

MIL-C-24524 (SHIPS)
18 September 1975

MILITARY SPECIFICATION

CABLE ASSEMBLIES, MAGNETIC MINESWEEPING, TYPE CL2B

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers type CL2B magnetic minesweeping cable, a single-conductor, insulated, buoyant connecting-link cable with external plastic flotation elements of ball and socket design.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-1055 - Barrier Material, Waterproofed, Flexible.

STANDARDS

FEDERAL

FED-STD-601 - Rubber: Sampling and Testing.

MILITARY

MIL-STD-129 - Marking for Shipment and Storage.

DRAWINGS

MILITARY

NAVSHIPS S8101-1566524 - Type CL2 Connecting Link Connectors.

NAVSHIPS S8101-1566635 - Splice for CL2 Cable.

NAVSHIPS S8101-1566636 - Die for CL2 Cable Fittings.

NAVSHIPS 3304176 - Type CL2 Clamp.

NAVSHIPS 3304180 - Type CL2 T.E. Clamp.

ANACONDA WIRE AND CABLE COMPANY

NBU-162 - SE-2 Float and Spacer.

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

G23 - Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) For Exposure of Nonmetallic Materials.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, 222 South Riverside Plaza, Room 1106, Chicago, IL 60606.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION INCORPORATED, AGENT

National Motor Freight Classification Rules.

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., 1616 P St. N.W., Washington, D C 20036.)

FSC 1075

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(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Length. Cable assemblies shall have a length of 450 feet within tolerances of plus 10 feet or minus 2 feet.

3.2 Construction.

3.2.1 Conductor. The conductor shall be 1660 thousand circular mils of hard drawn alloy 1350 aluminum 37 ropes, each rope composed of 19 wires, each wire 0.0486 inch in diameter. Nominal overall diameter of the conductor shall be 1.701 inches.

3.2.2 Strand sealing. The conductor shall be blocked with the compound and in the manner described in the attached appendix to prevent the passage of any trace of water through the cable when tested in accordance with 4.13.

3.2.3 Sheath. The cable sheath (insulation and jacket) shall have a nominal thickness of 170 mils and may be of either taped or extruded construction. If taped, the sheath shall be fabric reinforced, but there shall be no fabric in the outer 50 mils of jacket and there shall be no fabric in a 60 mil thickness of the total insulation thickness. If taped construction is used, curing tapes shall be completely removed so that no fabric ravelings remain. If extruded construction is used, a reinforcing braid, completely bonded to both insulation and jacket, shall be applied between insulation and jacket. Whether taped or extruded, the insulation and jacket shall be vulcanized together so as to produce a single cohesive mass (see 3.8).

3.2.4 Insulation. Insulation material shall be styrene-butadiene (SBR) or butyl or chlorosulphonated polyethylene (Nypalon), or equal.

3.2.5 Jacket. Jacket material shall be neoprene or, if the insulation material is chlorosulphonated polyethylene, the jacket shall be of the same material.

3.2.6 Sheath thickness. The average thickness of the cable sheath shall be not less than 90 percent nor more than 110 percent of nominal value, and the thickness at any spot shall be not less than 75 percent of nominal value nor more than an amount greater than nominal which would reduce clearance between cable and floats by more than 50 percent. The diameter of molded insulation over the terminal barrels shall be 2.820 inches plus or minus 0.020 inch for proper fit of insulating sleeves (see 4.6.1).

3.2.7 Jacket tensile strength. The cable jacket shall have a tensile strength of 1800 pounds per square inch (lb/in^2) when tested in accordance with 4.6.2.

3.2.8 Jacket elongation. Elongation of the cable jacket shall be not less than 250 percent when tested in accordance with 4.6.4.

3.2.9 Oxygen and sunlight resistance. The tensile strength and elongation of the cable jacket, when tested in accordance with 4.6.5, shall be not less than 60 percent of the values obtained in 4.6.2 and 4.6.4. Surface checks and cracks shall not be visible to the naked eye when the visual examination of 4.6.5 is performed.

3.2.10 Sheath bond. The cable sheath shall be bonded to the conductor with sufficient strength to prevent sheath slippage when tested in accordance with 4.8.

3.2.11 Dielectric strength. The dielectric strength of the cable shall be sufficient to prevent damage to the cable when tested in accordance with 4.11.

