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American National Standard

ANSI C12.7-1993 (R-1999)

American National Standard

Requirements for Watthour Meter Sockets

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ANSI C12.7-1993 (R-1999)
(Revision of ANSI C12.7-1987)

American National Standard

Requirements for Watthour Meter Sockets

Accredited Standards Committee on Electricity Metering, C12

Accredited by the:

American National Standards Institute

Secretariat:

National Electrical Manufacturers Association

Reaffirmed: September 21, 1999
American National Standards Institute

Abstract: The general requirements and pertinent dimensions applicable to watthour meter sockets rated up to and including 600 V and up to and including 320 A continuous duty per socket opening are covered.

Keywords: conduit connection, knockout, multi-stator watthour meter, ringless socket, single-stator watthour meter, socket jaw, socket sealing ring, watthour meter socket.

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Foreword

(This introduction is not a part of ANSI C12.7-1993 (R-1999), American National Standard Requirements for Watthour Meter Sockets.)

This standard was developed by subcommittee 15 and ballotted by the Accredited Standards Committee on Electricity Metering, C12, for full consensus approval as an American National Standard. This revised version supersedes ANSI C12.7-1987. Certain performance requirements covered by the latest revision of Underwriters Laboratories Standard for Safety on Meter Sockets have been adopted and referred to in this standard. Information on subsequent revisions of these provisions can be obtained through the Underwriters Laboratories Subscription Revision Service.*

This standard covers the dimensions and functions of meter test switches for transformer-rated watthour meters when used in conjunction with instrument transformers.

Suggestions for improvements of this standard will be welcomed. They should be in the form of a proposed change of text, together with appropriate supporting comments.

Comments on standards and requests for interpretations should be addressed to:

Secretary, NEMA
1300 N. 17th Street, Rosslyn, VA 22209

At the time this standard was completed, Subcommittee 15 of ANSI Committee C12, which developed and revised this standard, had the following membership:

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AMERICAN NATIONAL STANDARD **C12.7-1993 (R1999)**

Requirements for Watthout Meter Sockets

1 Scope

This standard covers the general requirements and pertinent dimensions applicable to watthour meter sockets rated up to and including 600 V and up to and including 320 A continuous duty per socket opening.

2 References

This standard shall be used in conjunction with the following standards. When the following standards are superseded by an approved revision, the revision shall apply.

ANSI C12.10-1997,	*American National Standard for Electromechanical Watthour Meters*[1]
ANSI/NEMA Z535.4-1998,	*Product Safety Signs and Labels*
ANSI/UL 50-1987,	*Enclosure for Electrical Equipment*[2]
ANSI/UL 414-1991	*Safety Standard for Meter Sockets*
NEMA 250-1997,	*Enclosures for Electrical Equipment (1000 V Maximum)*[3]

3 Definitions

3.1 circuit bypass means (bypass): An assembly of parts which, when properly operated, closes the circuit between the line and load jaws.

3.2 continuous-duty current rating: The rating in amperes that a meter socket will carry continuously under stated conditions, without exceeding the allowable temperature rise.

A multiposition trough socket has an additional current rating that denotes the maximum ampere capacity of the line buses.

3.3 continuous load: A load where the current continues for 3 h or more.

3.4 meter socket (socket): An enclosure that has matching jaws to accommodate the bayonet-type (blade) terminals of a detachable watthour meter and has a means of connections for the termination of the circuit conductors. It may be a single-position socket for one meter or a multiposition trough socket for two or more meters.

3.5 meter support: The part of a ringless-type meter socket that positions and supports a detachable watthour meter.

3.7 ring-type meter socket: A meter socket that has a socket rim.

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[1] ANSI/NEMA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5776 USA.

[2] UL publications are available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, USA.

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3.8 socket cover: The removable portion of the enclosure that provides access to the meter socket wiring.

3.9 socket rim: That part of a ring-type meter socket that is required to accommodate the socket sealing ring that holds a detachable watthour meter in place.

3.10 socket sealing ring: A ring used to overlap the socket rim and the detachable watthour meter cover ring to hold and provide means for sealing a detachable watthour meter in place.

4 Electrical ratings

4.1 Current ratings

Continuous duty current ratings of sockets shall include 20, 80, 100, 120, 150, 160, 2500, and 320 A.

4.2 Voltage ratings

The voltage ratings shall be 300 V or 600 V. Meter sockets shall be so designated as to be applicable to one or more of the following nominal voltages:

300 V rating includes		
120/240	3-wire	single phase
208Y/120	3-wire	open Y
208Y/120	4-wire	three-phase Y
240/120	4-wire	three-phase Δ
120	3-wire	three-phase Δ

600 V rating includes		
480	3-wire	three-phase Δ
480Y/277	4-wire	three-phase Y
600	3-wire	three-phase Δ

5 Performance requirements

Performance requirements for meter sockets shall be in accordance with applicable performance sections of ANSI/UL 414-1991.[4]

6 Construction requirements

6.1 Construction and workmanship

The watthour meter socket and its components shall be constructed of materials suitable for the particular use. They shall be made and finished with a high degree of uniformity and in a workmanlike manner.

6.2 Marking

The manufacturers' identifying marking shall be provided on the device.

[4] Information on references can be found in clause 2.

