

GGG-R-791H
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 SUPERSEDING
 GGG-R-791G
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FEDERAL SPECIFICATION

RULES, MEASURING

This specification is 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 measuring rules used for English, metric, or a combination of English and metric measurements.

1.1.1 Federal specification coverage. Federal specifications do not cover all varieties of the commodity indicated by the title of the specification, or which are commercially available, but are intended to cover only those generally used by the Federal Government.

1.2 Classification.

1.2.1 Types, classes, and styles. The measuring rules covered by this specification shall be of the following types, classes, and styles, as specified (see 6.1):

Type I	- Caliper
Type II	- Carpenters' folding
Type III	- Multiple folding
Class I	- Wood
Style 1	- Standard duty, inside reading
Style 2	- Standard duty, outside reading
Style 3	- Heavy duty, outside reading, with extension slide
Class 2	- Steel
Class 3	- Aluminum
Type IV	- Steel, machinists'
Class 1	- Rigid
Class 2	- Flexible
Type VI	- Glaziers
Class 1	- Plain cap
Class 2	- Hook cap
Type VII	- Blacksmiths'
Type VIII	- Key seat
Type IX	- Hook
Type X	- Circumference
Type XI	- Shrinkage
Type XII	- Aluminum, one-piece

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2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specification:

PPP-P-40 - Packaging and Packing of Hand Tools

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and Commercial Item Descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification, and other Federal specifications and Commercial Item Descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.)

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

Military Standard:

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

(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.)

3. REQUIREMENTS

3.1 Illustrations. Illustrations herein are descriptive and not restrictive and are not intended to preclude the purchase of rules otherwise conforming to this specification.

3.2 Graduation lines. The graduation lines shall be of a uniform and readily distinguishable width and depth, shall be straight, permanent, and free from discontinuities and ragged edges and shall appear in a distinctive manner so as to be readily legible under all service conditions. Graduation lines representing equal fractional aliquots of any scale, in descending order, shall be of equal height and readily distinguishable by the relative height from graduation lines representing other fractional aliquots. The maximum variation in width between like types of graduations and in the individual

graduation shall be such that the maximum width shall not exceed the minimum width by more than 35 percent of the minimum width. Graduations shall extend to the reading edge of the measuring rule.

3.3 Figures. All figures shall be clear, permanent, free from ragged edges and breaks and shall appear in a distinctive manner so as to be readily legible under all service conditions. The figures and graduations shall resist easy removal by scraping. Except types I and II measuring rules shall read from left to right. Types I and II rules shall read from right to left. When specified (see 6.1), type III rules shall read from right to left.

3.4 Marking. Each item shall be marked with the manufacturer's name or identifying symbol and the state or country of manufacture. The marking shall be engraved, etched, molded, or indented directly on the item's surface in such a manner that it remains clearly legible throughout the legible throughout the life of the item.

3.5 Type I, caliper rule.

3.5.1 Construction. The type I, caliper rule shall be constructed that one fold (leg) of the rule shall be grooved and provided with a substantial sliding, flush-fitting caliper made of brass. The folds of the caliper rule shall be constructed of seasoned boxwood, unless maple, beech, or birch is specified (see 6.1). The free ends of the end folds shall be bound with brass, securely fastened by means of rivets passing through the folds and binding members. Unless otherwise specified, the middle joint of the rule shall be either of the "square joint" or "arch joint" type, and shall have two flanges (wings) for each fold covering the faces of the fold at the ends. The middle joint shall be brass and shall be secured to the ends of the folds with neatly headed rivets which pass through the folds and joint members. The width of the folds of any one rule shall be uniform.

3.5.2 Graduations and figures. The caliper slide shall have one face subdivided for at least 5 inches to sixteenths or thirty-seconds of an inch and the opposite face to thirty-seconds of an inch with both faces reading from right to left from the inside caliper hook. The four edges of the rule shall be respectively subdivided to eighths, tenths, twelfths, and sixteenths of an inch, except that the eight inch graduations may be on the edge of only one fold. The sixteenth inch graduations shall be continuous over the joint. One corner of each graduated edge of each face shall be marked to show the smallest fractional subdivision to which it is graduated. All inch graduations shall be marked with the proper figures.

3.5.3 Accuracy. The scale error of any graduated edge shall not exceed $\pm 1/64$ inch between any two graduations, 3 inches apart, including the total length of the graduated edge.

3.5.4 Finish. The wood folds shall have a protective coating suitable for preventing absorption of moisture. Calipers, end bindings, joints, and other bindings shall be of bright finished brass.

3.5.5 Requirements. The type I, caliper rule shall conform to the requirements of table I and shall be similar to figure 1.

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TABLE I. Type I, caliper rule

Size	Number of folds	Joint location	Width folded $\pm 1/16$ inch	Length unfolded (excluding head)	Graduated length of caliper slide (minimum)
Feet			Inches	Inches	Inches
1	2	6 inch division	1-3/8	12	5

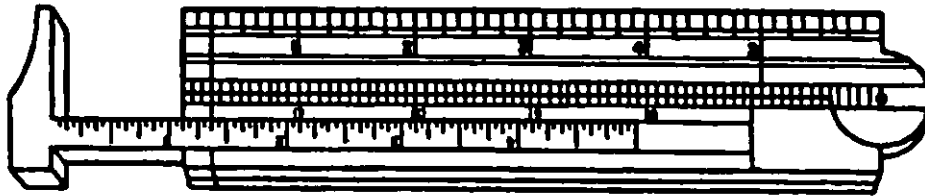


Figure 1. Type I, caliper rule.

3.6 Type II, carpenters' folding rule.

3.6.1 Construction. The folds of the carpenters' folding rule shall be constructed of seasoned boxwood, unless maple, beech, or birch is specified (see 6.1). The free ends of the end folds shall be bound with brass, securely fastened by means of rivets passing through the folds and binding members. The middle joint of the rule shall be either of the "square joint" or "arch joint" type, and shall have two flanges (wings) for each fold covering the faces of the folds at the ends. Intermediate joints shall be of the "middle plate" type and shall have two plates for each fold, set flush with the top and bottom edge surfaces of the folds at the ends. The middle and intermediate joints shall be brass and shall be secured to the ends of the folds with neatly headed rivets or cut pins which shall pass through the folds and joint members. The width of the folds of any one rule shall be uniform.

3.6.2 Graduations and figures.

3.6.2.1 Two foot size. Unless otherwise specified (see 6.1), the two foot size shall have the two edges of the rule respectively subdivided to eighths and sixteenths of an inch, one edge of one face subdivided to eighths of an inch and one edge of the opposite face subdivided to sixteenths of an inch. The subdivision on at least one edge of each face shall be continuous over all joints. All inch graduations, except on joints and terminal end, on one face shall be marked with the proper figures.

3.6.2.2 Three foot size. The three foot size rule shall have one edge of one face subdivided to eighths of an inch and one edge of the opposite face subdivided to sixteenths of an inch. The subdivision shall be continuous on one face over all joints. All inch graduations except on joints and terminal end shall be marked with the proper figures.

3.6.3 Accuracy. The scale error of any graduated edge shall not exceed $\pm 1/32$ inch between any two graduations, 3 inches apart, including its total length of graduated edge.