3.2.12 Cable terminals. Each end of a cable shall be terminated (after installation of floats) with a connector similar to part number J263 of Drawing S8101-1566524, except that the thickness of the tongue shall be 0.75 inch. One surface of the tongue shall be on centerline of the barrel. The connector shall have part number J263A. The part number, the legend "use Navy die number 30", and the cable supplier's identification shall be stamped on the part.

3.2.12.1 Pressing die. Cable terminals (and splices (see 4.7)) shall be pressed onto the cable with a pressing die in accordance with Drawing S8101-1566636.

3.2.13 Terminal bolts. One terminal of each cable assembly shall be supplied with two 2-1/4 inch 5/8 NC II-2 brass or nickel-copper alloy bolts with washers and self-locking nuts.

3.2.14 Flotation components. Floats and spacers shall be in accordance with Drawing NBD-162, clamps shall be in accordance with Drawing 3304176, and end clamps shall be in accordance with Drawing 3304180, except that the material for all flotation components shall be Cyclocac, grade H, or equal. Color shall be gray. Plastic parts shall have a smooth finish free from ridges, flash, and excess weld material. Float filler material shall be foamed polystyrene. Floats shall be installed on the cable alternately with spacers. Clamps shall be installed at approximately 20-foot intervals in place of spacers at those points. An end clamp shall be installed at each end, leaving a space of 2 to 3 inches between end clamp and terminal.

3.3 Buoyancy. Specific gravity of the cable shall not exceed 0.92 when tested in accordance with 4.5.

3.4 Float compression strength. Floats shall withstand a radial compression load of 1,000 pounds without fracture or opening of seams when tested in accordance with 4.4.

3.5 Tensile strength. Tensile strength of cable assemblies shall be not less than 15,000 pounds when tested in accordance with 4.7.

3.6 Insulation resistance. Insulation resistance of each cable assembly, corrected to a temperature of 15°C shall be not less than 200 megohms as measured in accordance with 4.12.

3.7 Contact resistance. Contact resistance between cable conductor and connectors shall not exceed 4 microhms when measured in accordance with 4.9.

3.8 Elastomer bond. The bond between insulation and jacket, and between molded insulation and connector fittings shall be such that a force of at least 8 pounds per inch is required for separation when tested in accordance with 4.6.3 and 4.10.

3.9 Splices. Cable assemblies shall not contain splices in the conductor or the sheath.

3.10 Identification.

3.10.1 Cable. The cable type designation (i.e., CL2B), cable serial number, manufacturer's name, and year of manufacture shall be clearly molded into the insulation over the barrels of the terminals at each end. In addition, the cable type and serial number shall be stamped into one side edge of the tongue of the terminal at each end.

3.10.1.1 Serial numbers. Cable serial numbers will be furnished by the Naval Ship Engineering Center (NAVSEC).

3.11 Government furnished equipment. When specified (see 6.1.1), the Government will furnish the reels specified in 5.1.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Inspection system program plan. The supplier shall provide and maintain an inspection system program plan in accordance with the data ordering document included in the contract or order (see 6.1.2).

4.2 Test specimens.

4.2.1 Lot. A lot shall consist of not more than 25 cables.

4.3 Tests. The tests specified in 4.4 through 4.13 shall be conducted.

4.4 Float compression test. Three floats, selected at random from floats to be used on a cable lot, shall be subjected to a radial compressive force of 1,000 pounds applied between two flat steel plates for a period of 1 hour. The test shall be made at a temperature of 27°C ± 6°C. No damage or seam opening or permanent deformation shall result. If

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one or more floats fail the test, 20 floats selected at random from the same lot as the 3 floats shall be similarly tested. If more than one of the 20 floats fail, the lot from which the floats were selected shall be rejected (see 3.4).

