

FF-C-88C

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SUPERSEDING

Int. Fed. Spec. FF-C-0088B(GSA-FSS)

April 24, 1970 and

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Fed. Spec. FF-C-86

April 16, 1938

FEDERAL SPECIFICATION

CASTERS, RIGID AND SWIVEL, INDUSTRIAL DUTY

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers rigid and swivel, plate-mounted, industrial duty casters for non-powered, material-transport equipment. The requirements for one socket-mounted, swivel caster are also included.

1.2 Classification.

1.2.1 Group, type, class, style, and form. The casters covered by this specification shall be one of the following groups, types, classes, styles and forms, as specified (see 6.2).

Group A - Commercial.

Type I - Rigid.

Type II - Swivel.

Class 1 - Light duty.

Class 2 - Light-medium duty.

Class 3 - Medium duty.

Class 4 - Medium-heavy duty.

Class 5 - Heavy duty.

Style 1 - Hard tread, plastic wheel.

Style 2 - Metal wheel with molded-on soft rubber tread.

Style 3 - Metal wheel with demountable soft rubber tread.

Style 4 - Hard tread, all-rubber wheel (commercial).

Style 4a- Hard tread, all-rubber wheel (special).

Style 5 - Soft tread, all-rubber wheel.

Style 6 - All metal wheel.

Style 7 - Metal wheel with demountable polyurethane tread.

Style 8 - Metal wheel with molded-on polyurethane tread.

Group B - Special.

Types and forms:

Type I - Rigid.

Form 1-250 pound capacity.

Form 2-400 pound capacity.

Type II - Swivel.

Form 1-250 pound capacity, flat mounting plate.

Form 2-250 pound capacity, threaded-socket mounting.

Style:

Style 4A - Hard tread, all rubber wheel (special).

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 this specification to the extent specified herein.

FF-C-88C

Federal Specifications:

PPP-B-621 - Boxes, Wood, Nailed and Lock Corner.
PPP-B-636 - Box, Fiberboard.

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).
Fed. Test Method Std. No. 151 - Metals: Test Methods.
Fed. Test Method Std. No. 406 - Plastics: Methods of Testing.
Fed. Test Method Std. No. 601 - Rubber: Sampling and Testing.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Washington.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

MIL-P-116 - Preservation, Methods of.
MIL-L-10547 - Liners, Case and Sheet, Overwrap; Water-Vaporproof or Waterproof, Flexible.

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables of Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors 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 a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA):

AFBMA Standards for Balls.

(Application for copies should be addressed to the Anti-Friction Bearing Manufacturers Association, Inc., 60 East 42nd Street, New York, New York 10017.)

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., Agent, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Tariff Publishing Officer, Room 202 Union Station, 516 W. Jackson Blvd., Chicago, Illinois 60606.)

National Bureau of Standards (NBS) Handbook:

H28 - Screw-Thread Standard for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.)

3. REQUIREMENTS

3.1 Classification of requirements. The requirements for the product are classified herein as follows:

<u>Requirement</u>	<u>Paragraph</u>
First article (wheel compound only).	3.2
General requirements, groups A and B.	3.3
General requirements, groups A only.	3.4
Detail requirements, group A only.	3.5
General requirements, group B only.	3.6
Detail requirements, group B only.	3.7
Wheel assembly requirements.	3.8
Performance requirements, groups A and B.	3.9

3.2 First article (wheel compound only). When specified (see 6.2) before production is started, the minimum number of caster wheels or molded material specimens necessary for testing in accordance with 4.3 shall be submitted or made available for approval by the contracting officer or his authorized representative. Approval of the sample authorizes the commencement of production but does not relieve the supplier of the responsibility for compliance with all applicable provisions of this specification. The samples furnished shall be the same as those used in the end item.

3.3 General requirements, groups A and B.

3.3.1 Material. Material not definitely specified herein shall be of the kind and quality normally used by the manufacturer for casters of the specified type, class, style, and size, provided that the complete caster shall meet the applicable requirements of section 3 when tested in accordance with section 4.

3.3.2 Matching set, design and construction. When specified (see 6.2), rigid and swivel casters shall be furnished as matching sets. The maximum amount of difference in overall height in any matching set of casters, furnished by the same manufacturer, shall not exceed 1/8 inch. There shall be no difference, between the two types, in the style of attachment, the kind of material, or in the operational load capacity.

3.3.3 Dimension tolerances. Unless otherwise specified herein, the tolerances for overall height, mounting-plate overall size, hole spacing for mounting plates, mounting bolt-hole diameter, and swivel radius shall be in accordance with the American National Standards Institute (ANSI) Standard MH 11.1.

3.3.4 Threads. Threads for axle bolts and nuts shall be in accordance with the applicable screw-thread standards of NBS H28.

3.3.5 Finish. Except for aluminum, exterior metal surfaces of the casters shall be cadmium or zinc plated, painted, lacquered, or enameled, as specified (see 6.2).

3.3.6 Rubber or polyurethane tires or treads. The rubber or polyurethane tires or treads shall not have any visible blisters, cracks, checks, or discolorations. The remaining flash at the parting line on the face of soft rubber or polyurethane tires or treads shall not exceed 0.032 inches in height or in width. All hard tread wheels shall have the flash completely removed so that there is no visible evidence of the mold parting line.

3.3.7 Marking. Casters shall be permanently and legibly marked with the manufacturer's name or trademark. This marking may be provided in the form of a decal provided that the decal can normally be expected to remain legible for the life expectancy of the caster. This markings shall be visible when the caster is completely assembled.

3.3.8 Workmanship. The casters shall be clean, properly assembled, and lubricated as specified. All burrs and sharp edges which are visible or can be felt shall be removed. There shall be no visible damage (i.e. nicks or gouges in the wheels larger than 1/16 inch in diameter; bent metal parts which visibly weaken the caster, interfere with the operation of the swivel assembly or bind the caster wheel.

3.4 General requirements, group A, commercial. Casters in this group are those casters available as industry standard items (i.e. catalog items), which meet the applicable requirements of section 3 when tested in accordance with section 4.

FF-C-88C

3.4.1 Types. Casters in this group shall be type I - rigid in accordance with 3.5.1 or, type II - swivel in accordance with 3.5.2.

3.4.2 Classes. Casters in this group have been divided into classes based on the material from which they are fabricated, their load capacity, the dimensions, wheel styles, wheel sizes, and wheel bearing types.

3.4.2.1 Material. Casters in all classes shall be made from steel, cast iron, or aluminum, as specified (see 6.2).

3.4.2.2 Operational load capacity. The operational load capacity for each class shall be in accordance with table I and shall be as specified (see 6.2).

TABLE I. Operational load capacity

Class	Wheel diameter	Tread Width	Wheel Style 1	Wheel Style 2	Wheel Style 3	Wheel Style 4	Wheel Style 5	Wheel Style 6	Wheel Style 7	Wheel Style 8
	inches	inches	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds
	Nominal	Nominal	Min.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
1 Light	2	13/16	-----	-----	-----	100	75	-----	-----	-----
	3	13/16	-----	-----	-----	125	100	-----	-----	-----
	4	15/16	-----	-----	-----	130	110	-----	-----	-----
	5	15/16	-----	-----	-----	145	125	-----	-----	-----
2 Light-medium	3	1-1/4	-----	-----	-----	210	125	210	-----	-----
	3-1/2	1-1/4	-----	-----	-----	225	140	225	-----	-----
	4	1-1/4	-----	-----	-----	255	165	255	-----	-----
	5	1-1/4	-----	-----	-----	280	190	280	-----	-----
3 Medium	3	1-1/2	-----	-----	-----	225	140	225	-----	-----
	4	1-1/2	375	200	-----	300	200	425	-----	420
	5	1-1/2	440	240	240	350	240	500	360	480
	6	1-1/2	430	280	280	400	280	575	420	560
4 Medium-heavy	4	2	500	300	-----	400	300	550	-----	500
	5	2	580	350	-----	450	325	700	-----	700
	6	2	640	410	410	560	400	850	615	820
	8	2	675	500	500	600	475	1050	700	1000
5 Heavy	5	2-1/2	720	455	-----	-----	-----	900	-----	-----
	6	2-1/2	800	540	540	-----	-----	1200	900	1100
	8	2-1/2	850	670	670	-----	-----	1400	1005	1340
	10	2-1/2	940	790	790	-----	-----	1650	1185	1580
	12	3	1240	1140	1140	-----	-----	2100	1710	2280

3.4.2.3 Dimensions. The dimensions for the overall height, mounting plate, bolt-hole spacing, mounting-bolt-hole diameter and swivel radius shall be in accordance with table II and shall be specified (see 6.2).

