

MIL-R-24536(SH)  
18 April 1978

### MILITARY SPECIFICATION

#### ROPE, FIBROUS, DOUBLE-BRAIDED, CONTINUOUS POLYESTER FILAMENT WITH A STAPLE WRAP

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 Scope. This specification covers fibrous double-braided polyester rope, continuous polyester filament, with a staple wrap cover and filament polyester core.

1.2 Classification. The rope shall be furnished in one type and in the circumference specified (see 6.2.1).

#### 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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

UU-T-81 - Tags, Shipping and Stock.

###### MILITARY

MIL-C-3131 - Cordage: Preparation for Delivery of.

MIL-L-17672 - Lubricating Oil, Hydraulic and Light Turbine, Noncorrosive.

##### STANDARDS

###### FEDERAL

FED-STD-191 - Textile Test Methods.

###### MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

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

#### 3. REQUIREMENTS

3.1 Sample for first article inspection. When specified (see 6.2.1), prior to beginning production, a finished sample shall be submitted to the contracting officer or his designated representative in accordance with the following requirements for inspection as specified in 4.1.1. A continuous length of 50 feet shall be submitted.

3.2 Materials. The inner braid shall be fabricated from bright white virgin, continuous filament, heat and light resistant polyester fiber of at least 7.0 grams (g) per denier strength. Material requirements shall be determined in accordance with 4.2.1. The outer braid shall be fabricated from white 100 percent polyester yarn HD bright type 77 or equal, of at least 7.0 g per denier strength.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Ship Engineering Center, SEC 6124, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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3.3 Construction. The rope shall conform to the requirements specified herein. It shall be of double braided construction, wherein a braid of hollow structure manufactured in a separate operation shall serve as the core, while a cover is braided over it in a second operation. In the manufacture of each braid, one-half of the yarns shall have an "S" twist, while "Z" twist shall be employed in the remaining yarns. The texture of the ultimate rope shall be firm and shall exhibit no undue sleaziness.

3.3.1 All core yarns shall be one size and all cover yarns shall be one size. The number of carriers and the ends per carrier for the respective inner braid and the outer braid shall be in accordance with tables I and II. The weight of either constituent (the core or the outer braid) shall not exceed 55 percent of the total weight of the rope for any designated size.

TABLE I. Structural requirements for inner braid (core).

Cores for use in ropes of indicated circumference sizes <sup>1/</sup> (inches)	Type of braid	Number of carriers	Ends per carrier		Multiplier for use in determination of picks per inch <sup>2/</sup>	
			min	max		
3/4 to 2-1/4 incl or 3/4 to 2-1/4 incl	Plain	8	2	6	1.5	2.0
	Twill	12	1	4	2.5	3.3
2-1/2 to 5 incl or 2-1/2 to 5 incl	Plain	8	3	6	1.5	2.0
	Twill	12	2	4	2.5	3.3

<sup>1/</sup> These measurements shall be taken at the appropriate load "P" for the desired ultimate rope size.

<sup>2/</sup> Use of the system of multipliers shown in columns 6 and 7 overcomes the difficulty encountered during the determination of picks per inch especially in those cases where less than a full pick or picks may be obtained. The calculation is as follows:

$$\text{Picks per inch} = \frac{\text{Multiplier}}{\text{Circ.} \times \text{LP}}$$

TABLE II. Structural requirements for outer braid (cover).

Rope size circumference <sup>1/</sup> (inches)	Type of braid	Number of carriers	Ends per carrier		Multiplier for use in determination of picks per inch <sup>2/</sup>	
			min	max		
3/4 to 1-1/2 incl	Twill	12	2	3	5.9	7.0
1-3/4 to 2-1/2 incl	Twill	20	2	2	6.8	8.0
2-3/4 to 5 incl	Twill	24	1	2	7.6	9.0

<sup>1/</sup> These measurements shall be taken at the appropriate load "P" for the desired ultimate rope size.

<sup>2/</sup> Use of the system of multipliers shown in columns 6 and 7 overcomes the difficulty encountered during the determination of picks per inch especially in those cases where less than a full pick or picks may be obtained. The calculation is as follows:

$$\text{Picks per inch} = \frac{\text{Multiplier}}{\text{Circ.} \times \text{LP}}$$

3.3.2 During the enveloping of the core, the cover yarns shall be ultimately interlaced in such a way that the position of the basic filaments shall be substantially parallel to the axis of the rope. Heat setting of the rope or any of its components shall not be permitted.

3.4 Physical requirements. The finished rope shall conform to the physical properties specified in table III, when tested as specified in 4.2.5.