4.5 Buoyancy test. A sample of cable of convenient length but not less than 2 feet in length shall be fitted with one float clamp and enough floats and spacers applied alternately to cover the remainder of the length. The floats shall then be removed from the cable and four 1/4-inch holes shall be drilled in a spiral pattern, equally spaced radially and axially, completely through each float, thus providing 16 openings for the entry of water. The drilled floats shall then be submerged in water under a hydrostatic gage pressure of 20 lb/in² for 1 hour, after which they shall be replaced on the cable sample. The sample shall be floated in a tank of fresh water, and lead weights applied along the length of the sample until the whole sample sinks. Specific gravity (see 3.3) shall then be calculated from the following formula:

$$\text{Specific gravity} = \frac{\text{Weight of cable in air}}{(\text{Weight of cable in air}) + (\text{weight of lead in air} \times \frac{10.4}{11.3})}$$

4.6 Sheath test. The pieces of cable sheath removed from cable ends for installation of terminals shall be collected, and five specimens shall be taken at random from the collection for each of the tests specified in 4.6.1 through 4.6.5.

4.6.1 Thickness. At least five separate measurements of sheath thickness shall be made on each of the five specimens. The average of all measurements of a specimen shall be considered the average thickness of the specimen. Thickness shall meet the requirements of 3.2.6.

4.6.2 Tensile strength. The jacket material from five specimens shall be tested for tensile strength in accordance with method 4111 of FED-STD-601. The average tensile strength of the samples shall meet the requirements of 3.2.7.

4.6.3 Ply separation test. On five specimens the bond between successive sheath extrusions or between sheath tapes shall be tested using method 4221 of FED-STD-601 except that the force shall be applied in such a manner as to tend to separate the plies along their mating faces. Bond shall meet the requirements of 3.8.

4.6.4 Elongation. Elongation tests in accordance with method 4121 of FED-STD-601 shall be made on the jacket material from five specimens. The jacket material shall be obtained by slicing it from the specimens. Elongation shall meet the requirements of 3.2.8.

4.6.5 Oxygen and sunlight resistance. Five specimens shall undergo an accelerated aging procedure consisting of the exposures outlined in methods 7111 and 7311 of FED-STD-601. An alternative to test method 7311 for sunlight resistance, a 100 hour exposure in type D test equipment in accordance with ASTM G23 may be used employing a cycle of approximately 1 hour and 40 minutes of arc light exposure followed by approximately 18 minutes of exposure to arc light and water spray. Twenty-four hours after accelerated aging is complete, the specimens shall be examined visually and tested in accordance with 4.6.2 and 4.6.4 (see 3.2.9).

4.7 Cable tensile strength test. A two-foot minimum length of cable, including terminal, shall be cut from each of two completed cable assemblies selected at random from each lot. Removal of the test specimen shall not reduce the length of the cable to less than the tolerance specified in 3.1. The cut ends of the two lengths shall be joined by a repair splice, part J265 in accordance with Drawing S8101-1566635, and a tensile load of 15,000 pounds applied between the two terminals shall be sustained for 1 hour without damage to cable, terminals, or splice (see 3.5). The cable assemblies from which the test lengths were cut shall be fitted with new connectors (see 3.2.12).

4.8 Sheath slippage test. A four-foot length of cable, including terminal, shall be cut from a completed cable assembly selected at random from each lot. Removal of the test specimen shall not reduce the length of the cable to less than the tolerance specified in 3.1. A cable grip of convenient size shall be installed on the cut end of the test specimen and a tensile load of 2000 pounds applied between the cable grip and the cable terminal shall be sustained for 1 hour without slippage of the sheath on the conductor (see 3.2.10).

4.9 Contact resistance test. A direct current (d.c.) contact resistance test shall be made on each pressed connection of each cable, before molding insulation at the terminals, to verify that the requirement of 3.7 has been met.

4.10 Terminal insulation adhesion test. A test specimen shall be prepared from one of the insulated connectors cut from cable assemblies for the tensile test (see 4.7). Adhesion of the insulation to the connector barrel shall be tested by method 8031 of FED-STD-601 to verify that the requirement of 3.8 has been met.

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4.11 Dielectric test. A dielectric test on each cable shall be performed by immersing the cable in water for 4 hours after which time it shall be subjected to a potential of 2500 volts root mean square (rms), 60 hertz (Hz) between conductor and water for 5 consecutive minutes (see 3.2.11). A cable which fails to pass this test may be retested after repair.

4.12 Insulation resistance test. On successful completion of the dielectric test (see 4.11) and while the cable is still immersed, insulation resistance shall be measured using a 500 volt megohmmeter (see 3.6). A cable which fails to pass this test may be retested after repair.