TABLE II. Dimensions, group "A" casters inches

Class	Wheel diameter (nominal)	Tread width (nominal)	Overall height	Mounting plate overall size	Hole spacings for the mountings plate	Mounting bolt diameter	Swivel radius (max)
Light duty Casters	2	13/16	2-5/8	1-1/4x2-1/8	13/16x1-9/16	3/16	2
	3	13/16	3-13/16	2-3/4x3-3/4	1-3/4x3	1/4	2-3/4
	4	15/16	4-3/4	2-3/4x3-3/4	1-3/4x3	1/4	3-3/4
	5	15/16	5-3/4	2-3/4x3-3/4	1-3/4x3	1/4	4
Light medium duty	3	1-1/4	3-3/4 or 4-3/16	2-3/4x3-3/4 or 3-1/8x4-1/8	1-3/4x2-7/8 or 2-3/8x3-7/16	5/16	3

TABLE II. Dimensions, group "A" casters inches (con.)

Class	Wheel diameter (nominal)	Tread width (nominal)	Overall height	Mounting plate overall size	Hole spacings for the mountings plate	Mounting bolt diameter	Swivel radius (max)
Light medium duty	3-1/2	1-1/4	4-1/2 or 4-3/4	2-3/4x3-3/4 or 3-1/8x4-1/8	1-3/4x2-7/8 or 2-3/8x3-7/16	5/16	3-1/4
	4	1-1/4	5-1/16	2-3/4x3-3/4 or 3-1/8x4-1/8	1-3/4x2-7/8 or 2-3/8x3-7/16	5/16	3-3/4
	5	1-1/4	6-1/8	2-3/4x3-3/4 or 3-1/8x4-1/8	1-3/4x2-7/8 or 2-3/8x3-7/16	5/16	4-1/4
Medium duty	3	1-1/2	4-5/16 or 4-1/2	4x4-3/4	Slotted 2-5/8x3-5/8 to 3x3	3/8	3
	4	1-1/2	5-5/16 or 5-5/8	4x4-3/4	2-5/8x3-5/8 to 3x3	3/8	4
	5	1-1/2	6-3/16 or 6-7/16	4x4-3/4	2-5/8x3-5/8 to 3x3	3/8	4-3/4
	6	1-1/2	7-3/8	4x4-3/4	2-5/8x3-5/8 to 3x3	3/8	5-1/2
Heavy medium duty	4	2	5-9/16	5x5-1/2	4-1/8x4-1/2	3/8	4
	5	2	6-5/16 or 6-1/2	5x5-1/2	4-1/8x4-1/2	3/8	4-1/2
	6	2	7-3/8 or 8	5x5-1/2	4-1/8x4-1/2	3/8	5-3/4
	8	2	9-3/8 or 10	5x5-1/2	4-1/8x4-1/2	3/8	7-1/4
Heavy duty	5	2-1/2	7-3/16 or 7-5/8	5x7	3-3/8x5-1/4	1/2	5-1/4
	6	2-1/2	7-5/8 or 8-1/8	5x7	3-3/8x5-1/4	1/2	6-1/4
	8	2-1/2	10-1/4 or 10-5/8	5x7	3-3/8x5-1/4	1/2	7-1/4
	10	2-1/2	12-1/4	5x7	3-3/8x5-1/4	1/2	8-1/2
	12	3	14-1/2	5x7	3-3/8x5-1/4	1/2	10-1/4

3.4.2.4 Class delimitations. Only those casters which meet the applicable requirements of tables I through VII and the requirements for the wheel style specified, shall be covered by this specification. Purchasers shall specify the wheel diameters, tread widths, axle diameters, wheel styles, and bearings, in the combinations shown in tables I through VII, in 6.2).

TABLE III. Class 1, requirements capacity

Wheel diameter inches	Nominal tread width inches	1/ Style 4 capacity pounds	1/ Style 5 capacity pounds	Plain sleeve bearing	Self-lubricating bearing
2	13/16	100	75	X	X
2	1	125	80	X	X
3	13/16	125	100	X	X
4	15/16	130	110	---	X
5	15/16	145	125	---	X

1/ Operational load is based on 2 m.p.h., "intermittent" (see 3.9.1) manual operation on equipment not subject to prolonged static loads.

TABLE IV. Class 2, requirements

Wheel diameter inches	Nominal tread width inches	Style 4 capacity pounds	Style 5 capacity pounds	Style 6 capacity pounds	Self lubricating bearing	Straight roller bearing	Ball bearing
3	1-1/4	210	125	210	X	X	X
3-1/2	1-1/4	225	140	225	X	X	X
4	1-1/4	255	165	255	---	X	X
5	1-1/4	280	190	280	---	X	X

1/ Operational load is based on 2 m.p.h.; "intermittent" manual operation on equipment not subject to prolonged static loads.

2/ Operational load is based on 3 m.p.h.; "intermittent" manual operation.

TABLE V: Class 3, requirements

Wheel diameter inches	Nominal tread width inches	Style 1 capacity pounds	Style 2 capacity pounds	Style 3 capacity pounds	Style 4 capacity pounds	Style 5 capacity pounds	Style 6 capacity pounds	Style 7 capacity pounds	Style 8 capacity pounds	Bearing
3	1-1/2	---	---	---	225	140	225	---	---	Straight roller or ball only
4	1-1/2	375	200	---	300	200	425	---	400	
5	1-1/2	440	240	240	350	240	500	360	480	
6	1-1/2	430	280	280	400	280	575	420	560	

1/ Operational load is based on 2 m.p.h., "intermittent" manual operation on equipment not subject to prolonged static loads.

2/ Operational load is based on 3 m.p.h., "continuous" (see 3.9.1) manual operation.

TABLE VI. Class 4, requirements

Wheel diameter inches	Nominal tread width inches	Style 1 capacity pounds	Style 2 capacity pounds	Style 3 capacity pounds	Style 4 capacity pounds	Style 5 capacity pounds	Style 6 capacity pounds	Style 7 capacity pounds	Style 8 capacity pounds	Bearing
4	2	500	300	---	400	300	550	---	500	Straight roller or ball only
5	2	580	350	---	450	325	700	---	700	
6	2	640	410	410	560	400	850	615	820	
8	2	675	500	500	600	475	1050	700	1000	

1/ Operational load is based on 2 m.p.h., "intermittent" manual operation on equipment not subject to prolonged static loads.

2/ Operational load is based on 4 m.p.h., "intermittent" manual.

TABLE VII. Class 5, requirements

Wheel diameter inches	Nominal tread width inches	Style 1 capacity pounds	Style 2 capacity pounds	Style 3 capacity pounds	Style 6 capacity pounds	Style 7 capacity pounds	Style 8 capacity pounds	Bearing
5	2-1/2	720	455	---	900	---	---	Straight roller or ball only
6	2-1/2	800	540	540	1200	900	1100	
8	2-1/2	850	670	670	1400	1005	1340	
10	2-1/2	940	790	790	1650	1185	1580	
12	3	1240	1140	1140	2100	1710	2280	

1/ Operational load is based on 4 m.p.h., "continuous" manual operation.