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6.3 Enclosures

6.3.1 Protection

The enclosure shall be designed to protect:

a) Personnel against incidental contact with the electrical devices.

b) Electrical devices against specified external conditions.

The enclosure for current-carrying parts of the socket shall be so construed as to ensure ample strength and rigidity in order that the enclosure will keep its shape and that socket covers, when applicable, shall close tightly. The enclosure shall be reasonably tight and shall be provided with suitable means for mounting. Provisions shall be made for sealing the meter in the socket and for sealing to prevent any unauthorized access to the conductors or circuit-closing means. The socket cover shall be capable of being removed without the likelihood of its striking metal parts.

6.3.2 Construction

The enclosure shall be of the ring or ringless type and shall be referenced in NEMA 250-1997.

a) NEMA Type 1—Enclosures intended for indoor use primarily to provide a degree of protection against limited amounts of falling dirt in locations where unusual service conditions do not exist.

b) NEMA Type 3R—Enclosures intended for outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.

c) Semiflush—A semiflush enclosure is provided with a flange for mounting in a wall. That portion that may be exposed to weather shall be NEMA Type 3R construction but the portion that is normally protected may be NEMA Type 1 construction.

6.3.3 Enclosure material

The following materials, when employed in socket enclosures, shall meet the minimum requirements below.

NOTE—It is the intent to describe fully the means that may be employed to provide adequate rigidity for the enclosure structure, but to specify the minimum thickness permissible under this standard.

a) Die-cast—The minimum thickness of dielectric aluminum housings shall be 0.062 in. if the area is 24.0 in.^{2} or less and no dimension exceeds 7.250 in. The minimum thickness shall be 0.093 in. if the area is greater than 24.0 in.^{2} or if any dimension exceeds 7.250 in.

b) Sheet metal—Sheet metal enclosed meter sockets not wider than 20 in. (the smaller dimension of a rectangular panel) shall have a minimum thickness of 0.053 in. The maximum width implies a rectangular panel, supporting at all four edges. Adjacent panels may have edge supports in common and may be made of a single sheet. Supported at the edge means fastened to, resting against, or otherwise having a relatively solid support, stiffening member, or adequate reinforcement so as to prevent or minimize the bending of the panel at the edge. Narrow panels supported along one long edge and two short edges, with or without stiffening means along the opposite long edge depending upon the resulting structural rigidity, shall be considered satisfactory.

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6.3.4 Mounting bosses

Sockets shall be provided with mounting bosses or the equivalent to provide a minimum of 0.125 in. of air space between the back of the sockets and the surface on which they may be mounted.

6.3.5 Wiring space

The space within the enclosure of a socket shall be sufficient to provide ample room for the distribution of the maximum-size conductors for which the socket is intended.

Wiring space requirements for meter sockets shall be in accordance with the applicable section of ANSI/UL 414-1991.

6.4 Conduit connections and knockouts

When knockouts are provided in the housing of a socket, they shall conform in size to Table 1.

Holes and knockouts shall be located to provide adequate space for turning of locknuts and bushings that are not of the grounding type and that may be used for securing conduit or metal-clad cable connectors.

Concentric-type and eccentric-type knockouts shall be so constructed that any size knockout may be removed without disturbing the next larger-size knockout. If threads for the connection of conduit are tapped all the way through a hole in an enclosure, or if any equivalent construction is employed, there shall be not less than three threads in the metal and the construction shall be such that a suitable conduit bushing can be properly attached. If the socket is intended for outdoor use, the thread shall be tapered.

If threads for the connection of conduit are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, there shall be not less than five full threads in the metal and there shall be a smooth, well-rounded inlet hole for the conductors that is equivalent to that provided by a standard conduit bushing. This hole shall have an internal diameter approximately the same as that of the corresponding size of rigid conduit. If the socket is intended for outdoor use, the threaded hole shall be provided with a conduit end stop unless the thread is tapered.

A fixed hub in a socket enclosure shall be threaded and shall have a wall thickness before threading not less than that of the corresponding trade size of rigid conduit. A fixed hub shall not depend upon friction alone to prevent its turning and shall be capable of withstanding the torque given in ANSI/UL 50-1987.

Removable hubs interchangeable between conduit sizes shall be classified as follows:

a) Type 1—Interchangeable gasketless types designed to mount in end walls with hub mounting dimensions in accordance with Figure 8.

b) Type 2—Non-interchangeable types designed to mount in end walls with hub mounting dimensions to accept a gasketless or gasketed hub designed for use with other enclosures.

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Table 1 – Knockout and bushing dimensions

Conduit trade size	Knockout diameter			Lockout and bushing diameter		Minimum overlap over maximum knockout
	Minimum	Nominal	Maximum	Minimum	Maximum	
1	2	3	4	5	6	7
1/3	0.859	1.875	0.906	1.00	1.140	0.002
3/4	1.094	1.109	1.141	1.23	1.420	0.012
1	1.359	1.375	1.406	1.54	1.770	0.009
1-1/4	1.719	1.734	1.766	1.92	2.281	0.013
1-1/2	1.958	1.984	2.016	2.18	2.598	0.013
2	2.433	2.469	2.500	2.68	3.175	0.016
2-1/2	2.938	2.969	3.000	3.20	3.562	0.022
3	3.563	3.594	3.625	3.83	4.250	0.025
3-1/2	4.063	4.125	4.156	4.40	4.803	0.029
4	4.563	4.641	4.672	4.94	5.402	0.031
5	5.625	5.719	5.750	6.05	6.674	0.040
6	6.700	6.813	6.844	7.20	7.934	0.050