4.13 Hydrostatic test of strand sealant. A specimen of cable not greater than 3 feet in length, taken at the beginning of a production run, shall be subjected to a hydrostatic pressure test for a period of 3 hours. The test shall consist of exposing one end of the specimen to water at a gage pressure of 18 lb/in², while the other end is open to the atmosphere (see 3.2.2).

4.14 Test procedures, test reports, milestone plans, and milestone reports. The supplier shall prepare test procedures, test reports, milestone plans, and milestone reports in accordance with the data ordering documents included in the contract or order (see 6.1.2).

4.15 Examination of the preparation for delivery. An examination shall be made to determine that the packaging, packing, and marking comply with the requirements of section 5 of this specification. The sample unit shall be one shipping reel fully packaged, selected prior to the closing (lagging) operation. Reels fully prepared for delivery shall be examined for closure, strapping, and marking defects.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.2).

5.1 Packaging and packing. Packaging and packing shall be level A as specified herein.

5.1.1 Level A packaging. Each cable shall be wound on a separate shipping reel. Unless otherwise specified, reels shall be made of wood, combination wood and metal, or metal and shall be of the nonreturnable type. The reels shall be of a construction normally used by the manufacturer for nonreturnable applications and suitable for overseas destinations. The reel drum diameter shall be not less than eight times the diameter of the cable. Wood flanges shall be made of two or three plies of lumber assembled at right angles to each other. The arbor hole in wood reels shall be reinforced with a substantial metal bushing or metal plate to prevent excessive wear due to unrolling or handling. Where bolts are used to fasten reel flanges to the drum, after tightening, the bolt ends shall be peened. Nails used in flanges shall be driven from the inside (cable side) of the flange, countersunk a minimum of 1/16 inch and clinched a minimum of 1/8 inch on the outside face of the flange. Flat head screws if used, shall be turned so that their heads do not protrude above the surface of the wood. The cable shall be wound evenly on the reels in accordance with good industry practice to obtain uniformity, compactness, and the nesting of successive turns and layers. Both ends of the cable shall be securely fastened to the reel with synthetic rope. A minimum clearance of one cable diameter shall be provided between the outer layer of the cable and the inner face of the lagging. The cable shall be covered with a full wrap of barrier material conforming to PPP-B-1055 class II-J or L-2 nonbleeding or 0.006-inch thick opaque polyethylene. The wrap shall extend between the flanges with an end overlap to assure complete coverage and shall be secured in a manner to prevent unwrapping during handling, shipment, or storage. Wood lagging shall be used and the board thickness not less than nominal 2-inch lumber and shall be positioned so that all boards touch adjacent boards. The lagging shall extend to within 1/4 inch of the outside edges of the flanges and shall be secured to the wood flanges with cement coated nails. The lagging shall be strapped with two 3/4 inch by 0.023 inch minimum flat or 8 gage minimum round steel strapping. The strapping shall be galvanized or otherwise treated to resist corrosion. All straps shall be stapled at intervals of approximately 15 inches; however, where straps are applied directly over the perimeter of the reel flanges, the strapping may be secured by cement coated nails.

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5.1.2 Level A packing. Cable, packages as specified herein, shall not require over packing. The method of shipment shall be acceptable to the common carrier which will insure safe delivery at destination in a satisfactory condition at the lowest applicable rate and shall comply with Uniform Freight or National Motor Freight Classification Rules or other carrier rules as applicable to the mode of transportation.

5.2 Marking. In addition to any special marking required herein, or in the contract or order, each reel shall be marked in accordance with MIL-STD-129.

5.2.1 Identification plates. Both flanges of each reel shall have securely affixed thereto identification plates made by heat sealing between two approximately 0.020-inch thick, clear vinyl sheets, a paper printed with the following:

- (a) Cable type.
- (b) Cable serial number.
- (c) National stock number.
- (d) Contract number.
- (e) Manufacturer's name.
- (f) Shipping destination.

Identification plates of other types providing equivalent legibility and durability may be used when accepted by NAVSEC.

5.2.2 Precautionary marking. The caption "DO NOT USE FORK LIFT" shall be painted or stenciled conspicuously on both flanges of each reel.

6. NOTES

6.1 Ordering data.

6.1.1 Procurement requirements. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Whether the Government will furnish the reels specified in 5.1.1 (see 3.11).
- (c) Marking requirements, if other than as specified (see 5.2).