3.4.3 Bolt-connection holes. Bolt holes shall be accurately located within the tolerances specified in 3.3.3. Hole edges shall have no burrs to interfere with the seating of the bolt-head, washer, or nut.

3.4.4 Welded joints. Welds shall be sound, free from closely spaced in-line porosity or cracks, and shall be thoroughly fused to the base metal.

3.4.5 Castings. Castings shall be free from visible blow-holes, closely spaced in-line porosity or cracks. Castings shall not be plugged or welded for repair purposes.

3.4.6 Lubrication fittings. When specified (see 6.2), wheel and swivel bearings shall be provided with a readily accessible, hydraulic lubrication fitting or an oiler of the type normally supplied by the manufacturer for the class and size.

3.4.6.1 Lubrication. Wheel bearings and swivel bearings shall be factory lubricated prior to delivery. Unless otherwise specified (see 6.2) the lubricant shall be that normally used on the commercially available items.

3.5 Detail requirements, group A, commercial.

3.5.1 Type I, rigid. This type of caster shall consist of a non-swiveling caster assembly in accordance with 3.5.1.1, and a wheel assembly in accordance with 3.5.1.2. When specified (see 6.2), spanner bushings, wheel thrust washers, thread guards, and spacers, in accordance with 3.5.1.2.1 shall be provided.

3.5.1.1 Caster assembly. This caster assembly shall consist of a rigid fork and an axle bolt and nut.

3.5.1.1.1 Caster fork. The caster fork may be formed or stamped as one piece from steel, or it may be cast of iron or aluminum, or it may be a composite which shall have the flat mounting plate welded or riveted to the legs. The dimensions shall be in accordance with normal commercial practice for the class and size specified (see 6.2).

3.5.1.1.2 Axle assembly. The axle assembly shall consist of a steel axle bolt, either solid or with lubrication holes when required, and a nut. Provision shall be made to keep the axle from rotating in the fork. When straight roller bearings are specified the axle shall be of hardened steel unless a hardened steel spanner bushing has also been specified.

3.5.1.2 Wheel assembly. The wheel assembly shall consist of a wheel in accordance with 3.8.1 through 3.8.9 as specified (see 6.2), a wheel bearing of the type as specified (see 6.2), and any other components in accordance with 3.5.1.2.1 as specified (see 6.2).

3.5.1.2.1 Other components. When specified (see 6.2), spanner bushings, wheel thrust washers, thread guards, and spacers shall be considered part of the wheel assembly and shall meet the requirements of 3.5.1.2.1.1 through 3.5.1.2.1.4, as applicable.

3.5.1.2.1.1 Spanner bushing. The spanner bushing shall be a hardened steel tube and shall be smoothed on the outer surface to form an inner raceway for the wheel bearing.

3.5.1.2.1.2 Wheel thrust washers. Wheel thrust washers shall be of hardened steel.

3.5.1.2.1.3 Thread guards. Thread guards shall be formed from steel, aluminum, or impact resistant plastic of the size and thickness normally supplied by the manufacturer for the style of wheel specified.

3.5.1.2.1.4 Spacers. Where used or when specified, spacers shall be of steel with square non-rounded edges. There shall be full bearing contact between the faces of the spacers and the respective horn leg and thread guard.

3.5.2 Type II, swivel. Casters of this type shall consist of a flat mounting plate in accordance with 3.5.2.1, a swivel assembly in accordance with 3.5.2.2, a horn assembly in accordance with 3.5.2.3, and a wheel assembly in accordance with 3.5.2.4. When specified (see 6.2), spanner bushings, wheel thrust washers, thread guards, and spacers, in accordance with 3.5.1.2.1 shall be provided.

3.5.2.1 Flat mounting plate. This plate shall be flat, with no sharp corners, and shall be of sufficient strength and thickness to meet the performance requirements of 3.4 when tested in accordance with section 4. The dimensions shall be as specified (see 6.2) in accordance with table II. Slotted holes may be used in place of circular mounting bolt holes at the manufacturer's option.

FF-C-88C

3.5.2.2 Swivel assembly. The swivel assembly shall be a single level ball bearing assembly (class 1 only), a bi-level ball bearing assembly, or a double level ball bearing assembly, as specified (see 6.2). The raceways shall be in accordance with 3.5.2.2.1 and the balls shall be in accordance with 3.5.2.2.2.

3.5.2.2.1 Bearing raceways. The raceways shall have a smooth finish similar to that obtained from the use of a coining die and a hardness compatible to that of the bearing balls. The depth of the groove shall not be less than 60 percent of the radius of the balls. The race shall be well formed to prevent loss of balls. Bearing raceways shall be filled to capacity.

3.5.2.2.2 Ball-bearings. Ball bearings shall be carbon steel and shall meet the requirements of the Anti-Friction Bearing Manufacturers Association (AFBMA) for grade 1000 balls or better.

3.5.2.3 Horn assembly. The horn assembly shall consist of a rigid fork in accordance with 3.5.1.1.1 and an axle assembly in accordance with 3.5.1.1.2. The horn assembly shall be securely fastened to the swivel assembly and the flat mounting plate in accordance with normal commercial practice for the specified class and size.

3.5.2.4 Wheel assembly. The wheel assembly shall be in accordance with 3.5.1.2 and shall use one of the wheel styles in accordance with 3.8.1 through 3.8.9, as specified (see 6.2).

3.6 General requirements, group B, special. Casters in this group are those casters with more definitive requirements as set forth in 3.6.1 through 3.7.4.1.

3.6.1 Axle assembly. The axle shall be the nut and bolt type and shall be fabricated from cold rolled steel, 3/8 inch nominal diameter. Provision shall be made to prevent axle rotation.

3.6.2 Wheel assembly. The wheel assembly shall consist of a hard rubber wheel with an integral, metal, self-lubricating type bushing, a spanner bushing, two thread guards, and two spacers if required.

3.6.2.1 Wheel. This wheel shall be a style 4A, hard tread, all rubber wheel in accordance with 3.8.5.

3.6.2.2 Spanner bushing. Unless otherwise specified (see 6.2), a hardened steel spanner bushing, 9/16 inch nominal outside diameter and 0.082 inch minimum wall-thickness, shall be provided to prevent the clamping of the wheel between the legs of the fork when the axle nut is tightened on the axle bolt. The clearance between the outside diameter of the spanner bushing and the inside of the metal, self lubricating type wheel bushing shall not exceed 0.010 inch. The outside surface of the spanner bushing shall be smooth and it shall not rotate. The wheel shall rotate smoothly and fully on the spanner bushing.

3.6.2.3 Thread guards. The caster wheels shall be equipped with steel thread guards formed from stock not less than 1/32 inch thick. They shall be rigidly held to the caster forks and shall not bind the wheel.

3.6.2.4 Spacers. When used, spacers shall be of steel with square non-rounded edges. There shall be full bearing contact between the faces of the spacer and the adjacent horn-leg and thread guard.

3.6.2.5 Operational load capacity. The load capacity of the casters in this group shall be based on the load capacity of the style 4A wheels. For the purpose of this specification the load capacity for the 3-1/2 inch wheel shall be 250 pounds and for the 4 inch wheel it shall be 400 pounds.

3.7 Detail requirements, group B, casters.

3.7.1 Type I, form 1, rigid. This type of caster shall consist of a rigid fork assembly in accordance with 3.7.1.1, an axle assembly in accordance with 3.6.1, and a 3-1/2 inch diameter wheel assembly in accordance with 3.6.2 through 3.6.2.5. The overall height of the caster shall be $4-19/32 \pm 1/16$ inches.

