

**JAN-C-1196**

**30 June 1949**

**NATIONAL MILITARY ESTABLISHMENT SPECIFICATION**

**CHRONOMETERS, SHIPS'**

**This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments, and supersedes the following specification:**

**Navy 18C7c  
2 February 1931**

**This specification consists of this cover sheet and Navy Department Specification 18C7c dated 2 February 1931, attached hereto, without modification.**

**Copies of this specification may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va. Both the title and identifying number or symbol should be stipulated when requesting copies.**

**When a request for this specification is received by a supplying activity, it will be necessary to attach this cover sheet to the pertinent specification before issue.**

**18C7c****FEB. 2,  
1931****SUPERSEDING  
18C7b  
Apr. 1, 1919****NAVY DEPARTMENT SPECIFICATION****CHRONOMETERS, SHIPS'****A. GENERAL SPECIFICATIONS.**

General Specifications for Inspection of Material, issued by the Navy Department, in effect at date of invitation for bids, shall form part of this specification.

**B. GRADE.**

Ships' chronometers shall be furnished in one grade only, as determined by the trial number as stated in paragraph F-4.

**C. MATERIAL AND WORKMANSHIP.**

Material and workmanship shall be of the best quality.

**D. GENERAL REQUIREMENTS.**

See section E.

**E. DETAIL REQUIREMENTS.****E-1. Chronometers.**

E-1a. The chronometer shall have the ordinary compensated balance, with detent escapement and without auxiliary correctors; and shall beat half-seconds. The hair spring shall be of steel or palladium.

E-1b. Chronometers shall be made to run for 56 hours, and a dial shall be provided on the face to show the state of the winding.

E-1c. The dial shall be silvered, and marked from 0 to 12 hours. The second, minute, and hour marks shall be accurately and distinctly cut, and all marks on the dial shall be filled with black wax. On the dial shall be engraved the maker's name and the serial number.

E-1d. Chronometers shall be swung properly in gimbals in boxes fitted for that purpose.

**E-2. Boxes.**

E-2a. Chronometer boxes shall be made of properly seasoned mahogany or rosewood, all joints well made and the whole well finished. Boxes shall be neatly and securely marked, on the front of the lid and the inside of the bottom of the box, with the maker's name and the number of the chronometer. Boxes shall be made in three parts, the bottom in which the chronometer is to be mounted, a cover fitted with a glass top, and a lid.

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E-2b. The bottom and cover, and the cover and lid, shall be joined by a single hinge of strong construction, running the entire length of the edge of the box, and the pin shall have a hook or head at one end, by which it can be pulled out, thus making it possible to separate the parts without removing the screws by which the hinges are attached.

E-3. *Transporting cases.*

A transporting case of hard well seasoned wood shall be provided for each chronometer. This case shall be fitted with a leather strap,  $1\frac{1}{4}$  inches wide, for handling, and shall be lined with elastic felt covered with canton flannel. The bottom board shall extend out about an inch beyond the sides of the case, to the right and left, with screw holes by which it may be secured. The front of the lid shall bear a metal plate with the maker's name and the number of the chronometer.

**F. METHOD OF INSPECTION, TESTS, ETC.**

F-1. Before purchasing chronometers, makers of these instruments will be informed by the superintendent of the United States Naval Observatory that the department desires to make such a purchase and that on a date specified there will commence a competitive trial at the United States Naval Observatory of such instruments as may be offered by their makers for the purpose of selecting the number of instruments desired.

F-2. The trial shall be as follows: Chronometers entered shall be subjected to a test at special temperatures and to a trial of five weeks at ordinary temperatures under the natural conditions of the room.

F-2a. *Temperature trial.*—The range of temperature in this trial will be from 90° F. to 55° F., the chronometer being exposed for a term of five days to each of the following temperatures in succession, viz., 90°, 72½°, 55°, 55°, 72½°, and 90° (all Fahrenheit).

