

MIL-H-9859A
28 Aug 1968
~~SUPERSEDING~~
MIL-H-9859
30 March 1959

MILITARY SPECIFICATION

HANDWHEELS

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers commercial handwheels, 3 inches in diameter or larger, designed to transmit manual power to a shaft.

1.2 Classification. Handwheels shall be of the following types, compositions, classes, styles and sizes:

1.2.1 Body.

Type I - Straight

- Composition A - Aluminum alloy
- Composition B - Copper alloy
- Composition C - Gray iron
- Composition D - Malleable iron
- Composition E - Nodular iron

Type II - Offset

- Composition A - Aluminum alloy
- Composition B - Copper alloy
- Composition C - Gray iron
- Composition D - Malleable iron
- Composition E - Nodular iron

1.2.2 Body hub bore:

- Class 1 - Without keyway
- Class 2 - With keyway

FSC 5340

MIL-H-9859A

1.2.3 Handle

- Style 1 - Without handle
- Style 2 - With solid handle
 - Composition F - Aluminum alloy
 - Composition G - Naval brass
 - Composition H - Steel
- Style 3 - With revolving handle

1.2.4 Size. Handwheels shall be classified according to size by the outside diameter of the rim.

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 the specification to the extent specified herein.

SPECIFICATIONS

Federal

- QQ-A-225/6 - Aluminum Alloy Bar, Rod and Wire, Rolled, Drawn or Cold-Finished, 2024
- QQ-A-601 - Aluminum Alloy Sand Castings
- QQ-B-637 - Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products With Finished Edges (Bar, Flat Wire, and Strip)
- QQ-C-390 - Copper Alloy Castings (Including Cast Bar)
- QQ-I-652 - Iron Castings, Gray
- QQ-I-666 - Iron Castings, Malleable
- QQ-P-416 - Plating, Cadmium (Electrodeposited)
- QQ-S-634 - Steel, Bar, Carbon, Cold Finished (Standard Quality)
- QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements for
- PPP-B-585 - Boxes, Wood, Wirebound
- PPP-B-591 - Boxes, Fiberboard, Wood-Cleated
- PPP-B-601 - Boxes, Wood, Cleated-Plywood
- PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner
- PPP-B-636 - Box, Fiberboard
- PPP-T-60 - Tape, Pressure-Sensitive Adhesive, Waterproof, for Packaging
- PPP-T-76 - Tape, Pressure-Sensitive Adhesive Paper (For Carton Sealing)

MIL-H-9859A

Military

- MIL-P-116 - Preservation, Methods of
- MIL-B-121 - Barrier Material, Greaseproofed, Waterproofed, Flexible
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys
- MIL-I-11466 - Iron, Nodular Graphitic (Ductile Iron) Castings
- MIL-P-20689 - Plastic, Plastisol (For Coating Metallic Objects)

STANDARDS

Military

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-129 - Marking for Shipment and Storage
- MS21312 - Handwheel-Revolving Handle
- MS35756 - Key, Woodruff, Steel, Alloy, with Keyway and Key Slot Dimensions

(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.

United States of America Standards Institute (USASI)
Standard:
USAS B46.1 - Surface Texture

(Application for copies should be addressed to The United States of America Standards Institute, 10 East 40th Street, New York, New York 10016.)

3. REQUIREMENTS

3.1 Material.

MIL-H-9859A

3.1.1 Body. Handwheel bodies shall be cast from one of the following material compositions:

- Composition A - Aluminum alloy in accordance with QQ-A-601, alloy 195, temper T4.
- Composition B - Copper alloy in accordance with QQ-C-390, alloy no. B6.
- Composition C - Gray iron in accordance with QQ-I-652, class 30 thru 60.
- Composition D - Malleable iron in accordance with QQ-I-666, grade II.
- Composition E - Nodular iron in accordance with MIL-I-11466, class 5 or 6.

3.1.2 Solid handle. Handwheel solid handles shall be machined from one of the following material compositions:

- Composition F - Aluminum alloy in accordance with QQ-A-225/6, temper T4.
- Composition G - Naval brass in accordance with QQ-B-637, alloy 464.
- Composition H - Steel in accordance with QQ-S-634, having a minimum tensile strength of 60,000 p.s.i.

3.1.3 Revolving handle. Handwheel revolving handles shall be made from the following material compositions.

- (a) Sleeve shall be aluminum alloy, Composition F (see 3.1.2).
- (b) Stem shall be steel, Composition H (see 3.1.2).