6.1.2 Contract data requirements. When this specification is used in a procurement invoking the data requirement clause of the Armed Services Procurement Regulations (ASPR) paragraph 7-104.9 (n) and which incorporates a DD Form 1423 Contract Data Requirements List (CDRL), the data requirements identified below will be developed as specified in the cited Data Item Description (DID) and delivered in accordance with such CDRL. When the ASPR provisions are not invoked, the data specified below shall be delivered in accordance with the contract requirements.

	Specification paragraph	Data requirement	Service	Applicable DID	Options
(a)	4.1.1	Inspection system program plan	SH	DI-R-4803	---
(b)	4.14	Test procedures	SH	UDI-T-23732	---
(c)	4.14	Test/inspection report	SH	UDI-T-23473	---
(d)	4.14	Milestone (type II) report	SH	UDI-A-23018	---
(e)	4.14	Milestone (type II) plan for critical supply contracts	SH	UDI-A-23015	---

(Copies of DID's required by the supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.)

6.2 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

Preparing activity:
Navy - SH
(Project 1075-N036)

APPENDIX

CONDUCTOR STRAND SEALING OF ALUMINUM CONDUCTOR
MAGNETIC MINESWEEPING CABLE OF EXTERNAL FLOAT TYPES

10. SCOPE

10.1 This appendix covers formulation and application of a strand sealing compound for aluminum conductor magnetic minesweeping cable of external float types.

20. APPLICABLE DOCUMENTS

20.1 The following document, of the issue in effect on date of invitation for bids or request for proposal, forms a part of this appendix to the extent specified herein:

SPECIFICATION

FEDERAL

O-T-620 - 1, 1, 1, Trichloroethane, Technical Inhibited (Methyl Chloroform).

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

30. REQUIREMENTS

30.1 Formula shall be as shown in table I. The materials shown in table I, or their equals, shall be used.

Table I - Formula.

Ingredient	Availability	Parts by weight
FB neoprene	Dupont	80
Sundex 790 oil	Sun Oil Co.	100
Abitol	Hercules Powder Co.	50
33 Clay	Prooport Kaolin Co.	40
Indotex CB	S. Richardson Carbon Co.	10
Cab-O-Sil	Godfrey L. Cabot	1
Butyl LM 430	Exxon	30

30.2 Method of compounding ingredients. The liquid ingredients shall be mixed at a temperature of $80^{\circ}\text{C} \pm 3^{\circ}\text{C}$. The FB neoprene shall be added under continuous mixing. The dry ingredients, which are pre-blended, shall then be dispersed until a homogeneous mass is obtained.

30.3 Method of applying compound to conductor. Application of the sealant shall be accomplished by passing conductor strands through a receptacle (pot) filled with compound. Wiping dies attached to the exit side of the pots leave the desired amount of compound on strand surfaces. The compound shall be gravity fed at room temperature. Assembly of a 37 rope, 19 wires per rope conductor, for example, shall use two pots for assembling sub-strands: one for the central wire and one after the 6-wire closing die; and four pots for assembling the rope strand: one for the central rope; and one after each of the 6, 12, and 18 rope closing dies. Pressure sensitive mylar tapes shall be applied, adhesive side up, over the sealed conductor to prevent cure of the sealant from migration of curing agents in the cable sheath.

30.4 Removal of sealant. The strand sealing compound may be removed from the conductor for terminal installation by the following procedure: immerse the conductor to be cleaned in a solution of one part inhibited methyl chloroform in accordance with O-T-620, or ethylene dichloride, and three parts kerosene or diesel fuel agitated with compressed air. Opening the strand slightly is helpful. Following a 5-minute immersion in the air-agitated solution, the strand shall be blown clean with compressed air.

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40. QUALITY ASSURANCE PROVISIONS

40.1 Test. Test of the strand sealing compound and its application shall consist of a hydrostatic test of cable on which the compound is used to verify that the sealant will block passage of any water at a pressure differential of 18 lb/in² applied for a 2 hour period between the two open ends of a cable specimen not greater than 3 feet in length (see applicable cable tests).

50. NOTES

50.1 The strand sealing compound described herein is also identified as Boston Insulated Wire and Cable Company compound number Q-52.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
5. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
6. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
7. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		7b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
8. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	