3.6.4 Finish. The wood folds shall have a protective coating suitable for preventing absorption of moisture. Calipers, end bindings, joints, and other bindings shall be of bright finished brass.

3.6.5 Requirements. The type II carpenters' folding rule shall conform to the requirements shown in table II for the size specified (see 6.1) and shall be similar to figure 2.

TABLE II. Type II, carpenters' folding rule

Size	Number of folds	Joint location	Width folded $\pm 1/16$ inch	Length unfolded (excluding head)
Feet			Inches	Inches
2	4	6, 12, and 18 inch divisions	1	24
3	4	9, 18, and 27 inch divisions	1	36

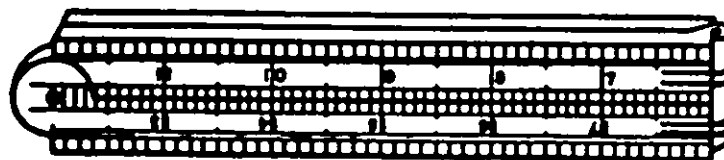


Figure 2. Type II, carpenters' folding rule.

3.7 Type III, multiple folding rule.

3.7.1 Class 1, wood rule.

3.7.1.1 Construction. The multiple folding, class 1, wood rule shall be multiple folding, having joints with metal joint plates and durable spring tempered inner springs every 6 inches along its length

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between ends. The folds shall be of seasoned hard maple, beech, or birch. The joints shall be of brass, phosphor bronze, copper-nickel-zinc alloy, or steel properly plated with brass, nickel, or similar material. The joints shall be securely fastened to the folds and shall be constructed in such a manner as to maintain the tolerance of accuracy specified in 3.7.1.4 when tested as specified in 4.4.2. When tested as specified in 4.4.2, the rule shall hold rigid in the extended position when supported edgewise between the third and fourth joints from either end and shall not stretch more than 1/16 inch from its original length when tested as specified in 4.4.2. The joints shall be permanently secured to the folds in such a manner that the folds will not loosen, weaken, or slip. The two extreme ends of the rule shall be provided with permanently secured tips of the same material as the joint plates, to prevent end-splitting and permit readability of end graduations. Each fold shall have two strike plates, one at each jointed end, arranged to prevent any contact between faces of adjacent folds, except that the first and last folds shall have a single strike plate at their joints. Strike plates shall be of the same material as the joint plates, except that brass strike plates may be furnished with plated steel joint plates, and shall be either independent members or part of the joint assembly. The metal joint plates and strike plates shall be free of hazardous sharp edges and burrs. Unless otherwise specified (see 6.1), the rule shall be either with or without a folding end hook, at the option of the contractor. The end hook, if any, shall be of substantial construction with a hinge rivet passing through the fold and arranged so as to extend 3/8 inch from the edge when unfolded and have the zero reading at the inside of the hook.

3.7.1.2 Sizes. Unless otherwise specified (see 6.1), the class 1, wood rule shall be of a 6 foot length $\pm 3/32$ inch. The width of the rule shall be $5/8 \pm 1/64$ inch.

3.7.1.3 Graduations and figures.

3.7.1.3.1 Subdivisions. Unless otherwise specified (see 6.1), subdivisions on each face of the rule shall be subdivided into a sixteenth of an inch. Either one edge or both edges of each face shall be subdivided. At the option of the manufacturer, figures on each face shall read either consecutively in inches over the total length of the rule, or consecutively in inches through the first eleven inches with the remaining length reading consecutively in inches on one edge and feet and inches on the other edge. Figures on one face shall read in a direction opposite those on the other face. Figures shall be horizontal reading; i.e., the figures shall be upright when the rule is horizontal, unless vertical-reading figures are specified (see 6.1). Graduations and figures shall be impressed into the surface of the folds, visible to the naked eye.

3.7.1.3.2 Special subdivisions. If engineers' (surveyors' or roadbuilders') rules are specified (see 6.1), the rules shall be subdivided to hundredths of a foot on one face and to sixteenths of an inch on the opposite face, with each foot on each face marked to indicate the number of feet. Each tenth-foot graduation line of the hundredths foot scale shall extend the full width of the rule and shall be marked to indicate to both feet and tenths of a foot, except that nine-tenths of the first foot of the rule shall be marked to indicate tenths of a foot only and each numbered foot shall be followed by the letter "F". Each inch graduation line of the sixteenth inch scale shall extend the full width of the rule and shall be marked to indicate both feet and inches, except that the first 11 inches of the rule shall be marked to indicate inches only and each numbered foot shall be followed by the letter "F".

3.7.1.3.3 Special graduations and figures. When specified (see 6.1), special graduations and figures such as the combination metric and English or other subdivisions shall be provided on the rule.

3.7.1.4 Accuracy. The scale error of any graduated edge at any 2 foot interval (span) shall be not more than 1/32 inch.

3.7.1.5 Finish. The rule shall have an enamel or lacquer finish and shall be either yellow or white. The ends of the folds, except under the metal end cap of the first and last fold, shall be smooth and coated with a contrasting colored enamel or lacquer to preclude the absorption of moisture.

3.7.1.6 Style 1, standard duty, inside reading rule. The folds of the style 1, standard duty, inside reading rule shall be at least 0.095 inch in finished thickness before enameling or lacquering. The style 1 rule shall be of the inside reading type; i.e., the numbering of figures shall commence on the inside of the folds.

3.7.1.7 Style 2, standard duty, outside reading rule. The folds of the style 2, standard duty, outside reading rule shall be at least 0.095 inch in finished thickness before enameling or lacquering. The style 2 rule shall be of the outside reading type; i.e., the numbering of figures shall commence on the outside of the folds.

3.7.1.8 Style 3, heavy duty, outside reading, with extension slide rule. The folds of the style 3, heavy duty, outside reading with extension slide rule shall be at least 0.120 inch in finished thickness before enameling or lacquering. The style 3 rule shall be of the outside reading type; i.e., the numbering of figures shall commence on the outside of the folds. The overall length of each joint shall be at least 1-1/2 inches. The joints shall be of brass, phosphor-bronze, copper-nickel-zinc alloy, or steel plated with brass, nickel, or similar material. The rule shall be equipped with a brass or plated steel slide for taking inside measurements. The ends of the folds shall be square and shall terminate on the even inch marks. The slide shall be graduated and numbered for a distance of 6 inches or more. The graduations shall be in 1/16 inch increments. The numbering shall be in inches. The slide shall run under friction. The slide shall travel 6 inches and a stop(s) shall be provided to retain the slide in the first fold and to stop the slide in the closed and extended positions. A stud or button-type head approximately 1/8 inch in diameter by 1/16 inch \pm 1/32 inch high shall be provided, beyond the 6 inch number on the slide, for adjustment of the slide by the operator's finger.

