

PURCHASE DESCRIPTION
ROPE, NYLON, KINETIC ENERGY RECOVERY

1. SCOPE

1.1 Scope. This purchase description covers an eight-strand cross-plaited nylon rope used for the recovery of mired armored vehicles.

1.2 Classification. The rope shall be furnished in a single size as defined by Figure 1.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

RR-C-271

UU-T-81

- Chains and Attachments, Welded and Weldless.
- Tags, Shipping and Stock.

MILITARY

MIL-L-17331

MIL-R-24337

- Lubricating Oil, Steam Turbine and Gear, Moderate Service.
- Rope, Nylon, Eight Strand Plaited.

STANDARDS

FEDERAL

FED-STD-191

- Textile Test Methods.

MILITARY

MIL-STD-105

- Sampling Procedures and Tables for Inspection by Attributes.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

FSC 4020

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DEPARTMENT OF DEFENSE (DoD)

Department of Defense Index of Specifications and Standards (DODISS).

(Copies of the DODISS are available on a yearly subscription basis either from the Government Printing Office for hard copy, or microfiche copies are available from the Director, Navy Publication and Printing Service Office, 700 Robbins Avenue, Philadelphia, PA 19111-5093.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY TESTING AND MATERIALS (ASTM)

- ASTM D1141 - Standard Specification for Substitute Ocean Water. (DoD adopted).
- ASTM D4268 - Standard Methods of Testing Fiber Ropes.

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

* 3.2 Materials. The rope shall be fabricated from bright, virgin continuous filament, heat and light resistant nylon fiber. The nylon shall be a long chain polyamide. Mixtures of nylon fiber types shall not be employed in any one rope.

✓3.3 Construction. The rope shall consist of eight strands arranged in four pairs, with one strand laid adjacent to the second strand in each pair. There shall be two pairs of left or "S" twist strands and two pairs of right or "Z" twist strands. The construction shall result in a rope that is non-rotating and torsionally balanced. The rope shall be fabricated without knots or splices in the single yarns, ply yarns, strands or rope other than the end eyesplices.

3.3.1 Eyesplices. The rope shall have eyesplices at each end meeting the dimensional requirements of 3.4. Failure of the rope in the tests required by 3.11, 3.12, 3.13 and 3.14 shall occur outside the loop formed by the eyesplice. Strand ends beyond the termination of the eyesplice shall not exceed two inches in length and shall be taped.

3.3.2 Sleeve protection. An eyesplice protection sleeve shall be included. The sleeve design shall ensure that failure will not occur within the loop formed by the eyesplice. The sleeve shall be dimensioned such that the eyesplice and sleeve shall meet the dimensional requirements of 3.4.

3.4 Dimensions. The rope shall meet the dimensional constraints and requirements of Figure 1.

3.4.1 Connection diameter. The diameter of the rope connection location shall be such that it can be easily installed within a Government furnished shackle, 1-5/8 inch, RR-C-271, grade B, type IVA, class 1.

3.5 Weight. The weight of the rope shall not exceed 120 pounds when weighed as specified in 4.8.

3.6 Finish. No extraneous material shall be added for the purpose of weighing the rope. The extractable matter of the end item shall not exceed 4.0 percent when tested as specified in 4.6.

3.7 Acidity/alkalinity (pH). The pH value of the rope shall be within the range of 5.0 to 9.0 when tested as specified in 4.9.

3.8 Hardness. The rope shall have a hardness between 20.0 and 50.0 pounds when tested as specified in 4.10.

3.9 Shrinkage. The rope shall show a residual shrinkage between 12.0 and 19.0 percent when tested as specified in 4.11.

3.10 Melting point. The rope shall have a minimum melting point of 410 degrees Fahrenheit (°F) when tested as specified in 4.12.

3.11 Quasi-static requirements.

3.11.1 Quasi-static breaking strength. The rope shall have a minimum breaking strength of 160,000 pounds when tested as specified in 4.6.

3.11.2 Quasi-static elongation. The rope shall have the following elongations when tested as specified in 4.6:

Table I. Quasi-static elongation.

Load (pounds)	Elongation (minimum percent)
40,000	40
80,000	50
160,000	60

3.12 Dynamic requirements.

* 3.12.1 Dynamic breaking strength. The rope shall have a dynamic breaking strength of 100,000 pounds when tested as specified in 4.14.

* 3.12.2 Dynamic elongation. The rope shall have the following elongations when tested as specified in 4.14.

Table II. Dynamic elongation.

Load (pounds)	Elongation (minimum percent)
20,000	10
40,000	20
100,000	30

* 3.13 Fatigue life. The rope shall be capable of surviving a minimum of 100 cycles when tested in the fatigue test as specified in 4.13.