NOTES

1 All dimensions are in inches.
2 Columns 2, 3, and 4 are dimensions for knockout diameters for single or concentric types only and exclude any projection of breakout ears or tabs.
3 Although the knockout diameter tolerance is liberal, it is desirable that the limits be held as close as possible to the nominal diameter.
4 Columns 5 and 6 are the minimum and maximum dimensions of the flange or base of a conduit bushing and across the corners of a hexagonal locknut.
5 Column 7 is the minimum overlap when a minimum diameter (column 5) locknut or bushing is used on a minimum diameter conduit installed in a maximum diameter knockout (column 4).

6.5 Limiting dimensions and relative locations of functional parts

A socket shall accommodate a detachable-type watthour meter and shall be constructed with limiting dimensions and tolerances as indicated in the table below.

Figure 1	Limiting dimensions of socket rim
Figure 2	Limiting dimensions and positions of socket jaws
Figure 3	Location of socket jaws (front view)
Figure 4	Socket-jaw position identification
Figure 5	Internal voltage connections of 13-, 14-, and 15-jaw sockets
Figure 6	Socket-sealing-ring dimensions
Figure 7	Hole dimensions to accommodate sealing means
Figure 8	Provisions for interchangeable gasketless hubs

A socket shall accommodate a detachable-type watthour meter that has limiting dimensions and tolerances as indicated in the table below. The figures are from ANSI C12.10-1997 (see the annex of this standard).

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Figure A1	Envelope of surfaces that project into socket for 4- to 6-terminal meters
Figure A2	Envelope of surfaces that project into socket for 5-terminal meters in 7-terminal sockets
Figure A3	Envelope of surfaces that project into socket for 7- and 8-terminal meters
Figure A4	Envelope of surfaces that project into socket for 8-terminal and 13- to 15-terminal meters
Figure A5	Mounting and terminal dimensions for detachable single-stator and multi-stator watthour meters with 4 to 8 terminals
Figure A6	Mounting and terminal dimensions for detachable multi-stator watthour meters with 8 terminals and 13 to 15 terminals
Figure A7	Envelope of round covers for detachable single-stator and multi-stator watthour meters.

6.6 Terminal connectors

All terminal connectors shall be suitable for use with aluminum or copper conductors, or both, and shall be of the pressure type (solderless connectors) for the connection of conductors corresponding in size to the rating of the socket or the circuit for which it is intended, except that a wire binding screw may be employed for the connection of an AWG No. 10 or smaller conductor.

In single-position gangable sockets or multiple-position sockets that are not bussed by the manufacturer, the connectors shall be of the lay-in type to provide for running the service and neutral conductors from position to position without cutting the conductors.

Each socket shall be equipped with neutral connection facilities for both line and load conductors. They may be connected to, or insulated from, but bondable to metal socket enclosures. Where practicable, these connecting facilities shall be so arranged that attachment of the neutral conductor may be made without cutting the neutral service conductor. In sockets intended for use on 3-wire, open-Y, or 3-phase service, a connecting facility shall be provided for a voltage tap from the neutral conductor or third phase to the required socket jaw. A connector for a grounding conductor for a metal socket shall be connected to the socket enclosure.

When multiple-position sockets are provided with buses by the manufacturer, the buses shall have adequate support and spacing. The assembly may be provided with only one set of line and neutral connectors that shall be adequate to accommodate conductors corresponding in size to the overall rating of the assembly. For each socket opening there shall be provisions for connecting the load-side neutral conductor to the common neutral bus. For each socket opening there shall also be provisions for connection of load-side conductors corresponding in size to the rating of the individual socket unit or the circuit for which it is intended.

In sockets of all types, means shall be provided for grounding the surge relief gaps of the watthour meter.

6.7 Circuit closing means (bypass)

Circuit closing means when intended for use with sockets for self-contained meters shall be rated at not less than 50% of the continuous-duty ampere rating of the socket with which it will be used.

Sockets intended only for use with instrument-transformer-rated equipment may be provided with devices for closing the various secondary current circuits connected to current transformers from line to load side. These devices shall be rated 20 A continuous.

6.8 Sealing

Each socket shall be so construed that it cannot be opened or have its bypass operated without first having its seal broken.

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After the installation and sealing are completed, the socket shall not have any openings, except as permitted by NEMA Type 3R construction (see 6.3.2, item b).

The sealing means shall provide for a lead-and-wire seal, padlock seal, or other similar means that can be accommodated by the dimensions of Figure 7.

6.9 Sectional and multiple-opening trough-type sockets

6.9.1 Structural types

Sockets intended for multiple-position applications shall be one of the following structural types:

a) Fabricated as one complete unit with two or more socket positions.

b) Fabricated as one or more socket positions with removable end walls, nesting arrangements, and coupling straps for ganging into a multiple-position socket assembly.

6.9.2 Covers

The cover or covers of a multiple-position socket shall be constructed to allow the removal of one meter without disturbing other meters.