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TABLE III. Physical properties.

Circumference at load "P" nominal	Diameter nominal	Load "P"	Feet per pound at load "P"	Minimum breaking strength
3/4	1/4	12	60	1,700
1	5/16	20	38	2,600
1-1/8	3/8	30	26	3,600
1-1/4	7/16	40	19.0	4,700
1-1/2	1/2	50	15	6,000
1-3/4	9/16	70	11	7,900
2	5/8	90	8.5	10,000
2-1/4	3/4	110	6.7	12,200
2-1/2	13/16	140	5.4	14,700
2-3/4	7/8	170	4.5	17,400
3	1	200	3.75	20,000
3-1/4	1-1/16	240	3.2	23,400
3-1/2	1-1/8	270	2.75	26,700
3-3/4	1-1/4	310	2.4	30,000
4	1-5/16	350	2.1	33,700
4-1/2	1-1/2	450	1.67	45,000
5	1-5/8	550	1.35	50,000

3.4.1 Elongation. The elongation of the ropes shall not exceed 25 percent at the breaking point, when determined as specified in 4.2.5. The load elongation curve, drawn autographically, shall not exhibit evidence of changes in load applications greater than 5 percent of the load weighed at the instant of change. Changes due to splice slippage shall not be considered in this determination.

3.5 Finish. No extraneous material shall be added for the purpose of weighting the rope. The extractable matter of the finished rope shall not exceed 4.0 percent when tested as specified in 4.2.5.

3.6 Moisture content. The moisture content of the rope "as received" shall not exceed 5.0 percent when tested as specified in 4.2.5.

3.7 Identification marker. The manufacturer shall identify his product by inserting a kraft paper or water-repellent cotton marker between the braids in all ropes larger than 1-1/8 inches circumference. Unless otherwise specified in the contract (see 6.2.1), the manufacturer's name, the year of manufacture, and type of fibre (filament polyester with staple wrap) shall be clearly printed on the marker in bold, easily-read type. Italic or script type shall not be used. The printing shall not be affected by exposure to salt water or mineral oil, when tested as specified in 4.2.5. This marker shall extend the entire length of the rope.

3.8 Identification ticket. In addition to marker requirements specified (see 3.7), each package unit shall have a ticket (identification tag) attached to it for identification purposes. The ticket shall conform to the requirements for type B, class 1, size 4 or 5 of UU-T-81. The ticket shall be made of not less than 15 points paper stock and shall have a minimum tearing resistance of both directions (total) of 850 g. The ticket shall be legibly printed, stamped or typed with water insoluble ink. The ticket shall contain the following information:

- (a) Stock number.
- (b) Nomenclature.
- (c) Specification number.
- (d) Length.
- (e) Contract number and date.
- (f) Date of manufacture (month and year).
- (g) Contractor's name.

3.9 Put-up. The standard put-up shall be 600 foot lengths. Unless otherwise specified (see 6.2.1), the rope shall be furnished without knots or splices on non-returnable reels not larger than 6 feet in diameter.

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3.9.1 Braider splices. Although it is desirable that no braider splices be present in the core or the cover of any size and length of rope, some methods of manufacture impose limitations. To compensate for these limitations, the following shall be considered acceptable:

3.9.1.1 For rope sizes up to and including 2-1/4 inches in circumference, no braider splices shall be permitted in either the core or cover when supplied in standard put-ups (600 feet).

3.9.1.2 One braider splice shall be permitted in the core and the cover for ropes whose sizes range from 2-1/2 inches through 5 inches in circumference when supplied in standard put-ups (600 feet). In producing the splices, the distance of the overlapping shall be equivalent to eight times the circumference in inches but not less than 24 inches for ropes whose sizes are 3 inches in circumference and less.

3.9.1.3 Because splices within the core are difficult to detect subsequent to overapplication of the cover, a manufacturer's certificate attesting to the number of such splices shall be considered acceptable for this situation (see 6.2.2). However, a record of verifiable information shall be available to the inspector.

3.9.1.4 For any rope furnished with a braider splice, one break test in accordance with 4.2.5.4.1 shall be conducted with a complete braider splice in the undisturbed section of the sample.

3.9.2 The ends of all rope shall be cut off squarely and securely whipped, taped, or heat sealed. The reels shall be wound so that each turn and layer is free from entanglement. A plus 10 percent tolerance in length will be permitted.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor 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 First article inspection. When specified (see 6.2.1), the first article sample submitted in accordance with 3.1 shall be visually inspected in accordance with table IV. The sample shall then be tested for physical and chemical requirements in accordance with 4.2.5.