F-2a (1). After the chronometers are placed in the temperature room, the temperature will be raised to 90° F. and after one day at that temperature their errors will be determined and the trial under those conditions will commence. At the end of the term, five days, the errors will be determined again. An interval of two days will be allowed to change the room to the new temperature, and for the instruments to settle to their new rates, after which their errors will be determined and the test for the second term will commence. The tests for the other terms will follow in the same manner, all changes in temperature being made gradually.

F-2a (2). Comparisons will be taken daily with the standard mean time clock, which is rated by transit observations. The errors being determined at the beginning and end of each term, the daily rates for the several temperatures will be deduced from them.

F-2b. *Ordinary temperature trial.*—After the temperature room trial, the chronometers will be rated for five weeks at ordinary temperatures to determine the regularity of their rates or the degree of accuracy with which they follow the curves.

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**F-3. Method of determining trial numbers.**—The merits of each chronometer will be determined by trial number, which will be derived from the following formulas:

**F-3a. Temperature room:** Following are temperatures used (below them are the corresponding observed rates).

90°	72½°	55°	55°	72½°	90°
c <sub>1</sub>	b <sub>1</sub>	a <sub>1</sub>	a <sub>2</sub>	b <sub>2</sub>	c <sub>2</sub>

$$a = \frac{1}{2} (a_1 + a_2) \quad b = \frac{1}{2} (b_1 + b_2) \quad c = \frac{1}{2} (c_1 + c_2)$$

$$m = a - b \quad n = b - c$$

$$a' = |a_2 - a| \quad b' = |b_2 - b| \quad c' = |c_2 - c|$$

$$\Sigma_2 = a'^2 + b'^2 + c'^2$$

Ordinary temperatures.

$t$  = one of the six temperatures.

$R$  = corresponding observed rate.

$[R]$  = sum of the five values of  $R$ .

$$V = \left| \frac{[R]}{5} - R \right|$$

$[V^2]$  = sum of the five values of  $V^2$ .

$$\text{Trial number} = I + II + III.$$

$$I = \frac{25}{7} [|m+n| + \frac{64}{63} (m-n)^2]$$

$$II = 50 \Sigma_2$$

$$III = 25[V^2]$$

**F-4.** As many chronometers as are desired will be selected in order of merit. Ordinarily no chronometers will be selected which have a trial number greater than 16, but the department, in its discretion, may extend this limit to 25.

#### G. PACKING AND MARKING.

##### G-1. Packing.

Unless otherwise specified, chronometers shall be delivered in substantial commercial containers, so constructed as to insure their being in good condition on arrival at the United State Naval Observatory.

##### G-2. Marking.

Shipping containers shall be marked with the name of the material and the quantity contained therein as defined by the contract or order under which shipment is made, the name and address of the manufacturer, the name of the contractor, and the number of the contract or order; also, with a large caution sign to carrier showing contents to be delicate instruments.

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**H. NOTES.**

H-1. Chronometers submitted for trial shall be delivered at the Naval Observatory, Washington, D. C., by the firms entering them, on or before the date specified, and shall be accompanied by a certificate of the maker, giving the date of manufacture and stating whether they have steel or palladium hairsprings, and the ordinary compensating balance, suitable for use on board seagoing vessels, and without correctors or auxiliary compensation.

H-2. Chronometers not accepted shall be removed from the observatory by the firms entering them.

H-3. It shall be understood, in submitting chronometers for trial, that they will be held at the owner's risk, but the department guarantees that all possible care will be given them at the observatory.

H-4. Copies of Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. When requesting, refer to specification by both title and number.

**REFERENCES:**

Nav. 824-7(1) L21(504), L2-1/824-7(7), Nov. 7, 1930, and L2-1(1518), L2-1/824-7(27), Dec. 3, 1930.

Navy Department Specifications Board 18-C-7b, Nov. 10, 1930, and 18-C-7c, Dec. 3, 1930.

S. & A. L2/JJ-18C7.

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