6.9.3 Meter position spacings

Meter position spacings shall be as follows:

a) Horizontal units—Horizontal units shall have a minimum spacing of 7.500 in. between meter centerlines.

b) Vertical units—Vertical units shall have a minimum spacing of 8.500 in. between meter centerlines.

6.10 Socket sealing

6.10.1 General

Socket sealing rings, if required, shall be constructed of material suitable for the application.

6.10.2 Dimensions and tolerances

Socket sealing rings shall conform with tolerances given in Figure 6.

6.10.3 Facilities for sealing

Facilities shall be provided in each socket sealing ring for a lead-and-wire seal, padlock seal, or other similar means that can be accommodated by the dimensions of Figure 7. These facilities shall be such that removal of the sealing ring, when it is placed in service and sealed, requires removal of the seal.

6.11 Watthour meter/ringless socket interface

When a watthour meter is installed in the ringless socket-type enclosure for which it is designed as intended for normal use, it shall not leave an opening such to permit the unrestricted insertion of a 1/8-in. rigid steel rod between the meter cover ring and the meter socket-enclosure cover, so as to contact live parts.

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NOTE—*The diameter of the watthour meter opening in a ringless type meter socket shall be no less than 6.55 in. (166 mm.)*

Compliance with this requirement shall be verified by the following test:

For the purpose of this test, the watthour meter, socket, and enclosure under test shall be mounted on a rigid vertical structure in the position it would assume under normal use.

At a point on the meter cover 2 in. outward from the meter-socket-enclosure cover, a 75 lb. force shall be applied in a downward direction for a duration of 1 min. After removal of the force, it shall not be possible to freely insert a 1/8 in. rigid steel rod between the meter cover ring and the meter socket enclosure cover, so as to contact live parts. The test shall then be repeated with the force applied in an upward direction.

6.12 Metric conversion

All drawings are dimensioned in inches. To convert to metric dimensions in millimeters, multiply the dimensions in inches by 2.54. The resulting metric dimension obtained shall be rounded to the nearest 0.02 mm.

Tolerances shall also be converted to the nearest 0.02 mm. to be equivalent to the corresponding tolerance in inches.

6.13 Safety alert markings

Appropriate safety alert markings shall be applied to each meter socket device. These safety alert markings shall be per ANSI Z535.4-1997.