3.2 Design.

3.2.1 Counterbalance. Styles 2 and 3 handwheels, 5 inches in diameter and larger, shall be counterbalanced to compensate for the weight of the handle. The design of the counterbalance shall be at the option of the manufacturer.

3.2.2 Hand rotation. Revolving handles for style 3 handwheels shall rotate without binding.

3.2.3 Spokes. Spoke design of handwheels shall be at the option of the manufacturer except as follows: Handwheels shall have a minimum of three spokes; minimum thickness of spokes shall be $1/4$ the rim thickness and minimum width of spokes shall be $1/2$ the rim thickness.

3.2.4 Attaching of handles. Handles for styles 2 and 3 handwheels shall be attached so that the handles shall not loosen during service. Any positive locking feature may be used to secure the handles to the handwheels.

3.2.5 Body hub bore. Unless otherwise specified (see 6.2), body hub bore shall be without keyway (class 1). When specified (see 6.2), body hub bore shall be with keyway (class 2). Keyway dimensions shall be in accordance with MS35756.

3.2.6 Handle location. Handwheel handles shall be located on the handwheel rim, as illustrated in figure 1.

3.3 Dimensions and tolerances.

3.3.1 Handwheels. Dimensions and tolerances of handwheels shall be in accordance with figure 1, tables I or II and MS21312, as applicable. Dimensions and tolerances shall apply prior to coating, except for the hub bore dimensions of anodized aluminum handwheels.

3.3.2 Concentricity. The outside diameter of the rim shall be concentric with the hub bore within 1 percent of the outside diameter of the rim, total indicator reading. The outside diameter of the hub shall be concentric with the hub bore within 3 percent of the outside diameter of the hub, total indicator reading.

3.3.3 Angularity. The outside faces of the rim and hub shall be square with the axis of the hub within $\pm 30'$. The axis of the handle shall be square with the face of the rim within $\pm 2^\circ$.

3.4 Surface roughness. Surface roughness shall be as specified in figure 1, in accordance with USAS B46.1.

3.5 Protective finish.

3.5.1 Anodic coating. Aluminum handwheels shall be anodized in accordance with MIL-A-8625, type II.

3.5.2 Cadmium plating. When specified (see 6.2), cadmium plating shall be in accordance with QQ-P-416, type II, class 3, except that the hub bore shall not be plated.

3.5.3 Zinc coating. When specified (see 6.2), zinc coating shall be in accordance with QQ-Z-325, type II, class 3, except that the hub bore shall not be coated.

MIL-H-9859A

3.5.4 Plastisol coating. When specified (see 6.2), plastisol coating shall be in accordance with MIL-P-20689, type II, class 1, .078 inch \pm .016 inch thick. Styles 1 and 2 shall have all surfaces coated except the hub ends and hub bore. Style 3 shall have the grip surface of the handle and all surfaces of the handwheel body coated, except the hub ends, hub bore and handle boss. The coating shall be either flush with exposed surfaces or chamfered $45^{\circ} \pm 10^{\circ}$ to the intersection of exposed surfaces.

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 Quality assurance terms and definitions. Quality assurance terms and definitions used herein are in accordance with MIL-STD-109.

4.2 Inspection provisions.

4.2.1 Lot. Unless otherwise specified, a lot shall consist of all handwheels of like design, produced by the same manufacturer, under essentially the same conditions and offered for acceptance at one time.

4.2.2 Sampling.

4.2.2.1 Examination. Sampling for examination shall be in accordance with MIL-STD-105.

4.3 Examination. Handwheels taken as specified in 4.2.2.1 shall be examined to determine compliance with the requirements of this specification. Examination shall be conducted in accordance with the following Classification of Defects. The Acceptable Quality Levels (AQL's) shall apply to the group and not to each listed characteristic.

