

INCH-POUND

MIL-G-82775(OS)
29 December 1989
SUPERSEDING
WS 21906A
9 December 1986
(See 6.5)

MILITARY SPECIFICATION

GRAPHITE CLOTH PHENOLIC COMPONENTS, MOLDED AND CURED IN-PROCESS REQUIREMENTS FOR

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

1. SCOPE

1.1 Scope. This specification covers the in-process requirements for two components; one type of retention ring, and one type of approach insert referred to herein as the components (see 6.1). The in-process requirements herein cover the components' characteristics which must be verified prior to assembly and fabrication of the end product.

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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station, Standardization Branch (3730), Indian Head, MD 20640-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1340

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-G-82775(OS)

SPECIFICATIONS

FEDERAL

TT-I-735 Isopropyl Alcohol

MILITARY

**MIL-D-3464 Desiccants, Activated, Bagged, Packaging
Use and Static Dehumidification**

STANDARDS

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: Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094).

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.

NAVAL SEA SYSTEMS COMMAND (CAGE Code 10001)

**WR-43 Preparation of Quality Assurance Provisions
(Including Classification of Characteristics)**

(Copies of WR-43 are available from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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 FOR TESTING AND MATERIALS (ASTM)

ASTM D 740 Methyl Ethyl Ketone (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

MIL-G-82775(OS)

UNITED STATES PHARMACOPEIAL CONVENTION, INC.

The United States Pharmacopeia Absorbent Gauze

(Application for copies should be addressed to the Mack Publishing Company, Easton, PA 18042.)

(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 In-process. The components shall conform to the requirements specified herein.

3.2 Surface condition. The surface condition of the components shall not exceed the permissible condition extent specified in table I.

TABLE I. Surface limits.

Condition <u>1/</u>	Permissible condition extent
1. Blemishes (see 6.3.1)	Any blemish less than 1/2 square inch in area, 1 inch in length, or 0.030 inch deep. None closer together than 1 inch. No more than one per surface.
2. Delaminations (see 6.3.2)	None allowed.
3. Cracks (see 6.3.3)	None allowed.
4. Wrinkled area (see 6.3.4)	None allowed.

1/ Any defects in overstock area (see 6.3.5) are acceptable (see figure 1).

MIL-G-82775(OS)