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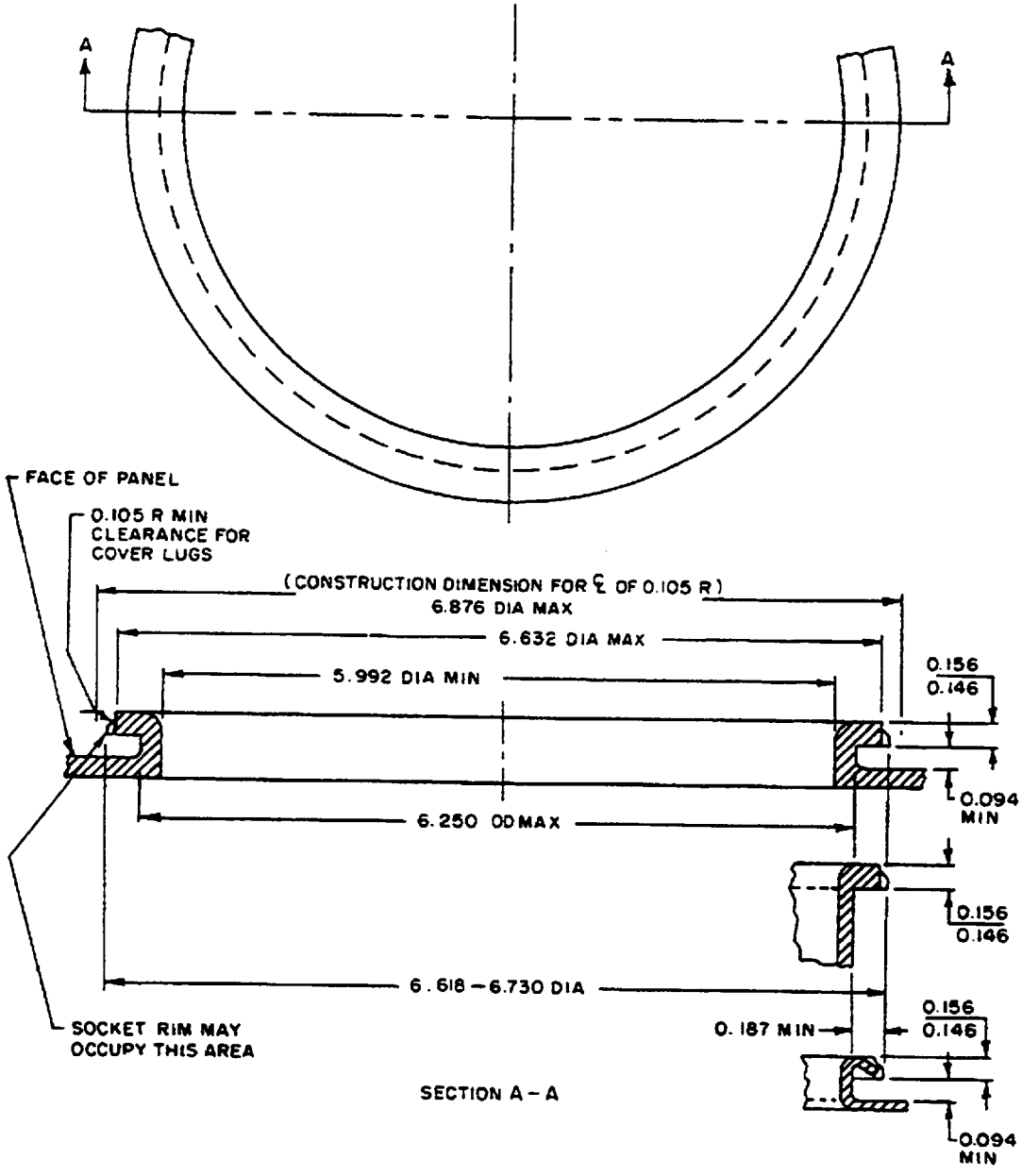
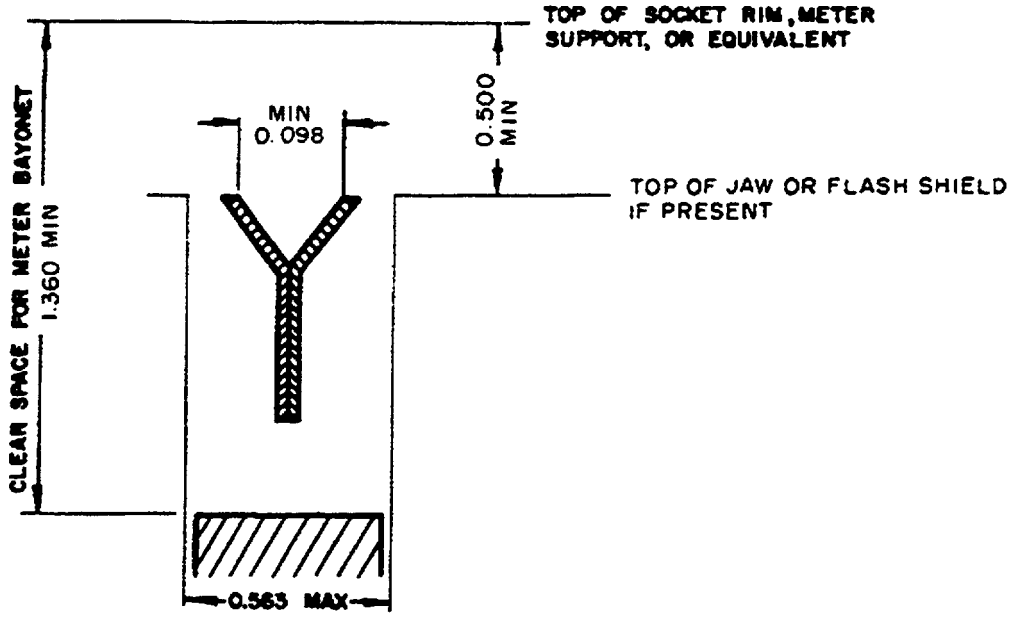
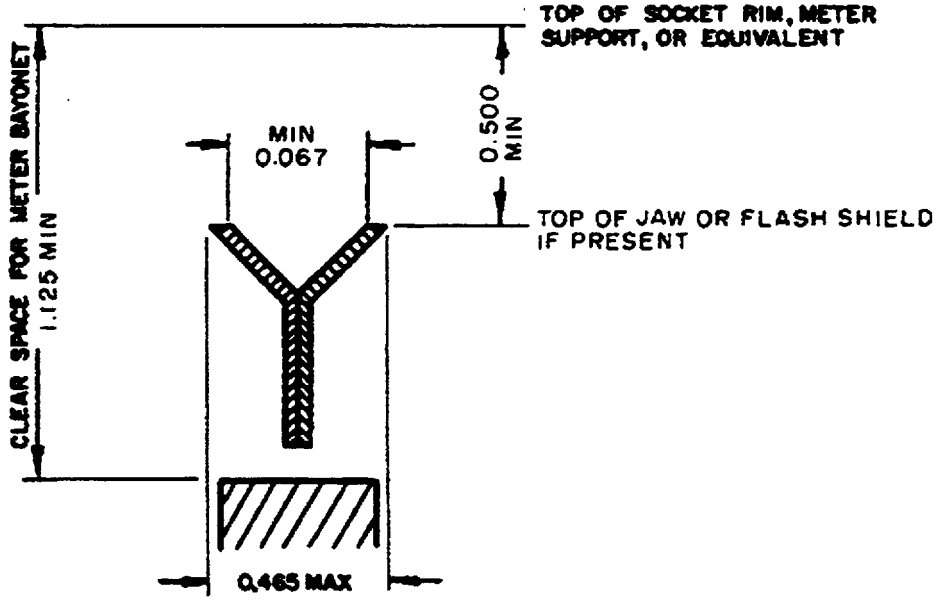