3.7.2 Class 2, steel rule.

3.7.2.1 Construction. The class 2 rule shall be made from high grade carbon steel, hardened, and spring tempered. Any 2 foot span of the rule be bent into a complete circle without showing a permanent set or damage to the joints. The class 2, steel rule shall be multiple folding having joints every 6 inches along the length between ends. The joints shall be formed by means of a 1/8 inch diameter rivet joining the ends of two sections and fitted at each end with a washer 1/64 inch thick and 1/4 inch outside diameter. Joints shall lock into position by means of two drawn spots in each end of each section, except ends, drawn in such a manner as to form a lug on one side of the section and a matching recess on the other side. When sections are aligned, the lugs on one section shall fit snugly into the recesses in the other section thereby holding the rule in rigid alignment. The rule shall

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hold rigid in the extended position when supported edgewise between the third and fourth joints from the end of the 6 foot rule and between the first joint and end of the 3 foot rule. The diametrical play at each joint shall not result in a total lengthwise movement of more than 0.020 inch for the 3 foot rule and 0.040 inch for the 6 foot rule.

3.7.2.2 Sizes. As specified (see 6.1), the rule lengths shall be 3 foot $\pm 1/64$ inch or 6 foot $\pm 1/32$ inch. The rule width shall be $3/4$ inch $\pm 1/32$ inch and the thickness shall be $1/32$ inch ± 10 percent.

3.7.2.3 Graduations and figures. The graduations and figures shall be machine cut or acid etched after machine dividing to a depth of 0.003 inch ± 0.001 inch. One edge of both faces of the rule shall be subdivided into sixteenths of an inch. Inch graduation lines shall extend fully to both edges, and figures shall read consecutively in inches over the total length of the rule, from left to right, on both faces. Opposite faces shall be numbered from opposite ends. Figures shall be horizontal reading; i.e., the figures shall be upright when the rule is in the horizontal position.

3.7.2.4 Accuracy. The scale error in any 1 inch interval shall not exceed 0.006 inch, and in any 3 foot interval shall not exceed $1/32$ inch.

3.7.2.5 Finish. The rule shall have a smooth natural ground surface, finished to minimize reflections, and shall be coated with an oil or grease compound suitable for prevention of corrosion.

3.7.3 Class 3, aluminum rule.

3.7.3.1 Construction. The class 3, aluminum rule shall be made from high grade aluminum alloy. The class 3, aluminum rule shall be multiple folding, and have joints every 6 inches along its length between ends. The joints shall be made of brass or brass-plated male and female plates securely fastened to the rule sections and joined by a corrosion-resistant rivet and washer. The rules shall hold rigid in the extended position when supported edgewise between the third and fourth joints from either end and shall not stretch more than $1/16$ inch from its original length. The joints shall be free of hazardous sharp edges and burrs. Joint plates shall mate in such a manner as to hold the rule sections in alignment when open or closed. When specified (see 6.1), the rule shall be fitted with a folding brass hook. The hook shall be of substantial construction with a brass hinge rivet passing through the section and shall be arranged so as to extend $3/8$ inch from the edge of the rule when opened. A zero reading shall be at the inside of the open hook.

3.7.3.2 Sizes. The rule lengths shall be 6 foot $\pm 1/16$ inch, the rule width shall be $9/16 \pm 1/16$ inch, and the thickness shall be $1/16$ inch ± 10 percent.

3.7.3.3 Graduations and figures. Graduation lines and figures shall be filled with durable black material. One edge of both faces of the rule shall be subdivided to sixteenths of an inch. Figures on each face shall read consecutively in inches over the total length of the rule with figures of one face reading in the opposite direction from those on the opposite face. The figures shall be horizontal reading; i.e., the figures shall be upright when the rule is horizontal, unless vertical reading figures are specified (see 6.1), then the figures shall be either inside or outside reading and the numbering shall commence on either the inside or outside faces of the end sections. When specified (see 6.1), the rule

shall be subdivided into one-hundredths of a foot on one face and to sixteenths of an inch on the opposite face. Each foot graduation on both faces shall be marked to indicate the number of feet. On the face graduated in one-hundredths of a foot, the tenth foot graduations within each foot shall be numbered 1 to 9, inclusive, and on the face graduated in sixteenths of an inch, the inch graduations within each foot shall be numbered 1 to 11, inclusive.

3.7.3.4 **Accuracy.** The scale error in any 2 foot interval (span) shall be not more than 1/32 inch.

3.7.3.5 **Finish.** The surface finish shall be natural dull aluminum.

3.7.3.6 **Requirements.** The multiple folding rules shall be similar to figure 3.

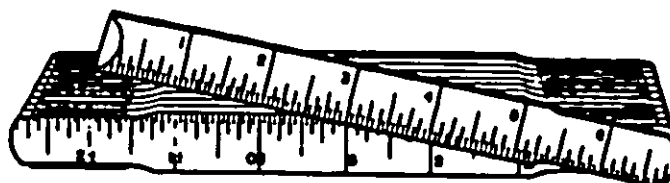


Figure 3. Type III, multiple folding, class 1, wood; class 2, steel; and class 3, aluminum rule.

3.8 Type IV, steel machinists' rule.

3.8.1 Class 1, rigid rule.

3.8.1.1 **Construction.** The steel machinists' rule shall be constructed in one piece, without joints, and shall be made of tool or stainless steel, properly hardened, tempered, ground, and finished to minimize reflections. The opposite faces and the opposite longitudinal edge surface shall be ground parallel (see 3.8.1.3.6); the opposite transverse edge surfaces shall be similarly ground, at right angles to the faces and longitudinal edge surfaces.

3.8.1.2 **Graduations and figures.** Class 1, rigid rule. The class 1, rigid rule graduations shall be machine cut or acid etched, and shall be graduated as specified herein for each class. The width of the graduations shall be uniform for each scale between 0.004 inch and 0.010 inch wide, the width of the graduation shall be less than the space between graduations. The depth of all graduations and figures shall be from 0.002 inch to 0.005 inch and all the graduations shall extend to and be perpendicular to the edge. One corner of each graduated edge shall be marked to show the smallest subdivision to which it is graduated. Inch graduations shall be suitably marked. Unless otherwise specified (see 6.1), except for rules having number 1, 10, and 12 graduations, subdivisions shall be numbered as follows: Thirty-seconds of an inch shall be numbered every fourth division; 4, 8, 12, 16, 20, 24, and 28. Sixty-fourths of an inch shall be numbered every eighth division; 8, 16, 24, 32, 40, 48, and 56. Tenths, fiftieths, and hundredths of an inch shall be numbered every tenth of an inch; 1, 2, 3, 4, 5, 6, 7, 8, and 9. Numbering shall not be required for eighths and sixteenths of an inch. Standard graduation combinations shall be used. As specified in 3.8.1.2.1 and 3.8.2.1, selections may be made for the class 1 rule and the class 2 rule from the standard graduations listed in table III.