Classification of Defects

<u>Category</u>	<u>Defect</u>	<u>Inspection Method</u>
Critical	None defined	
Major	AQL = 2.5	
101	Hub: Bore diameter out of tolerance	SIE *
102	Hub: Angularity out of tolerance	SIE
103	Handle, solid: Loose in hole	Manual
104	Handle, revolving: Loose in hole	Manual
105	Handle, revolving: Binds on mating diameter	Manual
106	Handle stem: Threads out of tolerance	SIE
Minor	AQL = 6.5	
201	Wheel: Depth out of tolerance	SIE
202	Rim: Outside diameter out of tolerance	SIE
203	Rim: Thickness out of tolerance	SIE
204	Spoke thickness not as specified	SIE
205	Spoke width not as specified	SIE
206	Hub: Outside diameter out of tolerance	SIE
207	Hub: Length out of tolerance	SIE
208	Handle: Grip length out of tolerance	SIE
209	Handle: Diameter out of tolerance	SIE
210	Concentricity of rim with bore, out of tolerance	SIE
211	Surface roughness not as specified	SIE
212	Protective finish missing or incomplete	Visual
213	Handwheel unbalanced	Manual
214	Wheel has less than three spokes	Visual
215	Angularity of rim out of tolerance	SIE
216	Angularity of handle out of tolerance	SIE

* SIE - Standard Inspection Equipment

4.4 Testing. Tests for physical properties, protective finishes and chemical compositions shall be in accordance with the applicable specification.

MIL-H-9859A

4.4.1 Preservation, packaging, packing and marking. Inspection and test of preservation, packaging, packing and marking shall be in accordance with MIL-P-116.

4.5 Rejection and retest. Handwheels failing to meet the requirements of this specification shall be rejected. A rejected lot may be resubmitted for Government acceptance in accordance with the provisions of MIL-STD-105.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A, B or C as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Handwheels shall be cleaned in accordance with method C-1 of MIL-P-116.

5.1.1.2 Drying. Handwheels shall be dried in accordance with any applicable method of MIL-P-116.

5.1.1.3 Preservative. Metal surfaces of handwheels not anodized, plated or coated shall be coated with type P-2 preservative of MIL-P-116.

5.1.1.4 Unit packaging. Handwheels not anodized, plated or coated shall be wrapped with barrier material in accordance with type I, grade C, class 1 of MIL-B-121. The wrapping shall be secured with tape in accordance with type V, class 2 of PPP-T-60. Partially plated or coated handwheels shall have unplated or uncoated surfaces preserved and openings capped with tape in accordance with type V, class 2 of PPP-T-60. Handwheels shall be packaged in accordance with MIL-P-116, method I if preservative is used or method III if no preservative is used, in fiberboard boxes in accordance with grade W5C, style RSC of PPP-B-636. The boxes shall be closed in accordance with the appendix of PPP-B-636. In addition, all seals and joints shall be sealed with tape, not less than two inches wide, in accordance with PPP-T-76.

5.1.2 Level B (see 6.3).

5.1.2.1 Cleaning, drying and preservation. Level B cleaning, drying and preservation shall be in accordance with the requirements of Level A.

5.1.2.2 Unit packaging. Level B unit packaging shall be in accordance with the requirements of Level A, except

MIL-H-9859A

that the fiberboard box shall be in accordance with type CF, class domestic, style RSC of PPP-B-636. Closure shall be in accordance with the appendix of PPP-B-636.

5.1.3 Level C. Cleaning, drying, preservation and packing shall be in accordance with good commercial practice.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2).

5.2.1 Level A. Interior packages shall be packed in overseas type containers in accordance with one of the following: PP-B-585, class 3, style 1 or 2; PPP-B-601, overseas type, style A or B; PPP-B-621, class 2, style 2 or 4; or PPP-B-591, class II, style A or B. The maximum gross weight of each shipping container shall not exceed 70 pounds for containers being shipped into combat areas or 200 pounds for all other shipments.

5.2.2 Level B. Interior packages shall be packed in domestic type containers in accordance with one of the following: PPP-B-585, class 1, style 1 or 2; PPP-B-601, domestic type, style A to K; PPP-B-621, class 1, style 2; or PPP-B-591, class I, style A or C. The maximum gross weight for shipping containers shall not exceed 200 pounds.

5.2.3 Level C. Handwheels shall be packed to insure carrier acceptance and delivery without damage to the first receiving point for immediate use. Containers shall be in accordance with Uniform Freight Classification Rules, National Motor Freight Regulations or other common carrier regulations applicable to the mode of transportation.

5.3 Marking. In addition to any special marking specified in the contract or order (see 6.2), each package and shipping container shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Handwheels covered by this specification are intended for use in rotating shafts on materiel which have loads small enough to permit hand turning. It is intended they be attached to the end of the shaft by threaded or spring type fasteners and depend on straight or Woodruff keys for transmitting torque loads.