3.14 Operational conditions. The rope shall be able to operate within the temperature extremes of -50°F to +120°F. The rope shall also be capable of operating in a humidity range of 5 to 100 percent, including full immersion.

3.15 Identification marker. The rope manufacturer shall be identified by inserting a kraft paper or water repellent cotton marker within one strand in all ropes. The marker shall be completely enveloped by the cover yarns in the strand in which it is enclosed. Unless otherwise specified, the manufacturer's name, year of manufacture, and type of fiber (nylon) shall be clearly printed on the marker. Italic or script type shall not be used. The printing shall not be affected upon exposure to water or mineral oil.

3.16 Identification ticket. In addition to the requirements specified in 3.15, a ticket (identification tag) shall be attached to each package unit. The ticket shall be in accordance with type B, class 1, size 4 or 5, 15 CSU grade designator as specified in UU-T-81. The ticket shall be legibly printed, stamped, or typed with water insoluble ink. Unless otherwise specified (see 6.2), the ticket shall contain the following information:

- (a) Stock number
- (b) Nomenclature
- (c) Rope type (i.e., nylon)
- (d) Part number
- (e) Diameter
- (f) Length
- (g) Manufacturer's name
- (h) Month and year of manufacture.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Except where specifically noted the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use their 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) First article inspection (see 4.3.)
- (b) Quality conformance inspection (see 4.4.)

4.3 First article inspection. First article inspection shall consist of the examinations and tests specified in 4.5 through 4.15.

* 4.3.1 First article sample. The first article sample shall consist of the length of ropes and number of finished ropes necessary to complete the examinations and tests specified in 4.5 through 4.15.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and the tests specified in 4.5 through 4.12.

4.4.1 Quality conformance sample. Unless otherwise specified, sampling for inspection shall be performed in accordance to MIL-STD-105.

4.5 Material. Material shall be verified through use of Method 1530 of FED-STD-191.

4.6 Construction, finish, quasi-static breaking strength and elongation. These requirements shall be inspected and tested as specified in 4.6.4, 4.6.5 and 4.6.6 of MIL-R-24337.

4.6.1 Eyesplice and sleeve protection. Conformance to the requirement of rope failures occurring outside the loop formed by the eyesplice shall be verified by visual inspection of the failed samples from the tests described in 4.6, 4.13, and 4.14. Compliance to the requirement of the inclusion of eyesplice sleeve protection and the taping of strand ends at the termination of the eyesplice shall be done by visual inspection. Results shall be reported as pass or fail.

4.7 Dimensions. Dimensions shall be verified for compliance through direct measurement and comparison to Figure 1. Compliance to the shackle connection requirement shall be verified by attachment of the rope to the shackle described in 3.3. Results shall be reported as pass or fail.

4.8 Weight. Compliance to the maximum weight requirement shall be verified through direct scale measurement of the finished rope. Results shall be reported as the average of two determinations (to the nearest pound).

4.9 Acidity/alkalinity (pH value). Compliance to the pH value requirement of the rope shall be verified through the use of Method 2811 of FED-STD-191.

4.10 Hardness. Compliance to the hardness requirement shall be verified through the use of the procedure of 4.10.1.

4.10.1 Hardness test procedure. In accordance with Method 1620 of FED-STD-191, the tip of a 14-inch marlinespike shall be started through the center of the rope so that two pairs of strands shall be visible on each side thereof. With the spike inserted, the rope shall be placed in a compression type testing machine in such a manner that the force necessary to push the

spike through the rope will be measured with the rope in a relaxed state without tension and completely free to absorb the force of the penetrating spike. The rate of loading shall be 6 ± 1 inches per minute. Care shall be taken to assure that the spike shall not be inserted less than five feet from an end and no less than four feet from an area which has been subjected to a previous hardness test. The load necessary to force the spike to the 0.5 inch diameter mark shall be measured. The mark shall be considered to be reached when the 0.5 inch diameter mark just disappears behind two pairs of strands. Results shall be reported as the average of three determinations to the nearest pound.

4.11 Shrinkage. The rope material shrinkage shall be determined through use of Method 6010 from FED-STD-191.

4.12 Melting point. The rope material melting point shall be determined by using Method 1534 of FED-STD-191.

* 4.13 Fatigue life. Verification of fatigue life requirements shall be determined by the use of either method 4.13.1 or 4.13.5. Ninety days prior to testing, the contracting officer shall be notified in writing of the test option chosen.