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TABLE III. Type IV, class 1 and 2, steel machinists' rule graduations

Graduation No.		
1	One face	One edge: 10ths, 20ths, 50ths, 100ths One edge: 12ths, 24ths, 48ths
	Other face	One edge: 16ths, 32nds, 64ths One edge: 14ths, 28ths
2	One face	One edge: 10ths, 20ths, 50ths, 100ths One edge: 12ths, 24ths, 48ths
	Other face	One edge: 16ths, 32nds, 64ths One edge: 8ths of an inch
3	One face	One edge: 32nds of an inch One edge: 64ths of an inch
	Other face	One edge: 10ths of an inch One edge: 50ths of an inch
4	One face	One edge: 32nds of an inch One edge: 64ths of an inch
	Other face	One edge: 8ths of an inch One edge: 16ths of an inch
4-1	One face	One edge: 8th of an inch One edge: 16ths of an inch
	Other face	Same but from opposite end
5	One face	One edge: 32nds of an inch One edge: 64ths of an inch
	Other face	One edge: 10ths of an inch One edge: 100ths of an inch

TABLE III. Type IV, class 1 and 2, steel machinists' rule graduations (cont'd)

Graduation No.		
6-1	One face	One edge: 10ths of an inch One edge: 50ths of an inch
	Other face	Not graduated
6-2	One face	Both edges: 10ths of an inch
	Other face	Both edges: 50ths of an inch
7	One face	One edge: 32nds of an inch - or - One edge: 16ths of an inch One edge: 64ths of an inch - or - One edge: 32nds of an inch
	Other face	One edge: 16ths of an inch - or - One edge: 64ths of an inch One edge: 100ths of an inch - or - One edge: 100ths of an inch
9	One face	One edge: 16ths of an inch One edge: 32nds of an inch
	Other face	One edge: 64ths of an inch One edge: Not graduated
10	One face	One edge: 32nds of an inch One edge: 64ths of an inch
	Other face	Not graduated
11	One face	One edge: 100ths of an inch One edge: 64ths of an inch
	Other face	Not graduated
12	One face	One edge: 50ths of an inch One edge: 100ths of an inch
	Other face	Not graduated

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TABLE III. Type IV, class 1 and 2, steel machinists' rule graduations (cont'd)

Graduation No.		
16	One face	One edge: 32nds of an inch One edge: 64ths of an inch
	Other face	One edge: 50ths of an inch One edge: 100ths of an inch
M-1	One face	One edge: Millimeters One edge: 1/2 millimeters
	Other face	Not graduated
M-2	One face	Both edges: Millimeters, or millimeters and 1/2 millimeters
	Other face	One edge: Millimeters One edge: 1/2 millimeters
ME-1	One face	One edge: 1/2 millimeters One edge: 64ths of an inch
	Other face	Not graduated
ME-2	One face	One edge: Millimeters One edge: 64ths of an inch, or 1/32 and 1/64
	Other face	One edge: 1/2 millimeters or millimeters and 1/2 millimeters One edge: 32nds of an inch

3.8.1.2.1 Special graduations and figures. Unless otherwise specified (see 6.1), the rule shall carry No. 4 graduations as specified in 3.8.1.2 and table III. When specified, the rule shall carry one of the following graduations:

- No. 6-2 - 6, 12, 18, 24, 36, and 48 inch lengths
- No. 7 - 1, 2, 3, 4, 6, 9, 12, 18, 24, 36, and 48 inch lengths
- No. M-2 - 5, 10, 15, 20, 30, 50, and 100 centimeter lengths
- No. ME-2 - 5, 10, 15, 20, 30, 50, and 100 centimeter lengths

3.8.1.3 Accuracy.

3.8.1.3.1 Blades and scales. The zero end of the blade end is defined as that blade end nearest the lowest graduation. The leading edge of a graduation is defined as graduation edge closest to the blade end being used in the measurement.

3.8.1.3.2 Squareness of ends. Both blade ends shall be square to both blade edges within an angle of 90 degrees + 5 minutes.

3.8.1.3.3 Blade length tolerance. The blade length tolerance for 6 inch blades shall be +0.004 to -0.002 inches; for 9, 12, and 18 inch blades shall be +0.005 to -0.010 inches; and for 24 and 36 inch blades shall be +0.007 to -0.012 inches.

3.8.1.3.4 Scale centering error. The scale centering error shall be measured from the leading edge of the first 1/2 inch graduation to the zero blade end and from the leading edge of the last 1/2 inch graduation to the opposite blade end. The scale centering error shall not exceed ± 0.0025 inches for each measurement.

3.8.1.3.5 Scale graduation error. Throughout the first 6 inches, the scale graduation error measured between the left scale end and any graduation shall not exceed +0.004 to -0.0035 inches. Throughout greater than 6 inches to 12 inches inclusive, the scale graduation error measured between the left scale end and any graduation shall not exceed +0.005 to -0.0035 inches. Throughout greater than 12 inches to 18 inches inclusive, the scale graduation error measured between the zero scale end and any graduation shall not exceed +0.006 to -0.0035 inches. Throughout greater than 18 inches to 36 inches inclusive, the scale graduation error measured between the zero scale end and any graduation shall not exceed +0.007 to -0.0035 inches.

3.8.1.3.6 Parallelism. The out-of-parallel error of opposite edges shall not exceed 0.0024 inch. The out-of-parallel error of opposite faces shall not exceed 0.003 inch up to 18 inch lengths; rules over 18 inch in length shall not exceed 0.002 inch per foot.

3.8.1.3.7 Straightness. The straightness of any edge for each 12 inches or fraction thereof shall not vary more than ± 0.001 inch.

3.8.1.4 Finish. The class 1 rule shall have a chrome plated, natural ground or dull satin (nonglare) finish. The edges shall be ground and may be with or without plating. The rule graduations and figures shall be furnished with black fill. The rule shall have a coating of oil or grease suitable for preventing corrosion in storage.

3.8.1.5 Requirements. The class 1 rule shall conform to the requirements shown in table IV for the length specified (see 6.1) and shall be similar to figure 4. When specified (see 6.1), the class 1 rule shall be furnished with a positive or sliding hook.

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TABLE IV. Type IV, class 1, steel, machinists' rigid rule

Length		Width		Thickness	
		Minimum	Maximum	Minimum	Maximum
Inches	Centimeters	Inches	Inches	Inch	Inch
1	---	0.450	0.510	0.040	0.051
2	5	0.450	0.510	0.040	0.051
3	---	0.450	0.565	0.040	0.051
4	10	0.550	0.625	0.040	0.051
6	15	0.700	0.760	0.040	0.051
9	20	0.820	0.880	0.040	0.051
12	30	0.940	1.005	0.040	0.051
18	50	1.120	1.255	0.040	0.051
24	---	1.120	1.255	0.040	0.051
36	100	1.120	1.255	0.040	0.051
48	---	1.120	1.255	0.040	0.051

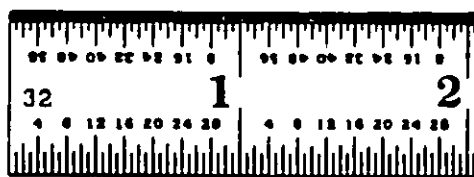


Figure 4. Type IV, steel machinists' rule; class 1, rigid, class 2, flexible; type XI shrinkage; and type XII aluminum.

3.8.2 Class 2, flexible.

3.8.2.1 Construction. The class 2 rule shall be constructed the same as specified in 3.8.1.1 with the exception that the rule shall be fully flexible.