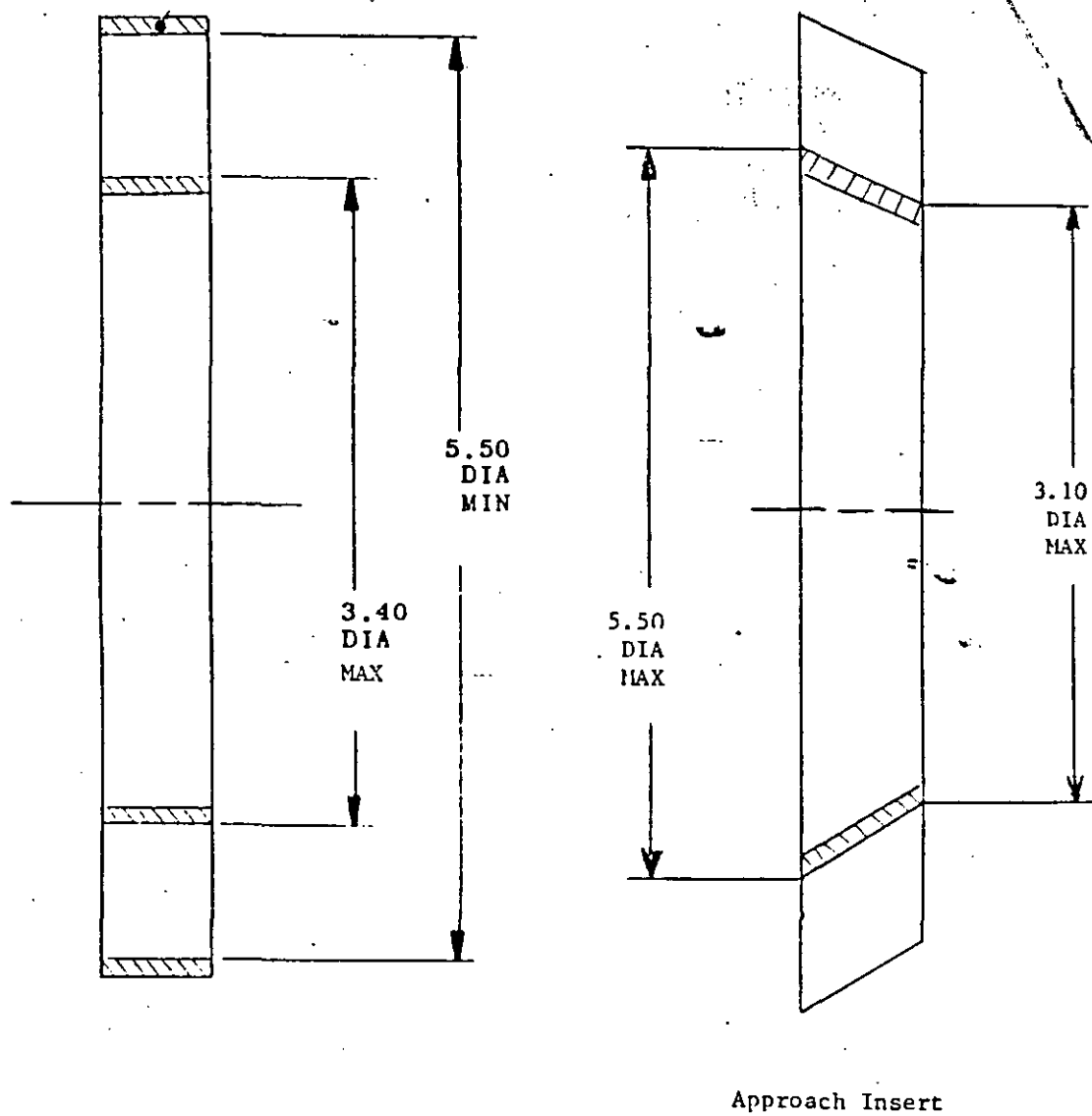


FIGURE 1. Overstock areas.

MIL-G-82775(OS)

3.3 Physical properties. Physical properties of the components shall be in accordance with table II.

TABLE II. Physical properties.

Property	Limits	
	Minimum	Maximum
Specific gravity 23/23 degrees Celsius (°C)	1.39	1.45
Residual volatiles, percent (%)	0.00	3.00
Resin content, %	28.00	37.00
Compressive strength, pounds per square inch (psi), with ply	11,000	25,000

3.4 Billet size. Retention ring and approach insert billets shall be no longer than 9 inches.

3.5 Workmanship. The components shall be free from surface contaminants, grease, oil, foreign material, and other defects which could render the components unsuitable for the intended purpose.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) specified herein. Except as otherwise specified in the contract or purchase order, 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3. The inspection 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 manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does

MIL-G-82775(OS)

not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 **Quality conformance inspection.** Quality conformance inspection shall consist of the examination and tests specified in table III.

TABLE III. Quality conformance inspection.

Inspections	Requirement	Inspection method
Visual examination	3.2, 3.4, & 3.5	4.3.1
Specific gravity test	3.3	4.3.2
Residual volatiles test	3.3	4.3.3
Resin content test	3.3	4.3.4
Compressive strength test	3.3	4.3.5

4.2.1 **Sampling for tests.**

4.2.1.1 **Lot.** A lot shall consist of components fabricated with the same lot of material, cured with the same parameters, and offered for acceptance at one time.

4.2.1.2 **Physical properties.** Billets shall be sampled in accordance with MIL-STD-105, Inspection Level II. Test rings shall be machined from the billets to be sampled. Each test ring shall be of sufficient size to obtain all required test specimens. Each test ring shall be identified with billet and lot number and stored in a sealed plastic bag.

4.2.1.3 **Acceptance criteria.** Each component shall be acceptable if it meets the requirements of 3.2 and 3.5, and if the average results of three test specimens taken from the lot sample billet meet the requirements of table II.