3.7.1.1 Fork assembly. The fork shall be made of forged or flat rolled steel, not less than 0.10 inch in thickness. The fork and mounting plate shall be formed in one integral piece and shall have deep rigidizing indentations. Loads transmitted from the mounting plate to the wheel axle shall be through parallel vertical members. The maximum size of the top surface shall be 5 inches in length by 2-1/2 inches in width. There shall be four mounting-bolt-holes, 5/16 inch diameter, drilled or pierced in the top. The hole centers shall form a rectangle 4 inches long by 1-3/16 inches wide.

3.7.2 Type I, form 2, rigid. This type of caster shall be in accordance with 3.7.1 except that the wheel size shall be 4 inches in diameter, the overall height of the caster shall be $5\text{-}1/16 \pm 1/16$ inches, and the fork assembly plate size shall be in accordance with 3.7.2.1.

3.7.2.1 Fork assembly. The fork assembly shall be in accordance with 3.7.1.1 except that the maximum size of the top surface shall be $6\text{-}1/4$ inches long by $3\text{-}3/16$ inches wide, the diameter of the mounting-bolt-hole shall be $3/8$ inch, and the hole centers shall form a rectangle 5 inches long by $1\text{-}3/4$ inches wide.

3.7.3 Type II, form 1, swivel. This type of caster shall consist of a flat mounting-plate in accordance with 3.7.3.1, a swivel assembly in accordance with 3.7.3.2 through 3.7.3.2.5, a horn assembly in accordance with 3.7.3.3, and a $3\text{-}1/2$ inch diameter wheel assembly in accordance with 3.6.2 through 3.6.2.5. The overall height of the caster shall be $4\text{-}5/8 \pm 1/16$ inches.

3.7.3.1 Mounting plate. The mounting plate shall be made of forged or flat-rolled sheet steel not less than 0.170 inch thick. The plate shall have rounded corners. There shall be two sets of four holes, or four slots, drilled or pierced in the top plate for a $3/8$ inch mounting bolt. The hole centers shall form two rectangles; one 3 inches by 3 inches, the other $3\text{-}7/16$ inches long by $2\text{-}3/8$ inches wide. The rectangles shall lie in the same plane as the outside of the top plate. The maximum size for the top plate shall be $4\text{-}1/2$ inches long by $3\text{-}3/4$ inches wide.

3.7.3.2 Swivel assembly. This swivel assembly shall consist of a main load bearing, a secondary load bearing, and a king bolt. The assembly shall be in accordance with 3.7.3.2.1 through 3.7.3.2.5.

3.7.3.2.1 Swivel assembly movement. The swivel assembly bearings shall consist of ball-bearings and hardened steel raceways, so designed that in swiveling under load all the forces will be transmitted through the balls. The minimum offset between the centerline of the axle and the centerline of the king-bolt shall be $1\text{-}1/4$ inches. When operating under either no load, or rated load, the horn assembly shall swivel freely and there shall be no visible evidence of binding between the balls and the raceways.

3.7.3.2.2 Ball-bearing raceways. The raceways shall have a smooth finish similar to that obtained through the use of a coining die. The depth of the groove shall be not less than 60 percent of the radius of the balls. The race shall be well formed to prevent the loss of the bearing balls. When tested in accordance with 4.5.8 the bearing surface of the raceway shall have a hardness of between 80 and 90 on the Rockwell 15N scale. The hardness shall extend to a depth of between 0.005 inch and 0.015 inch (see 4.4.1.2).

3.7.3.2.3 Ball-bearings. The ball-bearings shall be carbon steel, 0.250 inch nominal diameter, and shall meet the requirements of the Anti-Friction Bearing Manufacturers Association (AFBMA) for grade 500 balls.

3.7.3.2.4 King bolt. The king bolt shall be steel of a minimum effective body diameter of $1/2$ inch. The minimum head diameter shall be $13/16$ inch and the minimum head thickness shall be $1/8$ inch. The bolt shall be secured by cold-heading or upsetting the solid material in such a manner as to prevent rotation of the top mounting plate. The head of the king bolt shall not project above the top surface of the mounting plate. A threaded bolt and nut type king bolt is not acceptable.

3.7.3.2.5 Lubrication. The swivel bearings shall be lubricated, prior to delivery, with a lubricant suitable for use over a range of temperatures from minus 10°F . to plus 160°F .

3.7.3.3 Horn assembly. This horn assembly shall be formed from carbon steel not less than 0.100 inch thick. An axle assembly in accordance with 3.6.1 shall be included as a part of this assembly. The horn assembly shall be securely fastened, to the swivel assembly and the flat mounting plate, with a king-bolt in accordance with 3.7.3.2.4.

3.7.4 Type II, form 2, swivel. This caster shall consist of a threaded socket-mounting in accordance with 3.7.4.1, a swivel assembly in accordance with 3.7.3.2 and a $3\text{-}1/2$ inch diameter wheel assembly in accordance with 3.6.2 through 3.6.2.5. The overall height of the caster shall be $5\text{-}3/8 \pm 1/16$ inches.

3.7.4.1 Threaded socket-mounting assembly. The mounting assembly shall be of steel, hexagonally shaped, not less than $1\text{-}7/16$ inches across the flats. The mounting socket shall be internally threaded and chamfered to receive a standard $3/4$ inch threaded pipe with not less than 10 full threads available for engagement. The threads shall be smooth cut and full depth. The upper bearing swivel shall be adequately supported by means of a bearing plate not less than 0.120 inch in thickness, or by an increase in the mounting outside diameter to equal or exceed the centerline diameter of the ball race.

FF-C-880

3.8 Wheel assembly requirements, styles 1 through 8. The wheel assemblies, used in the casters covered by this specification shall be in accordance with the applicable requirements of 3.8.1 through 3.8.9.

3.8.1 Wheel assembly style 1, hard tread plastic. This style of wheel shall be fabricated of a phenolic resin reinforced with a macerated fabric or fiber filler. The material shall meet the requirements of 3.8.1.1.1 through 3.8.1.1.4 when tested in accordance with 4.3. The wheel tread, as received, shall meet the requirements of 3.8.1.2.1 and 3.8.1.2.2 when tested in accordance with 4.5. The wheel bearing type shall be in accordance with 3.8.1.3 when additional impact strength and load carrying capacity are specified (see 6.2), the tread shall be laminated canvas in lieu of the macerated fabric.

3.8.1.1 Material requirements.

3.8.1.1.1 Compressive strength. The minimum compressive strength shall be 20000 pounds per square inch (psi), when tested in accordance with table X.

3.8.1.1.2 Impact strength. The minimum impact strength shall be 1.7 foot-pounds on the izod 1/2 inch by 1/2 inch notched bar, when tested in accordance with table X.

3.8.1.1.3 Flexural strength. The minimum flexural strength shall be 9,000 psi, when tested in accordance with table X.

3.8.1.1.4 Water absorption. The maximum water absorption shall not exceed 2.5 percent when tested in accordance with table X.

3.8.1.2 Wheel tread requirements (end item).

3.8.1.2.1 Hardness. The hardness of the tread, as received on the assembled caster, shall be 85 \pm 5 points, as measured on the face of the tread with a shore, type D durometer, in accordance with 4.5.5.

3.8.1.2.2 Electrostatic conductive wheels. When specified (see 6.2), electrostatic conductive wheels shall be furnished. The wheels shall be compounded so that when the wheel is subjected to a load, equal to 25 percent of the operational load, the average electrical resistance of the wheel shall be less than 250,000 ohms and the maximum individual electrical resistance reading shall be less than 1,000,000 ohms. Testing shall be in accordance with 4.5.7.