3.8.2.2 Graduations and figures. Unless otherwise specified (see 6.1), all rules shall carry No. 10 graduations specified in 3.8.1.2 and table III. When specified, the rule shall carry one of the following graduations:

<u>Number</u>	<u>Lengths (inches)</u>	<u>Lengths (centimeters)</u>
3	6 only	---
5	6, 12, 18, 24, and 36	---
6-1	6, 12, 18, 24, and 36	---
9	6 only	---
11	6 and 12	---
12	6 and 12	---
M-1	---	10, 15, 20, 30, and 50
ME-1	---	10, 15, 20, 30, and 50

3.8.2.3 Accuracy. The accuracy requirements shall be as specified in 3.8.1.3.

3.8.2.4 Finish. The finish shall be in accordance with 3.8.1.4.

3.8.2.5 Requirements. The class 2 rule shall conform to the requirements specified in table V for the length specified (see 6.1) and shall be similar to figure 4.

TABLE V. Type IV, class 2, steel machinists' flexible rule

<u>Length</u>		<u>Width</u>		<u>Thickness</u>	
		<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>
<u>Inches</u>	<u>Centimeters</u>	<u>Inches</u>	<u>Inches</u>	<u>Inch</u>	<u>Inch</u>
1	---	0.450	0.500	0.010	0.016
2	---	0.450	0.500	0.010	0.016
3	---	0.450	0.500	0.010	0.016
4	10	0.450	0.500	0.010	0.016
6	15	0.450	0.500	0.010	0.016
9	20	0.450	0.500	0.010	0.016
12	30	0.450	0.500	0.010	0.016
18	50	0.675	0.750	0.016	0.021
24	---	0.675	0.750	0.016	0.021
36	---	0.675	0.750	0.016	0.021
48	---	0.675	0.750	0.016	0.021

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3.9 Type VI, glaziers' rule.

3.9.1 Class 1, plain cap.

3.9.1.1 Construction. The construction of the class 1, plain cap rule shall be constructed from one piece of wood fitted at each end with solid brass caps. The wood shall be made of close-grained, thoroughly seasoned, sound wood. The caps shall be not less than 1/4 inch wide and the rule ends shall be tenoned so that the cap and rule surfaces are flush. The caps shall be attached by means of countersunk brass rivets.

3.9.1.2 Sizes. The size of the rule shall conform to the dimensions shown in table VI for the size specified (see 6.1).

TABLE VI. Type VI, class 1, glaziers', plain cap rule

Rule length	Length tolerance (±)	Width (± 5 percent)	Thickness (± 10 percent)
Inches	Inch	Inches	Inch
36	1/64	2	1/4
48	1/32	2	1/4
60	1/32	2-1/2	1/4
72	1/32	2-1/2	1/4
84	3/64	3	1/4

3.9.1.3 Graduations and figures. Graduation lines shall be of uniform width and depth and shall be filled with a durable black material. Both edges of one face and one edge of the opposite face shall be subdivided to eighths of an inch and shall be numbered in consecutive inches over the length of the rule. The remaining edge shall be subdivided to 1/4 foot and shall have each foot graduation numbered to indicate the number of feet. The 1/4 foot graduations, within each foot, shall be numbered 3, 6, and 9 to indicate inches. The rule shall read from left to right on both faces with figures on one face reading in the opposite direction from those on the opposite face.

3.9.1.4 Accuracy. When used under normal atmospheric conditions, the scale error shall not exceed 1/64 inch in any 2 foot interval, 1/32 inch in any 6 foot interval, or 5/64 inch in any 12 feet.

3.9.1.5 Finish. The wood surface shall be smoothly and evenly machined and shall be sealed against moisture. The surface of brass caps shall be polished. Both wood and brass surfaces shall be coated with a transparent, abrasion, and moisture-resistant material.

3.9.1.6 Requirements. The class 1, glaziers' plain cap rule shall be similar to figure 5.

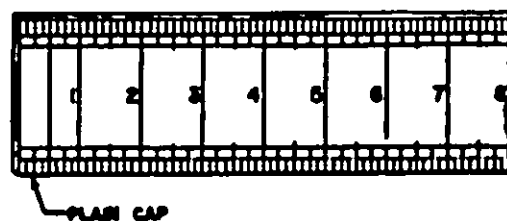


Figure 5. Type VI, class 2, glaziers' plain cap rule.

3.9.2 Class 2, glaziers' hook cap.

3.9.2.1 Construction. The glaziers' hook cap rule shall be constructed from one piece of wood, fitted on one end with a brass cap not less than 1/4 inch wide, and at the other end with two brass plates, extending not less than 1-1/4 inches from the rule end. The wood shall be made of close-grained, thoroughly seasoned, sound wood. One of the plates shall carry a head extending in one direction to form a substantial hook that shall extend 3/8 inch from the face of the rule. The other plate (plain) shall be fitted to the face of the rule opposite the hook and the plates and the rule joined by means of countersunk brass rivets. The rule ends shall be tenoned so that the cap and plates are flush with the rule faces.

3.9.2.2 Sizes. The size of the rule shall conform to the dimensions shown in table VII for the size specified (see 6.1).

TABLE VII. Type VI, class 2, glaziers' hook cap rule

Rule length	Length tolerance (\pm)	Width (\pm 5 percent)	Thickness (\pm 10 percent)
Inches	Inch	Inches	Inch
36	1/64	2	5/16
48	1/32	2	5/16
60	1/32	2-1/2	3/8
72	1/32	2-1/2	3/8
84	3/64	3	3/8
96	3/64	3	3/8
108	1/16	3	3/8
120	1/16	3	3/8
144	5/64	3	3/8

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3.9.2.3 Graduations and figures. Graduation lines shall be of uniform width and depth and shall be filled with a durable black material. Both edges of both faces shall be subdivided to eighths of an inch and numbered consecutively in inches. The rule shall read from left to right with the opposite face measuring in opposite directions. The inside, or hook, face shall have the beginning of measurement (zero) at the capped end, reading (left to right) toward the hook. The outside face (opposite hook) shall have the beginning of measurement (zero) opposite the inside of the hook, reading (left to right) away from the hook.

3.9.2.4 Accuracy. When used under normal atmospheric conditions, the scale error shall not exceed 1/64 inch in any 2 foot interval, 1/32 inch in any 6 foot interval, or 5/64 inch in any 12 feet.

3.9.2.5 Finish. The wood surface shall be smoothly and evenly machined and shall be sealed against moisture. The surface of brass caps shall be polished. Both wood and brass surfaces shall be coated with a transparent, abrasion, and moisture-resistant material.

3.9.2.6 Requirements. The class 2, hook cap rule shall be similar to figure 6.

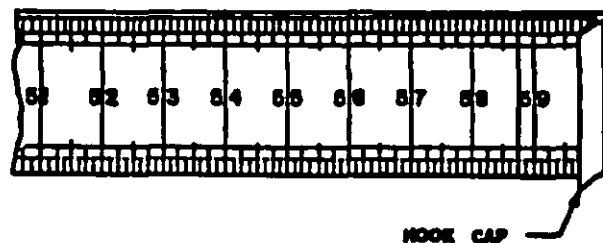


Figure 6. Type VI, class 2, glaziers' hook cap rule.

3.10 Type VII, blacksmiths' rule.

3.10.1 Construction. The blacksmiths' rule shall consist of two steel folds $\frac{3}{4} \pm \frac{1}{16}$ inch wide, and 0.032 ± 0.005 inch thick. The two folds shall be riveted together to form a 24 inch rule when opened. The rule shall be the stop-joint type capable of holding the two folds in a straight line.