4.1.1.1 First article inspection report. The contractor shall prepare a first article inspection report in accordance with the data ordering document included in the contract (see 6.2.2).

TABLE IV. Visual examination of defects.

Examine	Defect	Classification	
		Major	Minor
Appearance and workmanship	Undue sleaziness in rope texture.	X	
	Cut, any.	X	
	Chafed or damaged.	X	
	Kinks, or unevenly braided, resulting in open places, breaks in continuity of braid or soft spots.	X	
	Broken, loose, or projecting ends in the core or cover.	X	
	Excessive loose fibre ends on surface.		X
	Ends not cut off squarely.		X
	Ends not securely whipped, taped or heat sealed.		X

See footnote at end of table.

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TABLE IV. Visual examination of defects. - (Continued)

Examine	Defect	Classification	
		Major	Minor
Identification marker (Ropes 1-1/8 circum- ference or larger)	Omitted, incorrect, illegible.	X	
	Italic or script type used.	X	
	Not completely covered by cover yarns.	X	
	Not as specified.	X	
Identification ticket	Omitted, incorrect, illegible, insecurely attached. Handwritten entries.	X	X
Cleanliness	Spot, or stain, clearly visible. <sup>1/</sup>		X

<sup>1/</sup>At normal inspection distance (approximately 3 feet).

4.2 Inspection. Sampling and inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated.

4.2.1 Material and component inspection. Determination shall be made for conformance with all characteristics of table V, except material.

4.2.1.1 Certificate of compliance. The contractor shall prepare a certificate of compliance in accordance with the data ordering document included in the contract (see 6.2.2).

TABLE V. Component test.

Characteristic	Requirement	Test method
Material		
(a) Acceptable type.	3.2	<sup>1/</sup>
(b) Acceptable denier size.	3.2	<u>I</u> / <sup>1/</sup>
Tenacity (g per denier)	3.2	4100 (FED-STD-191)
Yarn sizes		
(a) Single size for core.	3.3.1	<sup>1/</sup> /Visual
(b) Single size for cover.		
Braider splices in core	3.9.1	<sup>1/</sup> /Visual
Picks per inch x circ. for inner braid	table I	<sup>1/</sup> /Visual
Number of carriers - inner braid	table I	<sup>1/</sup> /Visual
Number of ends/carrier - inner braid		
Number of ends/carrier - outer braid	table II	<sup>1/</sup> /Visual
Number of carriers - outer braid		

<sup>1/</sup>See 4.2.1.1.

4.2.2 Examination of the end item for visual defects. The defects listed in table IV shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition, in which case only the more serious defect shall be counted. The unit of product for this examination shall be one reel. Ten percent of the gross length contained on each sample unit, but not less than 100 feet, shall be subjected to the visual examination. The lot size for this examination shall be the quantity of rope procured in units of reels each. The acceptable quality level (AQL) shall be 1.5 major defects and 4.0 total defects (major and minor combined) per 100 units. The inspection level shall be level I per MIL-STD-105.

4.2.3 Examination for length and winding. The sample unit for this examination shall be one reel. The inspection level shall be level S-3 and the AQL shall be 4.0 percent

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defective. For lots consisting of 500 or fewer units, the sample size shall be 10 and the acceptable number, one. The lot size shall be the number of units in the inspected lot. Defects shall be as listed in 4.2.3.1 and 4.2.3.2.

4.2.3.1 Defects with regard to length shall be considered to exist if any of the following are determined during inspection:

- (a) Length of unit less than or more than length specified (including permitted tolerances).
- (b) Length of unit less than marked on ticket.
- (c) Reels not in continuous length.

4.2.3.2 Defects with regard to winding shall be considered to exist if the following are determined during inspection:

- (a) Improperly or not firmly wound resulting in slippage during unwinding or otherwise affecting free unhampered unwinding of rope.
- (b) Knot, splice, or otherwise joining of ends to make a continuous length.

4.2.4 Examination of preparation for delivery requirements. An examination shall be made to determine that packaging, packing, and marking requirements of section 5 of this specification are complied with. The examination shall be in accordance with MIL-C-3131, except that the inspection level shall be S-2 and the AQL shall be 2.5 defects per 100 units.

4.2.5 Test methods. The methods of testing shall be as specified in FED-STD-191, wherever applicable, and as listed in table VI. The physical and chemical values required in section 3 apply to the average of the determinations made on a sample unit for test purposes as specified in the applicable test methods. Sample size, acceptance and rejection numbers shall be in accordance with table VII. The sample unit for test purposes shall be 50 feet for ropes in the 3/4-inch to 5-inch circumference range.