3.8.1.3 Wheel bearings. This style of wheel shall use either a straight roller bearing or ball bearings. When a straight roller bearing is specified, a hardened steel outer raceway or sleeve shall be supplied.

3.8.2 Wheel assembly style 2, metal wheel with molded-on soft rubber tread. This style of wheel shall be fabricated from either steel, fine-grained cast iron, ductile iron, or aluminum alloy, as specified (see 6.2). It shall have a soft rubber tread molded or cured on to the metal rim. The rubber material shall meet the requirements of 3.8.2.1.1 through 3.8.2.1.3, when tested in accordance with 4.3. The wheel tread, as received, shall meet the requirements of 3.8.2.2.1 through 3.8.2.2.3, when tested in accordance with 4.5. The wheel bearing shall be in accordance with 3.8.1.3.

3.8.2.1 Material requirements.

3.8.2.1.1 Tensile strength. The tensile strength of the soft rubber compound shall not be less than 1300 psi when tested in accordance with table X. In addition, after being subjected to the accelerated aging test, in accordance with table X, the tensile strength shall not decrease more than 25 percent from the original condition.

3.8.2.1.2 Elongation. The elongation of the soft rubber compound shall not be less than 250 percent, when tested in accordance with table X. In addition, after being subjected to the accelerated aging test, in accordance with table X, the elongation shall not decrease by more than 25 percent from the original condition.

3.8.2.1.3 Compression set. The permanent set of the soft rubber compound shall not be greater than 50 percent of the deflection, as measured on the test specimen under load (The test specimen shall be subjected to a load which causes a deflection of 25 percent of the original thickness). Testing shall be in accordance with table X.

3.8.2.2 Wheel tread requirements (end item).

3.8.2.2.1 Hardness. Unless otherwise specified (see 6.2), the hardness of the tread, as received on the assembled caster, shall be 70 to 85 points, as measured on the face of the tread with a Shore, type A durometer, in accordance with 4.5.

3.8.2.2.2 Electrostatic conductive treads. When specified (see 6.2), electrostatic conductive treads shall be furnished. The tread shall meet the requirements of 3.8.1.2.2.

3.8.2.2.3 Adhesion. The force required to separate the soft tread from its base or wheel rim shall be not less than 50 pounds-per-inch-of-tread-width, (the tread width shall be measured at the base of the tread) when tested in accordance with 4.5.6. At the conclusion of the adhesion test, the material pulled off, and that remaining on the core or rim, shall show no evidence of blistering or porosity.

3.8.3 Wheel assembly style 3, metal wheel with demountable soft rubber tire. This style of wheel shall consist of two metal sides securely fastened together to hold the rubber tire securely between the rims of the wheel. The metal wheel fastening must be removable for the disassembly and removal of the tire. The lower base portion of the soft cushion rubber tire may be reinforced by metallic or canvas backing or it may be made of harder materials such as hard rubber, fiber, or phenolic materials. The rubber material, used in the tread shall meet the requirements of 3.8.2.1.1 through 3.8.2.1.3, when tested in accordance with 4.3. The wheel tread, as received, shall meet the requirements of 3.8.2.2.1 and 3.8.2.2.2, when tested in accordance with 4.5. When the base material is different from the tread material the tire shall meet the requirements of 3.8.2.2.3 and table VIII. The wheel bearing shall be in accordance with 3.8.3.2.

TABLE VIII. Minimum tread width and thickness

Wheel diameter inches	Tread width inches	Tread thickness ^{1/} _{2/} inches
4	1-1/2 or 2	1/2
5	1-1/2 or 2	1/2
5	2-1/2	3/4
6	1-1/2 or 2	1/2
6	2-1/2	3/4
8	2 or 2-1/2	3/4
10	2-1/2	1
12	3	1

1/ Tolerance plus or minus 1-1/2 percent.

2/ Applies only to cushion rubber tread tires when base material is different.

3.8.3.1 Electrostatic conductive tires. When specified (see 6.2), electrostatic conductive tires shall be furnished which shall meet the requirements of 3.8.1.2.2.

3.8.3.2 Wheel bearings. This style of wheel shall use either a straight roller bearing or ball bearings as specified (see 6.2). When a straight roller bearing is specified, a hardened steel outer raceway or sleeve shall be supplied.

3.8.4 Wheel assembly style 4, hard tread, all-rubber wheel (commercial). This style of wheel shall be fabricated from a non-marking, oil-resistant, high impact strength rubber compound. The rubber material shall meet the requirements of 3.8.4.1.1 through 3.8.4.1.3 when tested in accordance with 4.3. The wheel tread, as received, shall meet the requirement of 3.8.4.2.1, when tested in accordance with 4.5.5. The wheel bearing type shall be in accordance with 3.8.7.1.

3.8.4.1 Material requirements.

3.8.4.1.1 Tensile strength. The tensile strength of the rubber compound shall not be less than 2500 psi when tested in accordance with table X.

3.8.4.1.2 Elongation. The elongation of the rubber compound shall not be less than 1.5 percent when tested in accordance with table X.

3.8.4.1.3 Impact strength. The minimum impact strength of the rubber compound shall be 450 inch-pounds when tested in accordance with 4.3.2. There shall be no cracks or breaks visible after a single impact.

3.8.4.2 Wheel tread requirement (end item).

FF-C-88C

3.8.4.2.1 Hardness. The hardness of the tread, as received on the assembled caster, shall be 80 ± 5 points, as measured on the face of the tread with a Shore, type D durometer, in accordance with 4.5.5.

3.8.5 Wheel assembly style 4A, hard tread, all-rubber wheel (special). The wheel shall be molded, in the size as specified (see 6.2), from a non-marking, oil-resistant, high-impact composition which shall meet the requirements of 3.8.4.1.1, 3.8.4.1.2 and 3.8.5.1 when tested in accordance with 4.3. The wheel tread shall meet the requirements of 3.8.5.2.1 and 3.8.5.2.2. An integral, full-width, metal, self-lubricating bushing, shall be secured into the hub of the wheel so that it cannot work loose under normal operating conditions. The wheel faces shall be uniformly rounded and shall be concentric with the hub bushing, within a limit of 0.020 inches as measured at the highest point of the tread. There shall be no flat spots on the wheel tread. The sides of the wheel may be parallel, or tapered outward in the direction of the hub, at the option of the manufacturer. The greatest width of the wheel shall be at the hub.

3.8.5.1 Impact strength. The minimum impact strength of the rubber compound shall be 0.30 foot-pounds per inch of notch on the Izod notched bar specimen when tested in accordance with table X.

3.8.5.2 Wheel tread requirements (end item).

3.8.5.2.1 Tread width. Caster wheels 3-1/2 inches in diameter shall have a tread width of $1-5/16 \pm 1/16$ inches. Caster wheels 4 inches in diameter shall have a tread width of $1-9/16 \pm 1/16$ inches. The required tread width shall be measured along a circle whose radius is 1/4 inch less than the maximum wheel radius.

3.8.5.2.2 Hardness. The hardness of the tread, as received on the assembled caster, shall be in accordance with 3.8.4.2.1.

3.8.6 Wheel assembly style 5, soft tread, all-rubber wheel. This style of wheel shall have a hard rubber core which shall meet the requirements of 3.8.4.1.1 through 3.8.4.1.3. A soft rubber tread which meets the requirement of 3.8.2.1.1 through 3.8.2.2.1 shall be securely bonded to the hard rubber core. Wheel bearings shall be in accordance with 3.8.7.1.

3.8.6.1 Electrostatic conductive wheels. When specified (see 6.2), electrostatic conductive wheels shall be furnished. The wheels shall meet the requirements of 3.8.1.2.2.