Figure 1 – Limiting dimensions of socket rim

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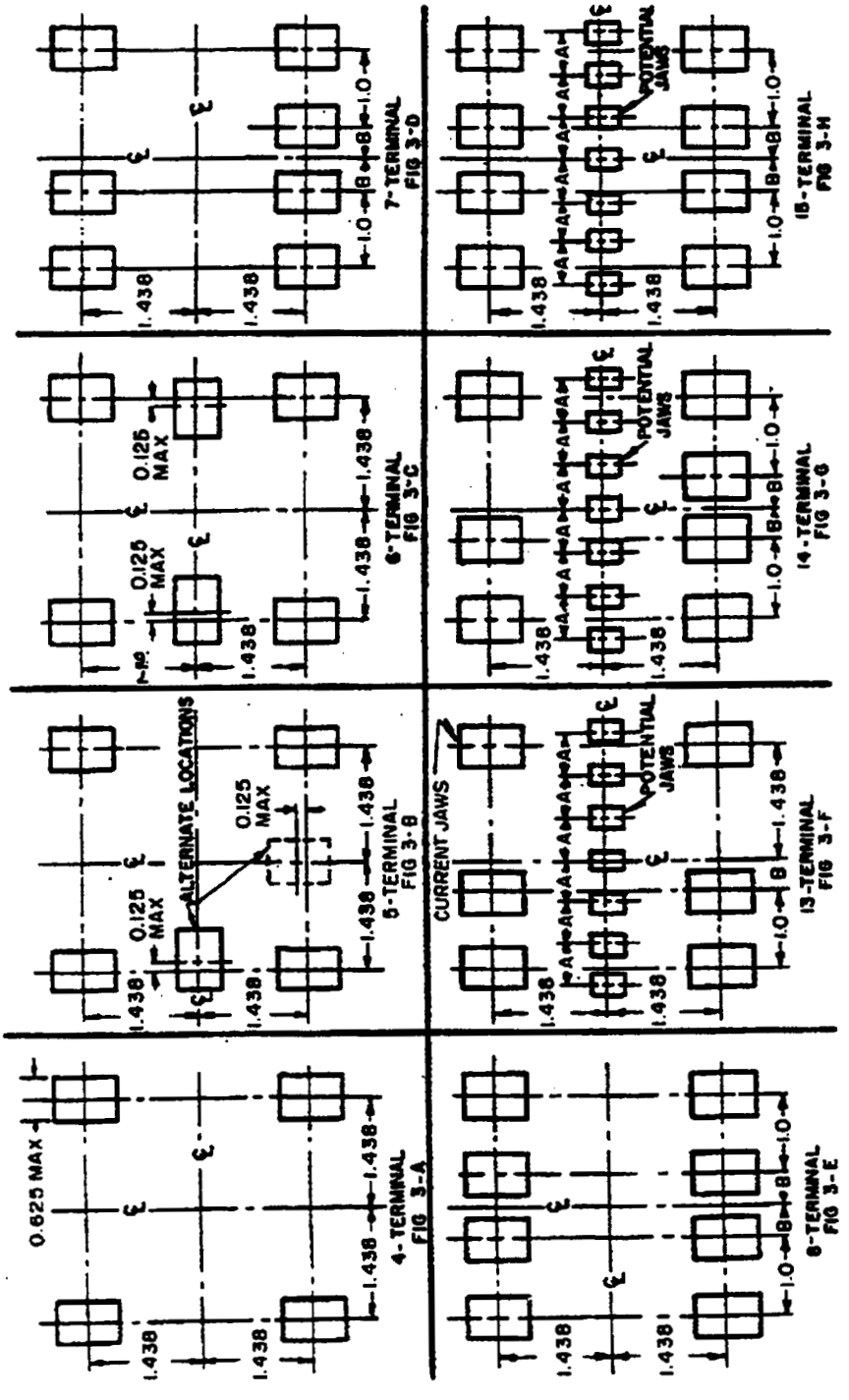
a) Current jaw envelopes for terminals 1–10 of Figure 4



b) Voltage jaw envelopes for terminals 11–17 (and alternate for 5A and 7 of Figure 4)

Figure 2 – Limiting dimensions and positions of socket jaws

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NOTES: (1) All dimensions are in inches.
(2) Unless otherwise specified, tolerances shall be ± 0.016 inch on any single dimension and ± 0.031 inch on any cumulative dimension.
(3) ℄ refers to Fig 1 center lines.

Figure 3 – Location of socket jaws (front view)