TABLE VI. Test methods.<sup>1/</sup>

Characteristic	Requirement	Test method	No. of deter. per indiv. sample unit	Results reported as:
No. of carriers (cover and core)	Tables I and II	Visual	1	Pass or fail
No. of ends per carrier: (cover and core)	Tables I and II	Visual	1	Pass or fail
Picks per inch x circ. (cover and core)	Tables I and II	4.2.5.2	3	2/
Circumference	3.4	4.2.5.2	3	Avg. of 3 deter. to nearest 1/16 inch
Length per pound	3.4	4.2.5.3	3	3/
Breaking strength	3.4	4.2.5.4	2	Avg. of 2 deter. to nearest 100 lbs.
Elongation	3.4.1	4.2.5.5	2	Avg. of 2 deter. to 0.1 percent
Extractable matter	3.5	2611 (FED-STD-191)	1	Avg. of 2 deter. to nearest 0.1 percent

See footnotes at end of table.

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TABLE VI. Test methods.<sup>1/</sup> - (Continued)

Characteristic	Requirement	Test method	No. of deter. per indiv. sample unit	Results reported as:
Moisture content	3.6	2600 (FED-STD-191)	1	Avg. of 2 deter. to nearest 0.1 percent
Identification marker	3.7	4.2.5.8	1	Pass or fail
Ratio cover to core	3.3.2	4.2.5.7	2	Avg. of 2 determinations
Identification ticket	3.8	5671 (FED-STD-191)	1	Pass or fail

<sup>1/</sup> Tests to determine compliance with specification requirements, including quantity of delivery, may be made under prevailing atmospheric conditions, except in settlement of dispute, in which case the tests shall be made upon material which has reached equilibrium under standard conditions described in FED-STD-191.

<sup>2/</sup> Average of three determinations reported to the nearest 0.1 pick for ropes 2 inches in circumference or less and 0.01 pick for ropes 2-1/4 inches in circumference and larger.

<sup>3/</sup> Results reported to the nearest 0.1 foot for ropes 1-3/4 inches in circumference or less, to the nearest 0.01 foot for ropes from 2 through 5 inches in circumference.

TABLE VII. Sampling for tests.

Number of reels in lot	Number of samples	Acceptance number for each test characteristic	Rejection number for each test characteristic
1 to 2	1	0	1
3 to 15	2	0	1
16 to 40	3	0	1
41 to 110	5	0	1
111 to 300	7	0	1
301 to 500	10	0	1
501 and over	15	1	2

4.2.5.1 Specimen preparation. The designated length and number of test specimens shall be removed from selected test reels.

4.2.5.1.1 The lengths shall be measured to the nearest 1/4 inch and weighed to within plus or minus 0.5 percent of the total weight. These data will be recorded for use in the length per pound determination.

4.2.5.1.2 The specimens shall then be prepared with buried eye splices in accordance with method 6015 of FED-STD-191. The inside length of each eye shall not be less than 12 inches.

4.2.5.2 Determination of circumference and picks per inch.

4.2.5.2.1 The circumference measurement shall be made in accordance with method 6003 of FED-STD-191 except that it shall be read while the breaking strength specimen is under load "P" as specified in table III.

4.2.5.2.2 Ten complete picks shall be counted and marked off while under this load and subsequent to the circumference measurement. The distance between the marks shall be measured to the nearest 1/16 inch. This procedure shall be repeated, at least three times in different positions not less than 1 foot of rope apart. The value of column 5 of table II shall be calculated for the respective sizes by dividing 10 by the observed dimension and multiplying the result by the circumference.

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4.2.5.3 Determination of length per pound. This determination, classed as nondestructive when compared with method 6004, is conducted simultaneously with the breaking strength determination. The feet per pound shall be calculated using the following equation:

$$\text{Feet per pound} = \frac{L \times (1 - \frac{e}{100})}{W}$$

Where: L = length of specimen as measured in 4.2.5.1.1 (feet).  
 W = weight of specimen as weighed in 4.2.5.1.1 (pounds).  
 e = percent of elongation at load "P" (see table III, determined as specified in 4.2.5.5).

4.2.5.4 Determination of breaking strength.

4.2.5.4.1 Breaking strength determinations shall be conducted in accordance with method 6015 of FED-STD-191, except as modified in 4.2.5.1.2.

4.2.5.4.2 If any rope is furnished with a braider splice, one break test shall be conducted with a complete braider splice in the undisturbed section of the same. This sample must meet the minimum breaking strength of table III; if not, it is cause for rejection of the lot.