4.2.2 **Classification of characteristics.** The characteristics verified by the tests and examination herein are classified as Major or Minor in accordance with WR-43. Tests that verify Major characteristics are identified by the symbol (M). The number following the classification symbol indicates the serial number of the test. The visual examination herein is not annotated with a classification code or serial number and is classified Minor.

4.3 **Methods of inspection.** The following inspection methods shall be used. Unless otherwise specified in the method, all weights, volumes, temperatures, and times shall be measured to the nearest specified unit or decimal.

MIL-G-82775(OS)

NOTE: Reagent grade chemicals shall be used for chemical reactions in the conduct of all inspections defined herein. Solvents and indicators may be commercial nonreagent grade materials.

4.3.1 Visual examination. Each component shall be visually examined to determine conformance to 3.2, 3.4 and 3.5. Noncompliance with any specified requirements shall be cause for rejection of the component. The following solvent wipe method shall be used as an examination aid in determining conformance to 3.2.

- a. Wet surface with methyl ethyl ketone (MEK) conforming to ASTM D 740 or isopropyl alcohol conforming to TT-I-735.
- b. Wipe off excess solvent with Type VIII absorbent gauze conforming to The United States Pharmacopeia.
- c. Allow the part to dry in air. Defects will appear as well-defined wetted lines.

4.3.2 Specific gravity. Specific gravity shall be determined in accordance with the following:

- a. Remove three test specimens (0.30 ± 0.06 inch by 0.30 ± 0.06 inch by 0.60 ± 0.06 inch) 120 ± 24 degrees apart, from the test ring.
- b. Clean each specimen using a clean cloth or a laboratory towel moistened with MEK or isopropyl alcohol and allow the specimen to dry in air for a minimum of 20 minutes (see 4.3.1a).
- c. Weigh each specimen in air, and record the weight to nearest 0.1 milligram (mg).
- d. Weigh each specimen in kerosene, and record the weight to nearest 0.1 mg.
- e. Calculate the specific gravity of each specimen as follows:

$$\text{Specific gravity at } 23/23^{\circ}\text{C} = \frac{A \times C}{A - B}$$

Where: A = weight of specimen in air, g

B = weight of specimen in kerosene, g

C = specific gravity of kerosene at 23/23°C.

- f. Record specific gravity of each specimen to the nearest 0.01 unit.
- g. Calculate the average specific gravity of the three specimens to the nearest 0.01 unit. Noncompliance of the average reading with

MIL-G-82775(OS)

the specific gravity requirement specified in 3.3 shall be cause for rejection of each component in the lot (see 4.2.1).

4.3.3 Residual volatiles. Residual volatiles shall be determined in accordance with the following:

- a. Remove three test specimens (0.30 ± 0.06 inch by 0.30 ± 0.06 inch by 0.60 ± 0.06 inch) 120 ± 24 degrees apart, from the test ring.
- b. Clean each specimen using a clean cloth or a laboratory towel moistened with MEK or isopropyl alcohol, and allow the specimen to dry in air for a minimum of 20 minutes (see 4.3.1a).
- c. Pre-dry the specimens for minimum of 18 hours in desiccant conforming to MIL-D-3464.
- d. Weigh each test specimen (to the nearest 0.001 gram (g)) in a tared crucible which has been previously heated at 325 ± 10 degrees Fahrenheit ($^{\circ}\text{F}$) for a minimum of 1 hour and cooled to room temperature in desiccator.
- e. Place each crucible and specimen into an air circulating oven which has been preheated to, and maintained, at $325 \pm 10^{\circ}\text{F}$.
- f. Heat crucibles and specimens in oven for 4 to 4.5 hours.
- g. Remove the crucibles and specimens from the oven, and cool in desiccator to room temperature.
- h. Weigh the crucible and contents (to nearest 0.001 g). Retain samples for determination of resin content (see 4.3.4).
- i. Calculate residual volatiles of each specimen as follows:

$$\text{Percent residual volatiles} = \frac{(A - B)}{A} (100)$$

A

Where: A = sample weight before heating, g

B = sample weight after heating, g
- j. Record average of three determinations to nearest 0.01 percent. Noncompliance of the average determination with the residual volatiles requirement specified in 3.3 shall be cause for rejection of each component in the lot (see 4.2.1).