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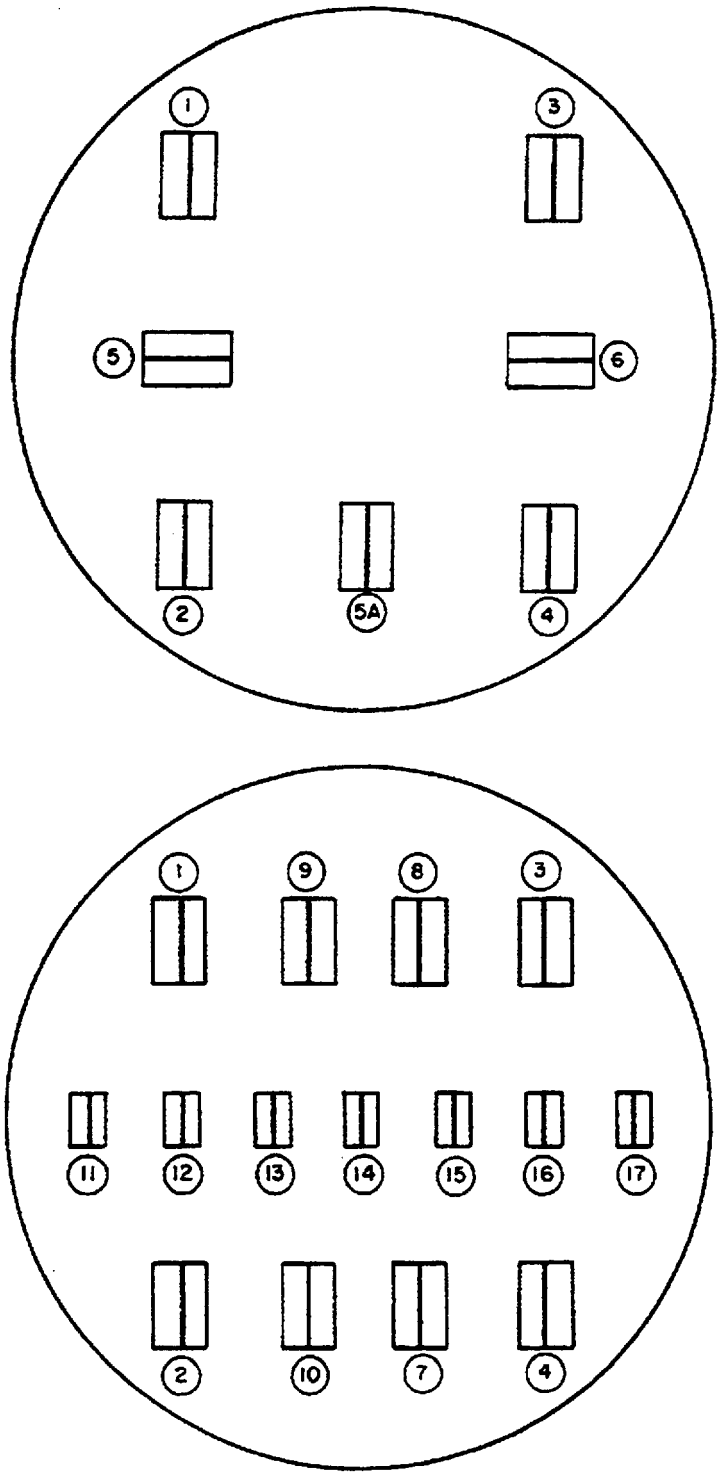
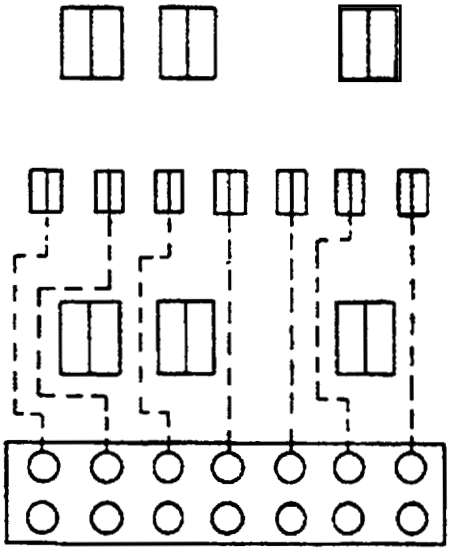
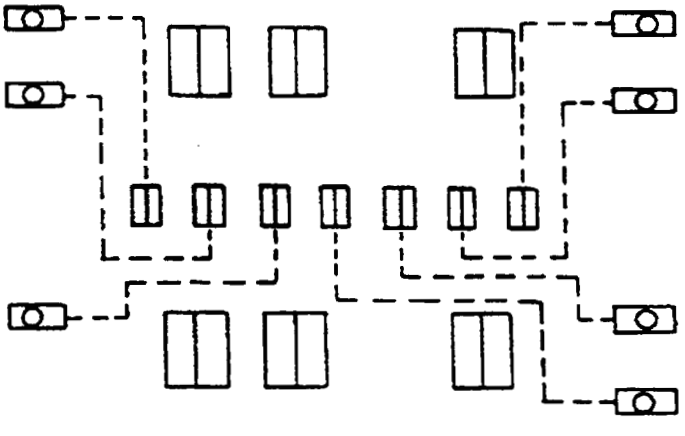


Figure 4 – Socket-jaw position identification

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a) Front view side connected