4.2.5.4.3 Any braider splice appearing too unsightly in the opinion of the Government representative may be removed from the rope and tested in accordance with 4.2.5.4.2.

4.2.5.5 Determination of elongation. A 20-inch gage, minimum, shall be marked off on each tensile specimen in the spliced, relaxed condition. The specimen shall be tensioned to load "P" specified in table III. The elongation under this tension shall be measured for each breaking strength specimen, averaged to the nearest 0.1 percent and recorded as value "e" for use in determining the length per pound (see 4.2.5.3). The elongation at the breaking point shall be determined and calculated to percent, as specified in method 6015 of FED-STD-191 with the gage length obtained under the tension of load "P".

4.2.5.5.1 The autographic recording obtained for each specimen while conducting the breaking strength test may be employed as an alternate method in determining the breaking elongation when industrial safety regulations will not permit use of the method described above.

4.2.5.6 Extractable matter. An extraction procedure, employing the Soxhlet apparatus, with chloroform or other suitable solvent shall be used in this determination. The procedure outlined in method 2611 of FED-STD-191 shall be followed.

4.2.5.7 Determination of cover to core ratio. A 2-foot specimen shall be cut off, after which the cover shall be separated from the core. The cover and core shall be weighed separately and the percentage of each by weight shall be determined for compliance with the requirements of 3.3.2.

4.2.5.8 Determination of fastness of printed matter of the identification marker to salt water and mineral oil. Three lengths of the marker approximately 1-1/2 feet each, one of which will be retained as a control, will be employed in this determination. Immerse one length for two hours in synthetic sea water composed of 3.0 percent sodium chloride and 0.5 percent anhydrous magnesium chloride. Soak the remaining length for 2 hours in mineral oil conforming to Military Symbol 2075-FH of MIL-L-17672. The fastness of the printed matter shall be considered satisfactory when no perceptible change in color or in legibility is noted during a visual comparison of the exposed specimens with the control specimen following removal from the respective environments.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements.)

5.1 Packaging, packing and marking. Rope in the quantity and on reels as specified (see 3.9) shall be packaged level A or C, packed level A, B or C as specified (see 6.2.1) and marked in accordance with MIL-C-3131.

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## 6. NOTES

6.1 Intended use. The rope covered by this specification is intended for use in high line personnel transfer and other applications that require maximum gripping surface and minimum elongation, while maintaining maximum breaking strength.

6.2 Ordering data.6.2.1 Procurement requirements. Procurement documents should specify:

- (a) Title, number, and date of this specification.
- (b) Circumference (size) required (see 1.2 and table III).
- (c) When first article sample is required (see 3.1 and 4.1.1).
- (d) When information on identification marker is other than specified (see 3.8).
- (e) Put-up and length when other than specified (see 3.9).
- (f) Selection of applicable levels of packaging and packing (see 5.1).
- (g) That purchaser will accept at original weight, any unit which has been shortened or cut for test specimens, if in complete compliance with this specification.
- (h) That this rope will be purchased on a price-per-pound basis (net weight).

6.2.2 Data requirements. When this specification is used in a procurement which invokes the provision of the "Requirements for Data" of the Armed Services Procurement Regulations (ASPR), the data identified below, which are required to be developed by the contractor, as specified on an approved Data Item Description (DD Form 1664), and which are required to be delivered to the Government, should be selected and specified on the approved Contract Data Requirement List (DD Form 1423) and incorporated in the contract. When the provisions of the "Requirements for Data" of the ASPR are not invoked in a procurement, the data required to be developed by the contractor and required to be delivered to the Government should be selected from the list below and specified in the contract.

<u>Paragraph</u>	<u>Data requirements</u>	<u>Applicable DID</u>	<u>Option</u>
4.1.1.1	First article inspection report	UDI-T-23450	
4.2.1.1	Certificate of compliance	DI-E-2121	

(Copies of data item descriptions required by the contractors 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.)

6.2.2.1 The data requirements of 6.2.2 and any task in section 3, 4, or 5 of the specification required to be performed to meet a data requirement may be waived by the procuring/purchasing activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item procured to this specification. This does not apply to specific data which may be required for each procurement regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 Adjustment for high moisture content. Material furnished containing an excess of moisture will be accepted by an adjustment in weight to the 5 percent moisture basis.

6.4 First article inspection.

6.4.1 Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection as to those bidders offering a product which has been previously procured 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 procurement.

Preparing activity:  
Navy - SH  
(Project 4020-N011)

2011-11-11

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