4.3.4 Resin content. (-M104) Resin content shall be determined in accordance with the following:

- a. Obtain three test specimens from residual volatiles test (see 4.3.3).

MIL-G-82775(OS)

- b. Record the specimen weight to nearest 0.001 g.
- c. Place the test specimen in Vycor tube and tightly attach the tube to test apparatus (see figure 2).
- d. Start the vacuum pump, and evacuate the system. Check for air leaks by clamping off the hose to the vacuum pump and noting manometer. The leak rate must be less than 5 millimeters (0.2 in) Hg per minute. Recheck the joints until this level is achieved.
- e. With the vacuum on and the pressure stabilized, place a Fisher burner under the specimen. Adjust the flame area to completely cover sample.

NOTE: A tube furnace maintained at $1500 \pm 25^{\circ}\text{F}$ may be used in place of the Fisher burner.

- f. Continue pyrolysis until manometer or gauge reading is the same reading as before pyrolysis.
- g. Turn off the burners, and cool under vacuum until the specimen is at room temperature (touch Vycor tube just under test specimen).
- h. Turn off the vacuum, and carefully let air into the system. When pressure equilibrium is reached, remove the specimen from the test tube and weigh to nearest 0.001 g.
- i. Repeat b through h for each specimen.
- j. Calculate the resin content of each specimen as follows:

$$\text{Dry resin content, percent} = (1.00 - \frac{A}{B}) (100)K$$

Where: A = weight of specimen after pyrolysis, g

B = weight of specimen before pyrolysis, g

K = constant ratio of percent resin (Soxhlet extraction or di-methyl-formamide (DMF) wash) to percent weight loss by pyrolysis (K - U.S. Polymeric = 2.110, K - Fiberite = 2.125).

- k. Record resin content average of the three specimens to the nearest 0.01 percent. Noncompliance of the average reading with the resin content requirement specified in 3.3 shall be cause for rejection of each component in the lot (see 4.2.1).

MIL-G-82775(OS)

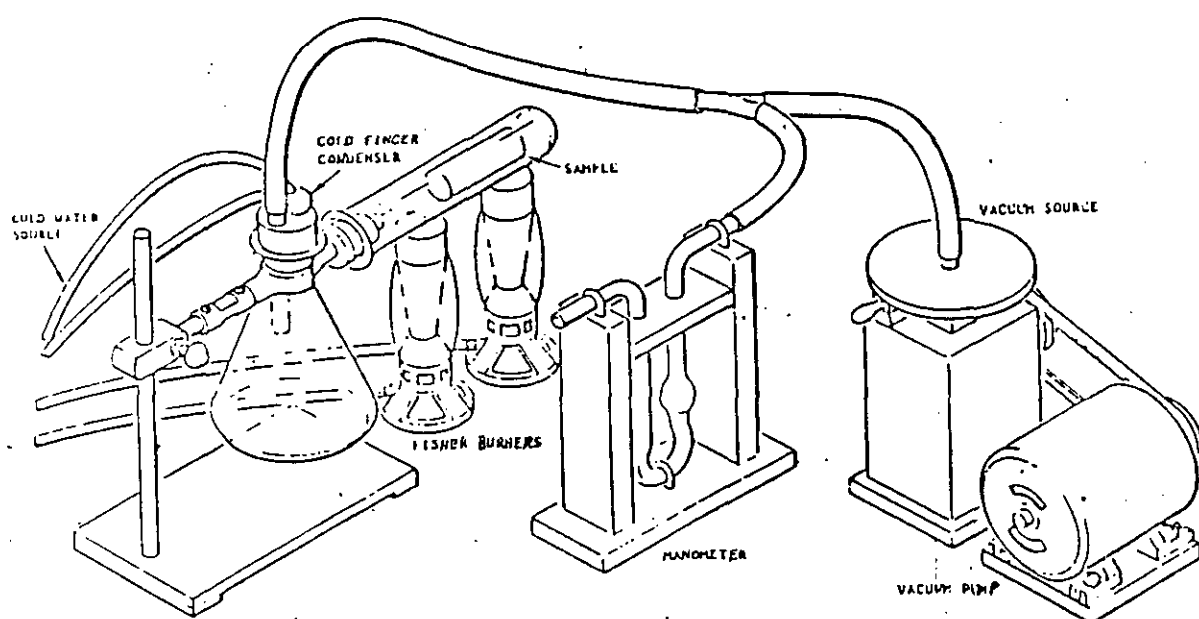


FIGURE 2. Resin content apparatus setup.