3.10.2 Graduations and figures. The opposite sides of the rule shall read from the reverse ends. One side of the rule shall be graduated in sixteenths of an inch and the opposite side in eighths of an inch. The graduated lines and figures shall be sunken, black, and easy to read.

3.10.3 Accuracy. The scale error on either graduated edge of the rule shall not exceed $\pm \frac{1}{64}$ inch between any two graduations including its total length of graduated edge.

3.10.4 Finish. The blacksmiths' rule shall have a smooth natural surface, finished to minimize reflections, and shall be coated with oil or grease compound suitable for the prevention of corrosion.

3.10.5 Requirements. The blacksmiths' rule shall be similar to figure 7.

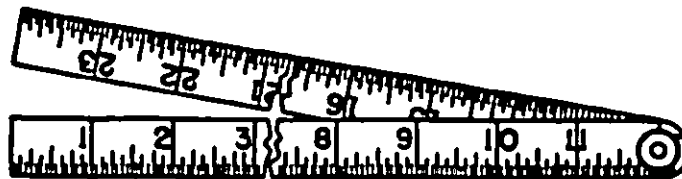


Figure 7. Type VII, blacksmiths' rule.

3.11 Type VIII, key seat rule.

3.11.1 Construction. Unless otherwise specified (see 6.1), the key seat rule shall be of one-piece construction (without clamps) or two-piece construction (with clamps), at the option of the contractor. The one-piece rule shall be made from a single piece of tool steel, shall represent a true right angle in section (measuring approximately 7/16 inch by 11/16 inch overall), and both outer edges shall be beveled and graduated in thirty-seconds of an inch. The two-piece rule shall consist essentially of one plain straightedge and one type IV, class 1, rigid steel rule, and when specified (see 6.1), one graduated auxiliary straightedge shall be furnished. The plain straightedge shall be fitted with two clamps suitable for properly clamping either the steel rule or the auxiliary straightedge to form a box square. The clamps shall be provided with suitable thumbscrews.

3.11.2 Graduations and figures. Graduation and figures shall conform to the applicable requirements of 3.8.

3.11.3 Accuracy.

3.11.3.1 Blades and scales. The zero end of the blade end is defined as that blade end nearest the lowest graduation. The leading edge of a graduation is defined as graduation edge closest to the blade end being used in the measurement.

3.11.3.2 Squareness of ends. The out of square error shall not exceed \pm one minute (either the 90 degree angle between end and edge of the one piece rule, or end and edge of any of the three straightedges on the two-piece rule, or the box square formed by clamping the plain straightedge to either of the two graduated straightedges).

3.11.3.3 Blade length tolerance. The overall length shall be either 6 or 9 inches as specified (see 6.1). The blade length tolerance for 6 inch blades shall be +0.004 to -0.002 inches; for 9 inch blades shall be +0.005 to -0.010 inches.

3.11.3.4 Scale centering error. The scale centering error shall be measured from the leading edge of the first 1/2 inch graduation to the zero blade end and from the leading edge of the last 1/2 inch graduation to the opposite blade end. The scale centering error shall not exceed \pm 0.0025 inches for each measurement.

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3.11.3.5 Scale graduation error. Throughout the first 6 inches, the scale graduation error measured between the left scale end and any graduation shall not exceed $+0.004$ to -0.0035 inches. Throughout greater than 6 inches to 12 inches inclusive, the scale graduation error measured between the left scale end and any graduation shall not exceed $+0.005$ to -0.0035 inches.

3.11.3.6 Parallelism. The out-of-parallel error of opposite edges shall not exceed 0.0024 inch. The out-of-parallel error of opposite faces shall not exceed 0.003 inch up to 18 inch lengths.

3.11.3.7 Straightness. The straightness of any edge for each 12 inches or fraction thereof shall not vary more than ± 0.001 inch.

3.11.4 Finish. Unless otherwise specified (see 6.1), the key seat rule shall have a smooth natural ground surface, finished to minimize reflections, and shall have an oil or grease coating suitable for preventing corrosion in storage without adversely affecting the material coated.

3.11.5 Requirements. The key seat rule shall be similar to figure 8.

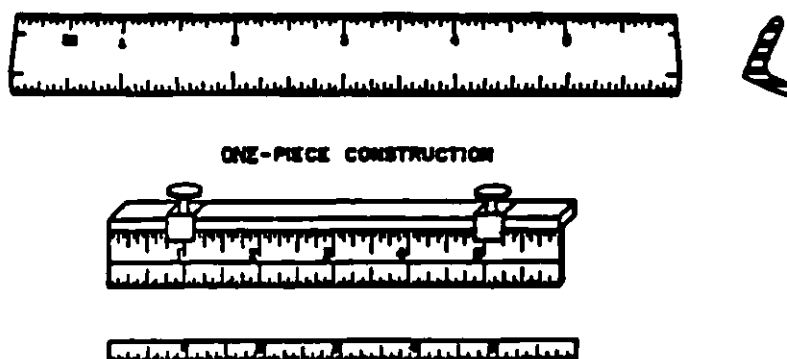


Figure 8. Type VIII, key seat rule.

3.12 Type IX, hook (narrow) rule.

3.12.1 Construction. The hook (narrow) rule shall be designed for taking measurements through holes and for setting calipers. The rule shall be constructed of tool steel, $3/16$ inch wide by $3/64$ inch thick ± 10 percent, or when specified (see 6.1), $3/8$ inch wide by $3/64$ inch thick ± 10 percent, properly hardened, spring tempered, ground, and finished to minimize reflection. The opposite faces and opposite longitudinal edges shall be ground parallel. Transverse edges, the end surface of the hook, the inside edge of the hook stop, and longitudinal edges shall be at right angles to the faces. Overall length, including the hook, shall not exceed $6-5/32$ inches.

The hook shall be either the fixed or sliding type, as specified, and shall be of hardened steel attached to the end of the rule. Removable hooks shall be provided with an eccentric stud clamping device for locking the hook in position. The hook shall extend beyond the graduated edge of the rule

approximately 1/8 inch so as to provide a stop, the inside edge of which shall be flush with the end of the rule. The inside edge of the stop shall be beveled so as to provide a surface width not more than the thickness of the rule.

3.12.2 Graduation and figures. One edge of one face of the rule shall be graduated to thirty-seconds of an inch, and one edge of the opposite face shall be graduated to sixty-fourths of an inch; width and depth of graduations shall be in accordance with 3.8.1.2. The face graduated in sixty-fourths of an inch may read from the hook end or opposite end of the rule. Graduations shall be machine cut or acid etched. One corner of each face shall be permanently marked to show the smallest fractional subdivision to which it is graduated.

3.12.3 Accuracy.

3.12.3.1 Blade length tolerance. The length of the rule as measured from the inside edge of the hook shall be 6 inches $+0.004$ inch to -0.002 inch. The scale error from either end of the rule to the nearest half-inch graduation shall not exceed a tolerance of $+0.005$ to -0.002 inch. The scale error between any two graduations shall not exceed ± 0.002 inch, nonaccumulative.

3.12.3.2 Parallelism. The out-of-parallel error of opposite faces and opposite edge surfaces shall not exceed 0.003 inch.