3.8.7 Wheel assembly style 6, all metal wheel. This style of wheel shall be of a metal and design as specified (see 6.2). The wheel shall be of the type commercially available for the specified class and size. Wheel bearings shall be in accordance with 3.8.7.1.

3.8.7.1 Wheel bearings. This style of wheel shall use a wheel bearing in accordance with tables III through VII (for the size specified) as specified (see 6.2).

3.8.8 Wheel assembly style 7, metal wheel with a demountable polyurethane tire. This style of wheel shall have two metal sideplates, of a metal as specified (see 6.2), securely bolted together to hold the polyurethane tire securely in place between the rims of the wheel. The tire shall be molded of polyurethane which shall meet the requirements of 3.8.8.1.1 through 3.8.8.1.3 when tested in accordance with 4.3. The wheel tread as received shall meet the requirements of 3.8.8.2.1, when tested in accordance with 4.5.5. The wheel bearing type shall be in accordance with 3.8.1.3.

3.8.8.1 Material requirements.

3.8.8.1.1 Tensile strength. The tensile strength of the polyurethane shall not be less than 4000 psi, when tested in accordance with table X. In addition after being subjected to the accelerated aging test, in accordance with table X, the tensile strength shall not decrease more than 25 percent from the original condition.

3.8.8.1.2 Elongation. The elongation of the polyurethane shall not be less than 375 percent when tested in accordance with table X. In addition, after being subjected to the accelerated aging test, in accordance with table X, the elongation shall not decrease by more than 25 percent from the original condition.

3.8.8.1.3 Compression set. The permanent set of the polyurethane shall not be greater than 50 percent of the deflection, as measured on the test specimen under load. (The test specimen shall be subjected to a load which causes a deflection of 25 percent of the original thickness). Testing shall be in accordance with table X.

3.8.8.2 Wheel tread requirements (end item).

3.8.8.2.1 Hardness. The hardness of the tread, as received on the assembled caster, shall be 90 ± 5 points, as measured on the face of the tread with a Shore, type A durometer, in accordance with 4.5.5.

3.8.9 Wheel assembly style 8, metal wheel with molded-on polyurethane tread. This style of wheel shall be of a metal and a design as specified (see 6.2), and shall have a polyurethane tread molded or cured on to the wheel base. The polyurethane shall meet the requirements of 3.8.8.1.1 through 3.8.8.1.3, when tested in accordance with 4.3. The wheel tread, as received shall meet the requirements of 3.8.9.1.1 and 3.8.9.1.2, when tested in accordance with 4.5. The wheel bearing type shall be in accordance with 3.8.1.3.

3.8.9.1 Wheel tread requirements (end item).

3.8.9.1.1 Hardness. The hardness of the tread, as received on the assembled caster shall be 90 ± 5 points, as measured on the face of the tread with a Shore, type A durometer, in accordance with 4.5.5.

3.8.9.1.2 Adhesion. The force required to separate the polyurethane tread from its base or wheel rim shall not be less than 100 pounds per inch of tread width (measured at the base of the tread), when tested in accordance with 4.5.6. At the conclusion of the adhesion test, the material pulled off and that remaining on the core or rim shall show no evidence of blistering or porosity.

3.8.10 Wheel tolerances. The tolerances for wheel diameters shall be $\pm 1/32$ inch for 2 inch to 5 inch wheels, $\pm 1/16$ inch for 6 inch to 8 inch wheels, $\pm 1/8$ inch for 10 inch to 12 inch wheels. The tolerance for tread widths shall be; $\pm 1/16$ inch for classes, 1, 2, and 3 and $\pm 1/8$ for classes 4 and 5.

3.9 Performance requirements, both groups.

3.9.1 Operational load capacity. The casters, covered by this specification shall be capable of carrying the loads as specified; in accordance with table I for group A casters, and in accordance with 3.6.2.5 for group B casters, when tested in accordance with 4.5.1. For the purposes of this specification "intermittent" shall mean 15 minutes of rolling operation for each hour of work and "continuous" shall mean 45 minutes of rolling operation for each hour of work. The cycling of the stop and go periods shall be at the option of the manufacturer. After the test, in accordance with 4.5.1, the casters shall be examined for any visible evidence of damage, binding, looseness, or permanent deformation.

3.9.2 Static load capacity. The casters covered by this specification shall be designed and constructed to withstand a compressive load equal to four times the load rating of the individual caster (see table I and 3.6.2.5), for a period of one minute. The casters after being tested in accordance with 4.5.2, shall show no visible damage to any parts nor any residual deformation of the wheel tread.

3.9.3 Transverse static load, type I only. Type I casters shall be designed to sustain a flexural load equal to the rated load when applied along the axis of the axle. The maximum deflection of the axle relative to the mounting plate shall not exceed the value of (0.030 inches times the nominal wheel diameter). The permanent displacement of the axle due to the application and removal of the load shall not exceed the value of (0.010 inches times the nominal wheel diameter). Testing shall be in accordance with 4.5.3.

3.9.4 Floormarking and operation. All casters which use a rubber, synthetic rubber, or plastic tread (except when conductive rubber is specified) shall leave no visible marks on a smooth concrete or wood floor. The caster wheel shall roll freely when loaded or unloaded. Swivel casters shall swivel freely and smoothly in both the clockwise and counterclockwise directions a full 360° when loaded or unloaded. Testing shall be in accordance with 4.5.4.

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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 that supplies and services conform to the prescribed requirements.

4.1.1 Inspection of components and materials. In accordance with 4.1, the supplier is responsible for insuring that components and materials are manufactured, and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified or, if none, in accordance with this specification.

FF-Q-88C

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

First Article Inspection (see 4.3).

Quality Conformance Inspection (see 4.4).

4.3 First article inspection. When required (see 6.2), the material used in the manufacture of the caster wheels, tires, or treads shall be tested in accordance with table X. The specimens to be tested shall either be molded specimens prepared at the time of manufacture of the wheels, or specimens cut from the completed wheel at the option of the manufacturer. When molded specimens are used they shall be prepared from the same compounding, in the same location and under the same conditions as the completed wheels.

4.3.1 First article sampling. The number of specimens to be tested shall be the number required to make one test unit in accordance with the applicable test method cited in table X. The material will be rejected whenever the average value, as computed in accordance with the applicable test method, does not meet the requirements of section 3.

TABLE X. First article inspection requirements, and tests

Inspect for	Requirements paragraph	Test standard	Test method	Wheel styles
Compressive strength	3.8.1.1.1	Federal	1021	1
Impact strength	3.8.1.1.2	Test	1071	1
Flexural strength	3.8.1.1.3	Method	1031	1
Water absorption	3.8.1.1.4	Standard 406	7031	1
Impact strength	3.8.4.1.3; 3.8.6	None	4.3.2	4,5
Impact strength	3.8.5.1	Federal Test Method Standard Number 601	11221	4A
Tensile strength	3.8.2.1.1; 3.8.3; 3.8.6; 3.8.8.1.1; 3.8.9		4111	2,3,5,7,8
Elongation	3.8.2.1.2; 3.8.3; 3.8.6; 3.8.8.1.2; 3.8.9		4121	2,3,5,7,8
Accelerated aging	3.8.2.1.1; 3.8.2.1.2; 3.8.3; 3.8.6; 3.8.8.1.1; 3.8.8.1.2 3.8.9		7001	2,3,5,7,8
Tensile strength	3.8.4.1.1; 3.8.5;		11011	4,4A,5
Elongation	3.8.4.1.1; 3.8.5;		11021	4,4A,5
Compression set	3.8.2.1.3; 3.8.3; 3.8.6; 3.8.8.1.3; 3.8.9		3311	2,3,5,7,8

4.3.2 Impact strength, styles 4 and 5. Mount a molded specimen, 4-inches in diameter and 1-1/2 inches thick, on a 3/4 inch diameter axle supported in "V"-grooves. Drop a 25 pound weight from a height of 18 inches on to the face of the tread. Check for cracks or breaks to determine conformance to 3.8.4.1.3.