MIL-H-9859A

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Type, composition and size of handwheel (1.2.1 and 1.2.4).
- c. Class of body hub bore (1.2.2).
- d. Style of handle and Composition of Style 2 handle (1.2.3).
- e. Military Standard part number, when applicable.
- f. Protective finish (3.5).
- g. Selection of applicable levels of preservation, packaging and packing (5.1 and 5.2).
- h. Marking, if required (5.3).

6.3 Level B preservation and packaging is intended to provide economical but limited protection, and should be specified only when it is determined that the handwheels will be held in covered storage approximately one year from date of initial packaging.

6.4 When warranted, the following paragraph should be included in the written contract to cover the type of quality assurance system that is desirable for this item.

Contractor's quality assurance system. The contractor shall provide and maintain a quality assurance system in accordance with MIL-Q-9858.

Custodians:

Army - WC
Navy - OS
Air Force - 82

Preparing activity:

Army - WC

Project No. 5340-0375

Reviewer activities:

Army - ME, MU
Navy - None
Air Force - 85
DSA - IS

User activities:

Army - AT, MI
Navy - MC
Air Force - None

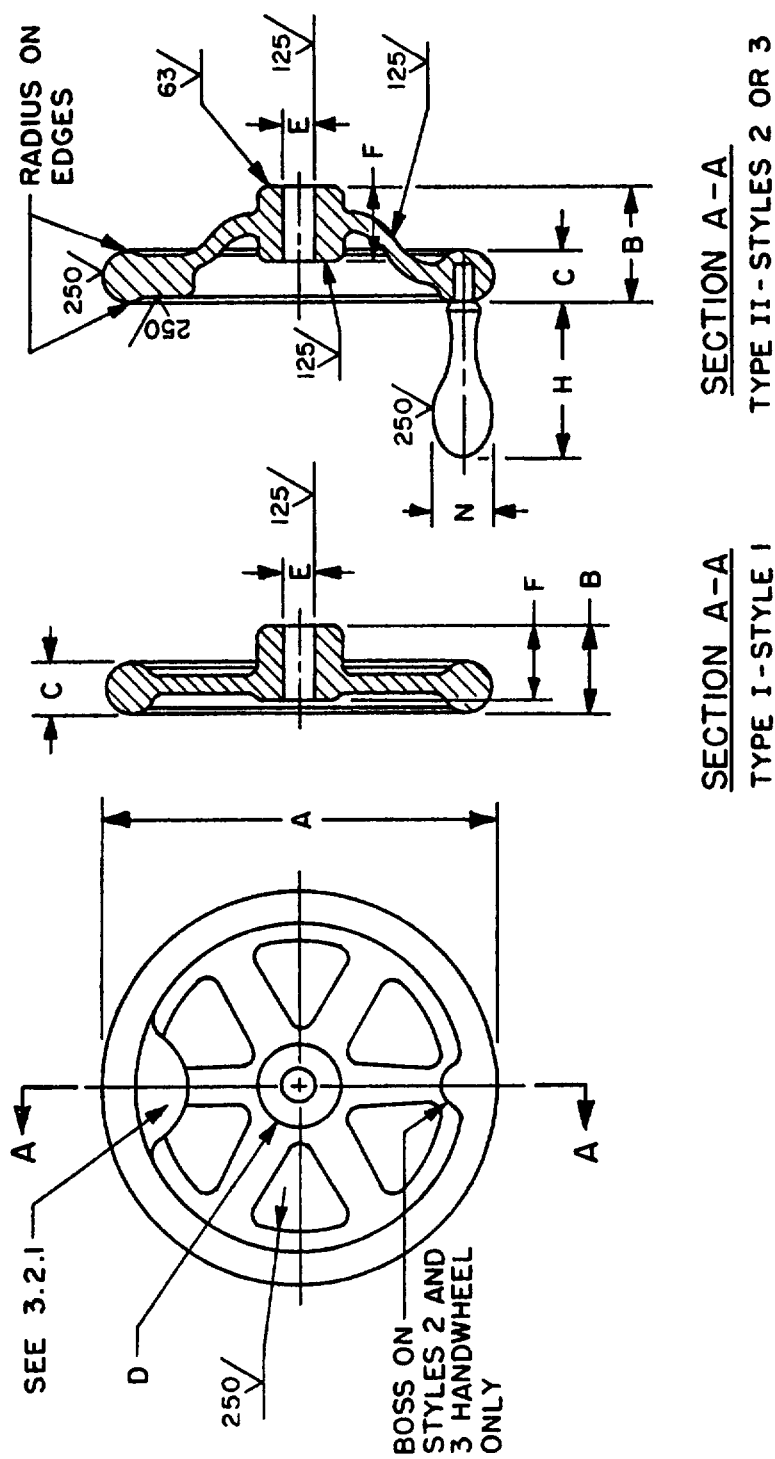


FIGURE 1 - HANDWHEEL DETAIL

MIL-H-9859A

TABLE I
Handwheel Dimensions
Type I

A WHEEL O.D.	TOL	B WHEEL DEPTH $\pm .016$	C RIM THICKNESS $\pm .031$	D HUB O.D. $\pm .03$	E HUB BORE $+ .002$ $- .000$	F HUB LENGTH $\pm .016$	H GRIP LENGTH NOM		N GRIP DIAMETER $\pm .03$	
							STYLE 2	STYLE 3	STYLE 2	STYLE 3
3.00		1.062	.625	1.00	.375	1.062	1.469	---	.62	---
4.00	$\pm .03$	1.125	.625	1.25	.375	1.125	2.000	2.062	.81	.88
5.00		1.125	.625	1.50	.375	1.125	2.125	2.062	.88	.88
6.00		1.312	.875	1.50	.500	1.250	2.750	3.031	1.12	1.12
7.00	$\pm .06$	1.250	.750	1.75	.500	1.250	3.219	3.281	1.19	1.19
8.00		1.562	1.000	1.75	.625	1.500	3.219	3.281	1.19	1.19
9.00		1.750	.875	2.00	.625	1.750	3.438	3.281	1.19	1.19
10.00	$\pm .09$	2.062	1.125	2.25	.625	2.000	3.438	3.281	1.19	1.19