* 4.13.1 Test machine. A full-sized end item shall be conditioned as described in paragraph 7.0 of ASTM D 4268. A test machine shall be used to perform the following tension fatigue test. The holding and pulling ends of this machine shall have pins or posts whose diameters are $1.63 \pm 0.12/-0.0$ inches. The machine shall be equipped with a load, a velocity, and an elongation indicating mechanism (such as a dial or digital readout). The machine shall also be equipped with autographic recorders capable of recording the load versus time, velocity versus time, and the load versus elongation graphs.

* 4.13.2 Test description. The machine shall be capable of performing the following test. The sample shall experience an elongation at 14.67 ± 0.5 feet/second until a load of 1250 ± 125 pounds is attained. At this point the rope shall develop a $45,000 \pm 5,000$ pound tensile load and a velocity of zero feet/second in 1 ± 0.25 second. The load on the rope shall then be reduced to zero pounds in 1 ± 0.25 second. The rope shall then be elongated to a tensile load of $20,000 \pm 2,000$ pounds in 1 ± 0.25 second. The load shall then be reduced to $10,000 \pm 1,000$ pounds in 1 ± 0.25 second. This 10,000 pound tensile load shall be held for 6 ± 0.25 seconds. At this point the load shall be released over a period of 1 ± 0.25 second and shall then be displaced to a condition of a 5 foot pin displacement over 19 ± 0.25 seconds at a velocity not to exceed 4 ± 0.5 feet/second. This constitutes one complete cycle with a 30 second period. At the completion of every 10 cycles the temperature of the rope shall be taken.

* 4.13.3 Test temperature and cycle constraints. Testing shall be delayed if the rope temperature ever exceeds 320°F. Testing shall resume when the rope temperature cools to 212°F. The gage length of the rope shall also be taken every 10 cycles until the percentage change between measurements is less than two percent. After that the gage length shall be taken every 25 cycles. This is accomplished by loading the rope with a 1250 pound tensile load and measuring the length of the rope. If a pause of more than two hours elapses between successive cycles the gage length of the rope shall be taken before beginning the next cycle. The rope shall be cycled until failure or 2000 cycles. The rope shall be considered acceptable if it experiences a minimum of 100 complete cycles without failure.

* 4.13.4 Reporting of results. Results to be reported shall consist of all gage length and temperature measurements taken; the autographically recorded load versus time, velocity versus time and the load versus elongation graphs for every cycle; and reports of any and all failures. Failure reports shall consist of all the above information; the cycle number at which the failure occurred; a minimum of one photo of the failure location; and the cause of the failure.

* 4.13.5 Vehicular test. A minimum of twelve full-sized end items shall be conditioned as described in paragraph 7.0 of ASTM D 4268. Two Bradley fighting vehicles shall be used to perform the Government sponsored tension fatigue test described in 4.13.2 at a location to be determined. The use of this method shall eliminate the requirements of 3.12. Vehicle testing shall not initiate until all other requirements have been met. Testing shall be completed within 120 days after receipt of the test samples. Results shall be reported as the average of three determinations.

* 4.14 Dynamic breaking strength and dynamic elongation. Both dynamic breaking load and dynamic elongation shall be determined by use of ASTM D 4268, with the exceptions that the rate of travel shall be 7.33 ± 0.5 feet/second; the test sample size shall be that of the finished rope; and the elongation measurements shall be taken by whatever means available as long as they meet the requirements of ASTM D 4268 and section 3.12 of this document. Results shall be reported as the average of three determinations to an accuracy of one percent.

4.15 Operational conditions. Verifications shall be performed of the capability of the rope to operate in the required environmental conditions. Tests 4.6, 4.13 and 4.14 shall be repeated on ropes that have been conditioned in each of the following manners:

- (a) The rope shall soak in fresh water for 24 ± 2 hours and shall be tested within two hours. Results shall be reported as the average of three determinations. The water temperature shall be between 59°F and 77°F and shall also be reported.

- (b) The rope shall be heated for $5 + 0.5$ days in a thermostatically controlled heating chamber at $120 + 5^{\circ}\text{F}$. After heating the specimen shall be allowed to reach equilibrium under standard conditions before being tested. Results shall be reported as the average of three determinations.
- (c) The rope shall be cooled for $5 + 0.5$ days in a thermostatically controlled cooling chamber at $-50 + 5^{\circ}\text{F}$. The specimen shall be tested within 1.5 hours of removal from the cooling chamber. Results shall be reported as the average of three determinations.

4.16 Identification marker. Three lengths of the identification marker shall be used to determine the fastness of the printed matter of the identification marker to saltwater and mineral oil. Each marker length shall be approximately 1.5 feet. One length shall be retained as a control; one length shall be immersed for two hours in synthetic seawater conforming to ASTM D 1141 stock solution number 1, 2, or 3; and one length shall be soaked for two hours in mineral oil conforming to symbol 2190-TEP as specified in MIL-L-17331. Following removal from the respective environments, the two exposed specimens shall be visually compared with the control specimen. The fastness of the printed matter shall be considered satisfactory when no perceptible change in color or legibility is observed. Results shall be reported as pass or fail.