4.4 Quality conformance inspection. Sampling for examination and test shall be in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.4.1 Intermediate inspection, group B, type II only. In accordance with 4.1.1, components shall be inspected and tested in accordance with all the requirements of referenced specifications and standards, unless otherwise excluded in this specification or applicable purchase document.

4.4.1.1 Intermediate dimensional examination. Bearing balls for swivel casters shall be examined to determine compliance with dimensional requirements of 3.7.3.2.3. The sample unit shall be one ball. The lot shall consist of all bearing balls of the same diameter offered for inspection at one time. The inspection level shall be S-2 with an acceptable quality level (AQL) of 4.0 defects, expressed in terms of defects per hundred units.

4.4.1.2 Intermediate hardness tests. Raceways and balls of the main and secondary load bearings shall be tested for hardness as specified in 4.5.8. The sample unit shall be one raceway or ball. A lot shall consist of all the raceways or balls that have been hardened. The inspection level shall be S-2 with an AQL of 1.5 defects, expressed in terms of defects per hundred units. Depth of hardness of the raceways (3.7.3.2.2) shall be determined during the hardness test.

4.4.2 End product inspection.

4.4.2.1 Lot size, individual casters. A lot shall consist of all casters of one group, type, class, size, and form offered for acceptance at one time. The sample unit shall be one complete caster.

4.4.2.2 Lot size, matching sets. When casters are furnished as matching sets, a lot shall consist of all matching sets of casters of one group, class, size, and form offered for acceptance at one time. The sample unit shall be four complete casters (two casters of each type).

4.4.2.3 Visual examination. Each sample unit shall be visually examined for defects as set forth in table XI. The inspection level shall be level V with an AQL of 1.5 percent defective for major defects and an AQL of 6.5 percent defective for minor defects.

TABLE XI. Classification of defects

Examine	Defect	Classification	
		Major	Minor
Caster	Casters not the group, type, or class specified (1.2).	X	
	Types I and II casters not matching sets as specified (3.3.2).	X	
	Dimensions not within specified tolerances (3.3.3, 3.4.2.3, 3.4.2.4, 3.6.1, 3.6.2.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.8.10).	X	
Axles	Threads not in accordance with NBS, H28 (3.3.4).		X
Wheels	Electrostatic conductive wheels not furnished, when specified (3.8.1.2.2, 3.8.2.2.2, 3.8.3.1, 3.8.6.1).	X	
All metal	Finish not as specified (3.3.5).	X	
Wheel tires and treads	Rubber or polyurethane tires or treads show visible blisters, cracks, checks, or discolorations. Flash not as specified (3.3.6).		X
Caster	Marking not as specified (3.3.7).		X
	Casters not clean or properly assembled, burrs and sharp edges not removed, parts damaged (3.3.8).	X	
	Material not as specified (3.4.2.1; 3.5.1.2.1.1; 3.5.1.2.1.2; 3.5.1.2.1.3; 3.5.1.2.1.4; 3.6.1; 3.6.2; 3.7.1.1; 3.7.3.1).	X	
	Dimensions not as specified (3.4.2.3, tables III through VII, 3.6.1, 3.6.2.2, 3.6.2.3, 3.7.1, 3.7.1.1, 3.7.2, 3.7.2.1, 3.7.3, 3.7.3.1, 3.7.3.2.1, 3.7.4, 3.7.4.1).	X	
	Caster component combination not as specified (tables III through VII).	X	
Mounting plate	Bolt hole edges not free from burrs (3.4.3).		X
Caster frames	Welds, when present, not free from closely spaced in-line porosity or cracks, and not fused to base metal (3.4.4).	X	
Caster frames and wheels	Castings not free from closely spaced in-line porosity or cracks. Castings plugged or welded (3.4.5).	X	
Wheel assembly	Components missing when specified (3.5.1.2.1).	X	
Bearings	Not lubricated (3.4.6.1, 3.7.3.2.5).	X	

FF-C-88C

4.4.3 Inspection of preparation for delivery. An examination shall be made to determine the conformance to section 5 for preservation, packaging, and packing. The sample unit shall be one container fully prepared for delivery. The lot shall be the number of containers offered for delivery at one time. The inspection level shall be S-2 with an AQL of 4.0 defects, expressed in terms of defects per hundred units. Defects will be in accordance with table XII.

TABLE XII. Examination of preparation for delivery

Examine	Defect
Markings	Omitted; incorrect; illegible; of improper size, location, sequence, or method of application.
Preservation	Preservative improperly applied or missing.
Materials	Component missing; damaged or otherwise defective.
Workmanship	Loose steel strapping or tape banding; blocking or cushioning inadequate, improper or missing.
Weight of contents	More than specified.

4.4.4 End item testing. Each sample unit shall be tested in accordance with 4.5.1 through 4.5.5. When electrostatic conductive wheels or treads are specified they shall be tested in accordance with 4.5.7. When wheels are specified with molded-on treads they shall be tested in accordance with 4.5.6. The sample unit shall be one complete caster of the same group, type, class, style, and size. (Caster wheels to be tested for electrostatic conductivity or adhesion shall be those removed from the casters in the sample unit.) The inspection level, for all testing, shall be S-1 with an AQL of 6.5 defects expressed in terms of defects per hundred units.

4.5 Test methods.

4.5.1 Operational load capacity. Attach the casters as running gear to a vehicle or frame capable of holding the rated load of the individual casters times the number of casters used. Mount the vehicle with attached casters on an endless belt or drum-type testing machine (Obstacles shall be built into the belt or drum so that the caster wheels are impacted once every 3 foot of travel. The height of the obstacle shall be dependent upon the diameter of the wheel and shall equal 1/16 inch in height for each two inches of wheel diameter). Run the machine for a period of two hours at the speed indicated in the footnotes of tables III through VII for the applicable class, style, and size. The operation cycling shall be in accordance with 3.9.1. At the completion of this test, there shall be no indication of excessive bearing wear, damage to bearing races, cutting or scuffing of tires or looseness of tire treads. Any such visual indication shall be cause for rejection.

4.5.2 Static load. Apply a compressive load, equal to four times the load rating of the individual casters (the applied load is dependent upon the number of casters attached to the frame or vehicle), to the caster through the top mounting surface for a period of one minute. Remove the load and examine the casters to determine conformance with the requirements of 3.9.2. Use the same casters which have been tested in 4.5.1.

4.5.3 Transverse static load, type I only. Attach the caster to a suitable test fixture. Apply a load equal to the rated load through the axle and perpendicular to the wheel. Measure the deflection of the axle, relative to the mounting surface, at maximum load, and after removal of the load. Use an instrument sensitive to 0.001 inch or smaller motion. (The test fixture shall have sufficient rigidity so that its deflection, due to the load applied to the casters, can be ignored.) Check the readings to determine conformance with the requirements of 3.9.3.

4.5.4 Floormarking and operation. This test shall be conducted on the sample unit which has been used for the test in 4.5.2. After the test indicated in 4.5.2 has been completed, move the dolly back and forth six revolutions of the wheel in each direction (one cycle) on a smooth concrete or hardwood floor. The speed of movement shall be in accordance with the speeds indicated in the footnotes of tables III through VII for the applicable casters. After the completion of 6 cycles inspect the floor to determine conformance with the requirements of 3.9.4.

4.5.5 Hardness. The tread of rubber, synthetic rubber, or plastic wheels shall be tested for hardness with a Shore type A or D durometer as applicable. Five separate, instantaneous readings shall be made at room temperature.