12.00		2.312	1.125	2.50	.750	2.250	4.062	4.188	1.38	1.38
14.00	$\pm .12$	3.500	1.250	3.00	.875	3.500	4.062	4.188	1.38	1.38

Note: All dimensions are in inches.

TABLE II
Handwheel Dimensions
Type II

A WHEEL O.D.	NOM	TOL	B WHEEL DEPTH $\pm .016$	C RIM THICKNESS $\pm .031$	D HUB O.D. $\pm .03$	E HUB BORE $+.002$ $-.000$	F HUB LENGTH $\pm .016$	H GRIP LENGTH NOM		N GRIP DIAMETER $\pm .03$	
								STYLE 2	STYLE 3	STYLE 2	STYLE 3
3.00			1.062	.625	.88	.375	.625	1.469	---	.62	---
4.00		$\pm .03$	1.500	.750	1.00	.375	1.000	2.000	2.062	.81	.88
5.00			1.625	.750	1.25	.375	1.125	2.125	2.062	.88	.88
6.00			2.000	.875	1.50	.500	1.250	2.750	3.031	1.12	1.12
7.00		$\pm .06$	2.250	1.000	1.50	.500	1.500	3.219	3.281	1.19	1.19
8.00			2.375	1.000	1.75	.625	1.500	3.219	3.281	1.19	1.19
9.00			3.000	1.125	2.00	.625	2.125	3.438	3.281	1.19	1.19
10.00		$\pm .09$	3.000	1.125	2.25	.625	2.125	3.438	3.281	1.19	1.19
12.00			3.250	1.125	2.50	.750	2.250	4.062	4.188	1.38	1.38
15.00			2.750	1.250	1.88	1.000	1.500	4.062	4.188	1.38	1.38
18.00		$\pm .12$	3.500	1.500	2.50	1.125	2.000	4.562	4.188	1.50	1.38
20.00			3.500	1.500	2.50	1.125	2.000	4.562	4.188	1.50	1.38
26.00			4.250	1.750	3.25	1.125	2.500	4.562	4.188	1.50	1.38

Note: All dimensions are in inches.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No 119-R004
<p align="center">INSTRUCTIONS</p> <p>This sheet is to be filled out by personnel either Government or contractor involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.</p>		
SPECIFICATION		
ORGANIZATION		CITY AND STATE
CONTRACT NO	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A GIVE PARAGRAPH NUMBER AND WORDING		
B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2 COMMENTS ON ANY SPECIFICATION EQUIPMENT CONSIDERED TOO RIGID		
3 IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES" IN WHAT WAY?		
4 REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

DD FORM 1426

APR 63

REPLACES NAVSHIPS FORM 4863 WHICH IS OBSOLETE

FOLD

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