3.12.3.3 Squareness of ends. The out-of-square error (90° angle between end and edge) shall not exceed \pm five minutes.

3.12.3.4 Straightness. The straightness of any edge shall not vary more than 0.0005 inch.

3.12.4 Finish. Unless otherwise specified (see 6.1), the rule shall have a smooth natural ground surface, finished to minimize reflection, and shall have a coating of an oil or grease compound suitable for preventing corrosion in storage without affecting the material coated. When specified (see 6.1), a nonreflecting chrome finish shall be furnished with black filled graduations and figures.

3.12.5 Requirements. The hook rule shall be similar to figure 9.

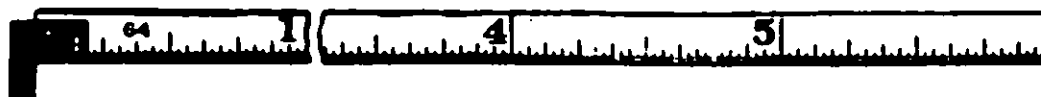


Figure 9. Type IX, hook rule.

3.13 Type X, circumference rule.

3.13.1 Construction. The type X, circumference rule shall be made of high grade carbon steel, hardened, and spring tempered. The circumference rule shall be constructed from one piece of steel and shall have a 1/4 inch hole centrally located in the first inch.

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3.13.2 Sizes. As specified (see 6.1), the circumference rule shall be furnished in 3 foot or 4 foot lengths $\pm 1/64$ inch. The rule width shall be $1-1/4 \pm 1/32$ inch and the thickness shall be $1/16$ inch ± 10 percent.

3.13.3 Graduations and figures. Graduations lines shall be of uniform width and graduations and marking shall be in accordance with 3.8.1.2. The width of the graduations shall be uniform for each scale between 0.004 inch and 0.010 inch wide for both acid etched and machine cut rules. For acid etched rules graduated in intervals of thirty-seconds of an inch or greater, widths may be between 0.010 inch and 0.018 inch wide; the width of the graduation shall be less than the space between graduations. The top edge of the graduated face shall be subdivided to sixteenths of an inch and numbered in consecutive inches. The bottom edge of this face shall be subdivided to eighths of circumference inches and numbered in consecutive circumference inches. The figures on both edges shall read from left to right with beginning of measurement (zero) located at the end of the rule where the hole is punched. The circumference, for any diameter, is read on the bottom edge opposite the diameter measurement on the top edge. The opposite face of the rule shall carry tables for laying out sheet metal measures for both liquid and dry measure and for laying out both flat top and pitched top cans. This face shall also carry cubic content date and mensuration formulas. All markings shall be etched to the same depth as graduations and figures on the measuring face.

3.13.4 Accuracy. The graduation error shall not exceed 0.006 inch in any 1 inch, 0.008 inch in any 1 foot, nor 0.012 inch in any 2 feet. The scale error between any two graduations shall not exceed ± 0.004 inch per foot, nonaccumulative.

3.13.5 Finish. The circumference rule shall have a smooth natural ground surface, finished to minimize reflections, and shall be coated with an oil or grease compound suitable for prevention of corrosion.

3.13.6 Requirements. The circumference rule shall be similar to figure 10.

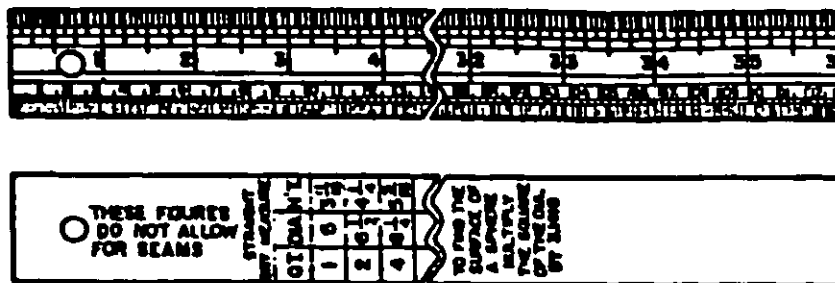


Figure 10. Type X, circumference rule.

3.14 Type XI shrinkage rule.

3.14.1 Construction. The shrinkage rule shall be constructed as specified in 3.8.1.1.

3.14.2 Graduations and figures. The shrinkage rule shall carry No. 4 graduations as specified in table III, unless otherwise specified (see 6.1). When specified, the rules shall carry No. 6-2 graduations as specified in table III. Using either graduations, the divisions shall be expanded and the overall length extended to allow for shrinkage of hot metals. As specified (see 6.1), the shrinkage allowance for each 1 foot (12 inches) shall be 1/16, 1/12, 1/10, 3/32, 1/8, 9/64, 5/32, 3/16, 1/4, 5/16, 3/8, 7/16, or 1/2 inch.

3.14.3 Accuracy. Accuracy shall conform to the requirements of 3.8.1.3 through 3.8.1.3.7.

3.14.4 Finish. The finish for the shrinkage rule shall conform to 3.8.1.4.

3.14.5 Requirements. The shrinkage rule shall conform to the requirements shown in table VIII for the length specified (see 6.1), and shall be similar to figure 4.

TABLE VIII. Type XI shrinkage rule

Length	Width		Thickness	
	Minimum	Maximum	Minimum	Maximum
Inches	Inch	Inches	Inch	Inch
6	11/16	3/4	0.031	0.052
12	15/16	1	0.041	0.068
24	15/16	1-1/4	0.041	0.068

3.15 Type XII aluminum one-piece rule.

3.15.1 Construction. The aluminum one-piece rule shall be constructed of one piece, without joints, shall be made of tempered aluminum finished to minimize reflection, and shall have a 1/4 inch hole centrally located at one end. The graduations and figures shall be printed black with a durable baking ink.

3.15.2 Graduations and figures. The aluminum, one-piece rule shall be graduated on one side only with one edge reading in sixteenths of an inch and the other edge in eighths of an inch, unless otherwise specified (see 6.1). Each inch graduation shall be suitably numbered with the numbering of each edge starting at opposite ends of the rule. One corner of each graduated edge shall be marked to show the smallest subdivision to which it is graduated.

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3.15.3 Accuracy.

3.15.3.1 Graduation error. The graduation error shall not exceed ± 0.008 inch in 12 inches or under, 1/64 inch in any 36 inches, or 1/32 in any 96 inches.

3.15.3.2 Parallelism. The out-of-parallel error of opposite edge shall not exceed 0.003 inch per foot.

3.15.3.3 Squareness of ends. The out-of-square error (90° angle between end and edge) shall not exceed ten minutes.

3.15.4 Finish. The surface finish shall be natural dull aluminum.

3.15.5 Requirements. The aluminum, one-piece rule shall conform to table IX for length specified and shall be similar to figure 4.

TABLE IX. Type XII. aluminum, one-piece rule

Length	Width		Thickness	
	Minimum	Maximum	Minimum	Maximum
Inches	Inch	Inches	Inch	Inch
12	27/32	1-1/16	0.035	0.045
18	1-1/16	1-3/16	0.035	0.045
24	1-3/16	2-1/16	0.060	0.085
36	1-11/16	2-1/16	0.075	0.085
48	1-15/16	2-1/16	0.075	0.130
72	1-15/16	2-1/16	0.097	0.130
96	1-15/16	2-1/16	0.097	0.130

3.16 Metric products. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-pound units, provided they fall within the tolerances specified and all other requirements of this document are met. If a product is manufactured to metric dimensions and those dimensions exceed the tolerances specified in the inch-pound units, a request should be made to the specification preparing activity for change to this document.