MIL-G-82775(OS)

4.3.5 Compressive strength. (+M105) Compressive strength shall be determined in accordance with the following:

- a. Remove three test specimens (0.300 ± 0.005 inch by 0.300 ± 0.005 inch by 0.600 ± 0.005 inch) 120 ± 24 degrees apart, from the test ring. Maximum surface roughness shall be 125 microinches root mean square (RMS). Specimens shall be machined such that length of specimen (0.600 inch reference) is tangent (within ± 18 degrees) to test ring curvature.
- b. Measure (to nearest 0.001 inch) length, width, and height of all test specimens with a calibrated micrometer. Record all readings on a data sheet. Calculate and record the cross-section of each specimen.
- c. Set test specimen on load cell table of an Instron tensile tester equipped with a Model CF load cell, with the length (0.600 inch reference) normal to the faces of the tester.
- d. Depress DOWN button to start compression. Cross-head speed should be 0.05 inch-per-minute.
- e. When the test sample fails, push RETURN button. This will return the crosshead to ZERO position.
- f. Repeat c through e for each test specimen.
- g. Calculate compressive strength of each specimen as follows:

$$\text{Compressive strength} = \frac{C}{A}$$

Where: C = maximum load, pounds

A = cross-sectional area, square inch

- h. Record average compressive strength of the three specimens to nearest psi. Noncompliance of the average reading with the compressive strength requirement specified in 3.3 shall be cause for rejection of each component in the lot (see 4.2.1).

5. PACKAGING

This section is not applicable to this specification.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

MIL-G-82775(OS)

6.1 Intended use. The retention ring and approach insert specified herein are intended for use as components in the Standard Missile Mk 104 Dual Thrust Rocket Motor.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1, 2.1.2 and 2.2).

6.3 Definitions

6.3.1 Blemishes. Any superficial imperfection or marks or deformities such as scratches, crazing, gouges, cuts, or stains.

6.3.2 Delamination. A separation between fabric plies which has sharply defined boundaries that are parallel to the fabric plies.

6.3.3 Crack. A parting or separation which extends across the fabric plies.

6.3.4 Wrinkled areas. Distortions in fabric orientation normal to the plane of the fabric.

6.3.5 Overstock area. Overstock is excess material which will be removed at a higher level of assembly.

6.3.6 Billet. A molded piece of graphite phenolic cloth from which individual components are machined.

6.4 Subject term (key word) listing.

Missile, Standard
Rocket Motor, Dual Thrust, Mk 104

6.5 Supersedure information. MIL-G-82775 incorporates the following engineering change proposals (ECPs) notices of revision (NORs) and specification change notices (SCNs):

<u>ECPs</u>	<u>NORs</u>	<u>SCNs</u>
MTA019 (7/1/87)	----	SCN 3 (7/1/87)
MTA080 (9/29/88)	ARC001.2 (7/27/89)	----
MTA082 (2/8/89)	MTA082.1 (1/23/89)	SCN 1 (5/8/89)
ARC001 (7/27/89)	ATC001.2 (7/27/78)	----

MIL-G-82775(OS)

**Preparing Activity:
NAVY-OS
(Project 1340-N784)**

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-G-82775

2. DOCUMENT DATE (YYMMDD)
29 December 1989

3. DOCUMENT TITLE

GRAPHITE CLOTH PHENOLIC COMPONENTS, MOLDED AND CURED

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial
(2) AUTOVON
(If applicable)

8. PREPARING ACTIVITY NAVAL ORDNANCE STATION (CODE 3730) INDIAN HEAD, MD 20640-5000

a. NAME

b. TELEPHONE (Include Area Code)

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c. ADDRESS (Include Zip Code)

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