemblies are fitted to prevent tne chain cable from twisting when tne ship is at anchor.	

ANNEX C

HULL DRAG

a. Calculated by the International Towing Tank Conference (ITTC) method with a fouling allowance equivalent to the 6 MOD tropical condition (i.e. six months out of dock in tropical waters):

$R = \frac{1}{2}pSV^2C_T$

Where p = mass density of sea water
S = wetted surface area
V = speed of tide
C_T = Total resistance coefficient $C_T = C_{FS} + C_R$
C_F = Functional resistance coefficient
C_R = Residuary resistance coefficient

(1). Calculate frictional resistance coefficient:

ITTC $C_F = \frac{0.075}{(\text{Log}_{10}\text{Rn} - 2)^2}$

Where $\text{Rn} = \frac{VL}{\Gamma}$

C_{FS}(Clean) = ITTC C_F + 0.00026 (correlation allowance)
C_F(6 MOD) = 1.56 C_{FS} + 0.00026 (correlation allowance)

(2). Calculate residuary resistance coefficient using:

$C_R = C_{FS}(\text{Clean}) \times 0.34$

NOTE This relationship is the result of an in–house MOD study of the value of residuary resistance of ships at speeds as low as the likely tide velocities.

(3). Calculate Total Resistance:

$C_T = C_{FS} + C_R$

(4). Calculate drag due to appendages with a tide:

The total appendage drag can be calculated by working out the drag of each appendage, or by using an appendage factor such that:

$P_{EAPP} = C_{ENAKED} \times$ Appendage Factor

Where P_{EAPP} = effective power of the appendages

Analysis of existing MOD data has shown that the Total Appendage Power varies as $V^{2.89}$ and therefore at any speed the following relationship can be used:

$P_{EAPP} = \frac{(V)^{2.89}}{(V)} \times P_{EAPP}$ (at speed V_m)

Where V = speed consideration
V_M = maximum speed

Therefore appendage resistance is:

$R_{APP} = P_{EAPP}/V$

(5). Calculate the Total Hull Resistance:

Total Hull Drag = $C_T + R_{APP}$

(6). Calculate the drag of the locked propellers:

(a). This can amount to more than twice the hull drag and can be assessed by using the following method;

(b). The graphs shown in Figure C1 enables the drag coefficient of a locked propeller to be estimated from its diameter, blade area ratio and pitch ratio.

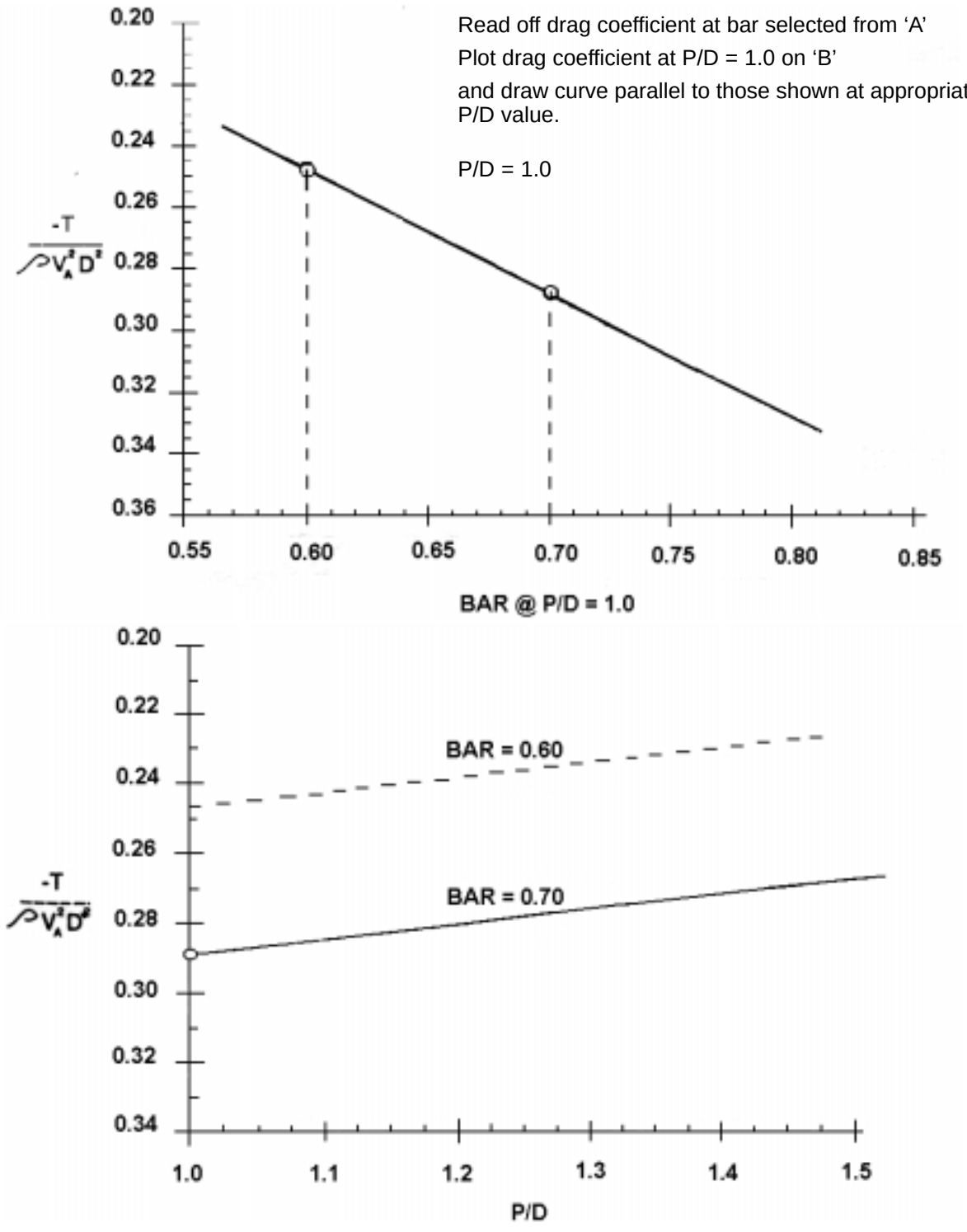


Figure C1 – Drag Coefficient for a Locked Propeller

ANNEX D.

WIND DRAG

The air resistance is calculated using the following formula:

$$R = \tfrac{1}{2} p A V_1^{\,2} C_D$$

Where p = mass density of air at 15°C and 760 mm pressure i.e. 1.226 kg/m3

A = maximum transverse area above the waterline

V1 = wind speed relative to the ship

C_D = drag coefficient

The relevant wind speed V_1 is calculated from:

$$V_1^{\,2} = \frac{(V + V_W)^2 + (V - V_W)^2}{2}$$

Where V = Speed of the ship

VW = Speed of the wind

In order to calculate C_D it is necessary to arrive at the following ship characteristics:

AR_{PR} = Aspect ratio profile = $\dfrac{\text{Profile area (above waterline)}}{(\text{Overall Length})^2}$

AR_{PL} = Aspect Ratio plan = $\dfrac{\tfrac{1}{2}\ \text{Overall plan area}}{(\text{Overall length})^{\,2}}$

$\dfrac{S}{L}$ = $\dfrac{\text{Profile perimeter length (excluding waterline)}}{\text{Waterline length}}$

and C_D is calculated by using:

$$C_D = 0.215\ AR_{PR}^{\,-1.35} \times AR_{PL} \times \frac{S}{L}$$

ALPHABETICAL INDEX

(NOTE: Page numbers are given)

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