3.7 Workmanship. Details of workmanship shall be in accordance with the best commercial standards and practices. Paints, coatings, platings, and finishes shall be smooth adherent, continuous, and not stained or discolored. Fasteners shall be firmly secured and show no evidence of deformation, cross threading, or hazardous burrs. Adhesives and lubricants adequate for their intended purpose shall be properly and neatly applied. Adhesives shall be adequately cured. External and bearing surfaces

shall be free of tool and gouge marks, nicks, or other surface imperfections. The item shall be free from manufacturing workmanship defects (e.g., loose, missing, binding or misaligned parts, sharp or rough external edges, corners or surfaces) and material workmanship defects (e.g., pits, rips, fins, burrs, tears nodules, cracks, blisters) which may adversely impact the item's serviceability, durability, safety or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Component and material inspection. In accordance with 4.1 above, the supplier is responsible for insuring that components and materials used were manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specification and standards to the extent specified, or, if none, in accordance with this specification.

4.2 Sampling procedures. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.3 Examination.

4.3.1 Visual examination. The end items shall be examined for the defects listed in table X. The lot size shall be expressed in terms of measuring rules. The sample unit shall be one measuring rule. The inspection level shall be S-3 and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 1.5 for major and 4.0 for total (major and minor combined) defects.

TABLE X. Classification of defects

Examine	Defect
Finish	Indication of corrosion Not smooth, not clean, not free from burrs, slivers or other detrimental defects
Material	Not fabricated from material specified
Design	Not type, class, and style specified

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TABLE X. Classification of defects (cont'd)

Examine	Defect
Construction and workmanship	Cracks, splits, deep pits, fractured, bent, warped, or crimped Loose rivets; rivets not furnished with washers Joints stick, bind, or are excessively loose Graduations or figures missing, illegible, not uniform, not readily distinguishable, not straight, discontinuities, ragged edges, or not graduated as specified Different fractional aliquots not distinguishable by their relative height
Marking	Missing, incorrect, not legible

4.3.2 Dimensional examination. The end items shall be examined to determine compliance with the dimensional requirements specified herein. Any dimension that is not within the specified requirements shall be classified as a defect. The lot size shall be expressed in terms of measuring rules. The sample unit shall be one measuring rule. The inspection level shall be S-3 and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

4.4 Testing. Each sample unit shall be tested in accordance with 4.4.1, 4.4.2, 4.4.3.1, 4.4.3.2, and 4.4.3.3. The lot size shall be expressed in units of measuring rules. The sample unit shall be one measuring rule. The inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

4.4.1 Scale accuracy (all types). The graduated scales for linear measurement shall be tested for compliance with the accuracy requirements specified for the individual type and class. These tests shall be made with suitable master rules, instruments, or laboratory apparatus of known accuracy. Tests for types IV, VII, IX, X, XI, and XII metal rules shall be conducted at 68°F; measurements at other temperatures shall be adjusted to values corresponding to the standard temperature of 68°F. The error in any test measurement for accuracy shall not exceed the permissible accuracy error specified herein.

4.4.2 Durability of construction of folding joints for type III, class 1, wood rules. Each folding joint of each type III, class 1, wood rule under test shall be swiveled through an arc of at least 90° (45° each side of the locking position of the joint) for complete cycles. A complete cycle shall consist of a forward and backward movement through the locking position. Oiling of the joint at the beginning and at the midpoint of the 7,000 cycles will be acceptable. The rule shall then be suspended from one end and a 5 pound weight attached to the other end for a period of one minute. After the above tests, the sample rule shall be inspected to determine conformance with the requirements of 3.7.1.1 and 3.7.1.3.

4.4.3 Parallelism, squareness of ends, and straightness for types IV, VII, VIII, IX, XI, and XII rules.

4.4.3.1 Parallelism. The type IV, VII, IX, XI, and XII rule shall be tested for compliance with the requirements of parallelism by means of a micrometer or by a method of equal or greater precision.

4.4.3.2 Squareness of ends. The type IV, IX, XI, and XII rule shall be tested for compliance with the requirements for squareness of ends by means of a precision surface plate and precision square and feelers or by a method of equal or greater precision.

4.4.3.3 Straightness. The type IV, VII, IX, XI, and XII rule shall be tested for compliance with the requirements for straightness by means of a precision surface plate and feelers or by a method of equal or greater precision.

4.4.3.4 Looseness of joints for type III, class 2, steel, and class 3, aluminum rules. The type III, class 2, steel, and class 3, aluminum rule shall be suspended from one end and a 5 pound weight attached to the other end for a period of one minute to determine conformance with 3.7.2.1 and 3.7.2.4, or 3.7.3.1 and 3.7.3.4, as applicable.

4.5 Inspection of preparation for delivery. An inspection shall be made to determine that the preservation, packaging, packing, and marking shall comply with the requirements of PPP-P-40.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking shall be in accordance with PPP-P-40.

6. NOTES

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

6.1 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type, class, and style, if applicable, of item required (see 1.2.1).
- c. Whether right to left reading rules are required (see 3.3).
- d. If maple, beech, or birch is required for types I and II rules (see 3.5.1 and 3.6.1).
- e. If special graduations or other subdivision or figures are required, and whether combination decimal, metric, or English measurement rules (see 3.6.2.1, 3.7.1.2.1, 3.7.1.2.3, 3.8.2.1, 3.14.2, and 3.15.2).
- f. If special length is required (see 3.7.1 and 3.7.2.2).
- g. If folding end hook is required (see 3.7.1.1 and 3.7.3.1).
- h. If vertical reading figures are required (see 3.7.1.2.1 and 3.7.3.3).

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- i. If a specific style of numbering of figures is required (see 3.7.1.2, 3.7.3.3, 3.8.1, and table III).
- j. If engineers' (surveyors' or roadbuilders') rules are required (see 3.7.1.2.2).
- k. If special numbering for subdivisions is required (see 3.8.1).
- l. Kind of special finish, if required (see 3.11.2.3 and 3.12.5), or if chrome finish is required (see 3.12.5).
- m. Size required (see 3.7.2.2, 3.8.1.5, 3.8.2.2, 3.9.5.2, 3.9.6.2, 3.11.2.1, 3.13.1.1, 3.14.5, 3.15.6, and tables II and IV to IX, inclusive).
- n. If positive of sliding hook is required (see 3.8.1.5 and 3.12.2).
- o. If other than one-piece or two-piece construction is required (see 3.11.1).
- p. If auxiliary straight edge is required (see 3.11.1).
- q. If 3/8 inch width is required (see 3.12.1).
- r. Shrinkage allowance (see 3.14.2).
- s. Level of preservation, packaging, and packing required (see 5.1).
- t. Marking, if other than specified (see 5.1).

MILITARY INTERESTS:**Custodians**

Air Force - 99

Review Activities

Army - MI

Air Force - 84

User Activities

Army - GL

Navy - MC, YD

MILITARY COORDINATING ACTIVITY:

Air Force - 84

Preparing Activity:

GSA - FSS