5. PACKAGING

5.1 Preservation, packaging, packing and marking. Preservation, packing, packaging and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The rope covered by this specification is intended for use in the recovery of mired armored vehicles by converting stored potential energy to kinetic energy.

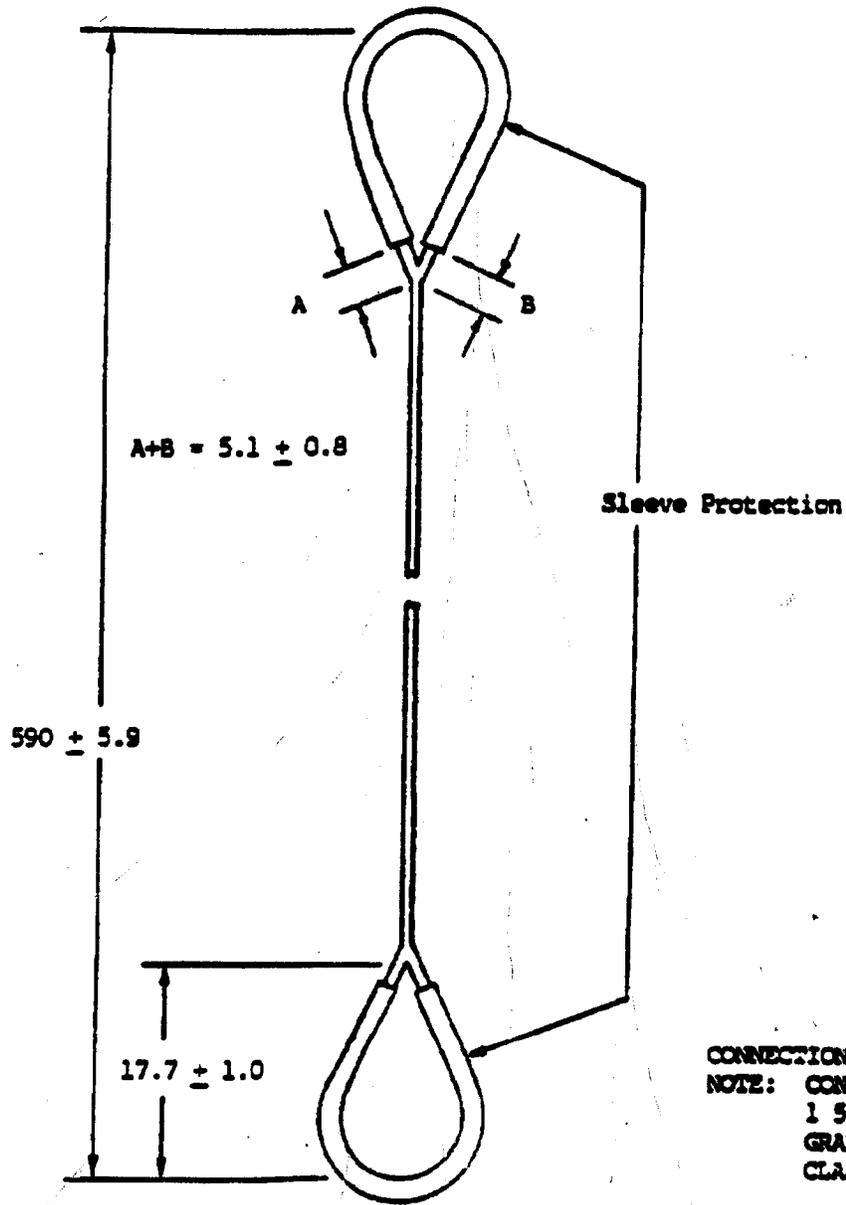
6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification (see 2.1.1).
- (b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.1.2).
- (c) When first article inspection is required (see 3.1).
- (d) When information on identification marker is other than specified (see 3.16).
- (e) Selection of applicable level and packaging requirements (see 5.1).

✓ 6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample; a first article sample; a first production item; a sample selected from the first production items; a standard production item from the contractor's current inventory; and also the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Changes from previous issue. Asterisks are used in this revision to identify changes with respect to the previous issue.

ALL DIMENSIONS ARE IN INCHES



CONNECTION DIAMETER LOCATION
NOTE: CONNECTION TO FIT
1 5/8" RR-C-271
GRADE B, TYPE IVA
CLASS 1 SHACKLE.

FIGURE 1. ALLIED KINETIC ENERGY RECOVERY ROPE