4.5.6 Adhesion, styles 2, and 8 only. This test shall be conducted at standard room temperature. Cut the tread transversely, down to its base. (The tread may be trimmed down to the base along the flanges to minimize tearing of the tread.) Support the wheel horizontally on free rotating bearings. Separate the tread circumferentially from the base (by means of a suitable testing machine which exerts a radial pull) at a rate of approximately 6-inches per minute to determine conformance with 3.8.2.2.3, and 3.8.9.1.2. at the conclusion of this test examine the material pulled off and that remaining for blistering and porosity.

4.5.7 Electrostatic conductive wheels. When electrostatic conductive wheels are specified (see 6.2), they shall be tested as follows: clean the surface of the wheel by any method which removes wax and dirt, but does not abrade or change the surface of the wheel. After cleaning the wheel, dry it and condition it for 24 hours at a temperature of 70°F and a relative humidity of less than 80 percent. Place a compressive load of 25 percent of its rated capacity on the wheel. Place the wheel on a clean, dry, flat, metal plate, attach one electrode to the axle or hub of the wheel. Attach the second electrode to the flat metal plate. Use any resistance apparatus of suitable range which has an open circuit (DC) of approximately 500 volts and measure the resistance between the electrodes. (For safety of the operator, the maximum current which can be delivered by the apparatus, through a resistance of 500 ohms, should be less than 10 milli-amperes) Rotate the wheel. As each successive quintile of the outer tread makes contact, with the plate, measure the resistance with the electrodes in the same relative position, as on the initial reading. Establish the average and the maximum values to determine conformance with 3.8.1.2.2.

4.5.8 Hardness, group B, type II only. Raceways and bearing balls shall be tested for Rockwell C hardness in accordance with method 243.1 of Federal Test Method Standard 151 to determine conformance with 3.7.3.2.2 and 3.7.3.2.3. Hardness of raceways shall be taken on an adjacent surface, near the raceway surface.

5. PREPARATION FOR DELIVERY

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

5.1.1 Level A. Each caster shall be lubricated to capacity with the manufacturer's recommended lubricant containing a rust inhibitor. Each caster shall be preserved in accordance with method III of MIL-P-116, and wrapped in kraft paper or polyethylene to prevent abrasion.

5.1.2 Level C. Casters shall be preserved and packaged in accordance with the industry's practice.

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

5.2.1 Level A. Casters, preserved and packaged as specified in 5.1, shall be packed in a snug-fitting shipping container conforming to class 2, style 2 or 4 of PPP-B-621; or style RSC, V3: or V3s of PPP-B-636. Casters shall be immobilized within the shipping container with lumber blocking and bracing, or scored and die-cut fiberboard sheets as applicable. Unless otherwise specified, each nailed wood shipping container shall be provided with a type I or II, grade C case liner conforming to MIL-L-10547. Each fiberboard shipping container shall be waterproofed by means of tape in accordance with the appendix of the container specification. Each shipping container shall be closed and reinforced with flat steel strapping or tape banding in accordance with the appendix of the applicable container specification. Weight of contents of the nailed wood container shall not exceed 120 pounds. Weight of contents of the fiberboard shipping container shall not exceed 65 pounds.

5.2.2 Level B. Casters, preserved and packaged as specified in 5.1, shall be packed in a snug-fitting shipping container conforming to class 1, style 2 or 4 of PPP-B-621; or style RSC, type CF or SF, class domestic of PPP-B-636. Casters shall be immobilized as specified in 5.2.1. Each fiberboard shipping container shall be closed in accordance with the appendix of PPP-B-636. Weight of contents of the nailed wood shipping container shall not exceed 120 pounds. Weight of contents of the fiberboard shipping container shall not exceed 65 pounds.

5.2.3 Level C. Casters, preserved and packaged as specified in 5.1, shall be packed in a manner to insure carrier acceptance and safe delivery at destination at the lowest transportation rate for such supplies. Shipments shall be in accordance with National Motor Freight Classification Rules or Uniform Freight Classification Rules, as applicable.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with Fed. Std. No. 123.

FF-C-88C

5.3.2 Military requirements. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Casters covered by this specification are designed for manual operation at speeds not to exceed 4 mph. They are used on material-transport equipment in warehouses, repair facilities, libraries, or post offices where the floors are relatively smooth and travel distances are short.

6.2 Ordering data. Purchasers should exercise any desired option offered herein, and procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Groups, type, class, style and form required (see 1.2.1).
- (c) Whether first article inspection or testing is required (see 3.2).
- (d) When casters of different types shall be furnished as matching sets (see 3.3.2).
- (e) Finish required (see 3.3.5).
- (f) Material (see 3.4.2.1; 3.8.2; 3.8.7; 3.8.8; 3.8.9).
- (g) Load capacity required (see 3.4.2.2; 3.6.2.5).
- (h) Dimensions for overall height, mounting plate, hole spacing, mounting-bolt diameter, and swivel radius required (see 3.4.2.3).
- (i) Wheel diameter, tread width, axle diameter, and bearing type (see 3.4.2.4; 3.5.1.2; table VIII; 3.8.3.2; 3.8.5).
- (j) Lubrication fittings (see 3.4.6).
- (k) Whether spanner bushings, wheel thrust washers, thread guards, and spacers are required (see 3.5.1.2.10, 3.5.1.2; 3.5.1.2.1; 3.5.2).
- (l) Whether a single level, bi-level, or double level ball bearing swivel assembly is required (see 3.5.2.2).
- (m) When style 1 wheel shall be of laminated construction (see 3.8.1).
- (n) When electrostatic conductive treads or wheels are required (see 3.8.1.2.2; 3.8.2.2.2; 3.8.3; 3.8.3.1; 3.8.6.1).

6.3 Definitions.

6.3.1 Wheel thrust washers. A hardened steel flat washer, normally used with straight roller bearings or plain sleeve bearings as a means of reducing the frictional wear between the wheel hub and the horn legs.

6.3.2 Electrostatic conductive casters. Casters having the capability to dissipate a static electric charge to the ground without sparking, (age, service, contact with lubricants and floor cleaning materials may adversely affect this quality.) Continuous testing should be accomplished at intervals of at least once per month to determine the conductive condition of the wheels.

DOD coordination waived.

Preparing activity:

GSA-FSS

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein. Price 20 cents each.

GENERAL SERVICES ADMINISTRATION - FEDERAL SUPPLY SERVICE SPECIFICATION COMMENT SHEET		BUDGET BUREAU NO. 29-R0175
INSTRUCTIONS		
This form provides a way for users of this specification to inform the originator of problems encountered in its use. It is not to be used to request changes to accommodate proprietary features. All comments will be considered and appreciated, but please do not expect a reply. To comment, detach, complete, and mail to Gen. Services Adm., FSS (FMSH), Washington, DC 20406		
NOTE: Comments on this form do not constitute or imply authorization to waive any part of the document or serve to amend contractual requirements.		
1. SPECIFICATION		
FF-C-88C Casters, Rigid and Swivel, Industrial Duty		
2. CONTRACT NO. (If any)	3. QUANTITY ON CONTRACT (Optional)	4. DOLLAR VALUE (Optional)
5. GENERAL NATURE OF PROBLEM (e.g., inspection difficulties, manufacturers unable to meet tolerances, containers collapse under normal warehousing conditions, etc.)		
6. SPECIFIC REQUIREMENTS AFFECTED (Include paragraph number and lines of wording)		
7. SPECIFIC PROBLEMS (e.g., tests in 4.2.2 will not assure that the battery will last required time; temperature ranges in table 2 do not conform to commercially available items.)		
8. RECOMMENDATIONS		
9. NAME OF MANUFACTURER, ASSOCIATION, GOVT., AGENCY, ETC.	10. ADDRESS (Number, Street, City, State and Zip Code)	
11. NAME AND TITLE OF SUBMITTER	12. DATE	