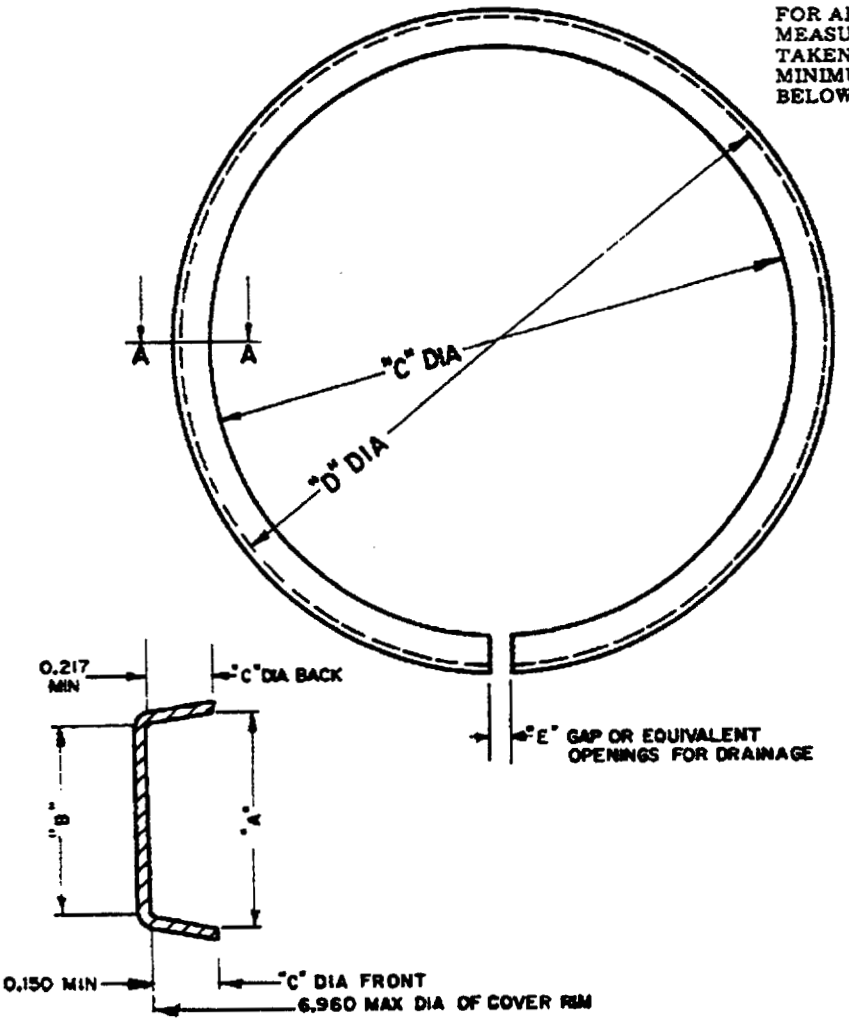


b) Front view bottom connected

Figure 5 – Internal voltage connections of 13-, 14-, and 15-jaw sockets

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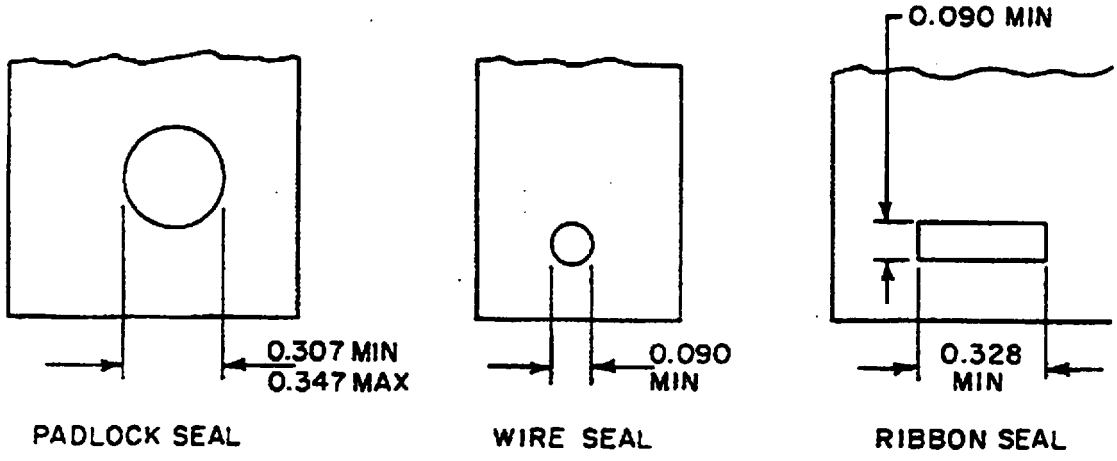


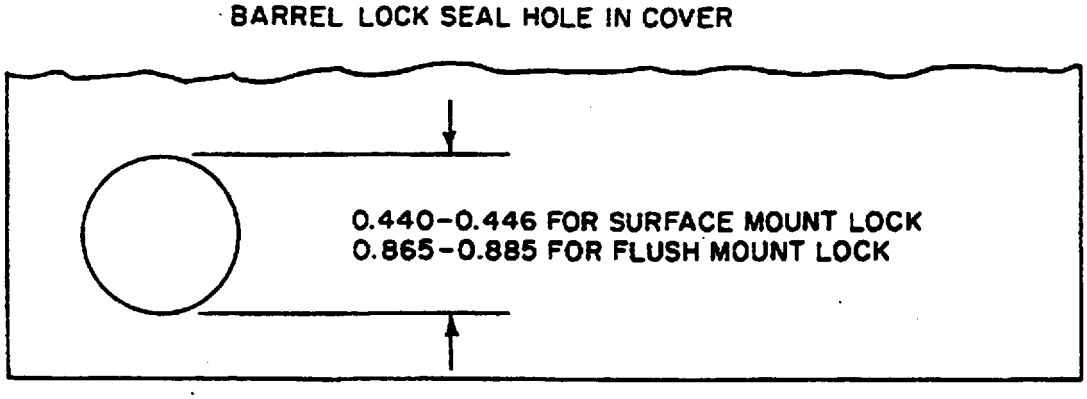
SECTION A–A

"A"		"B"		"C"				"D"	"E"	
				FRONT		BACK			ADJ	NON-ADJ
MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MIN	MIN	MIN
0.670	0.630	0.630	0.620	6.660	6.527	6.526	6.360	6.960	0.250	0.062

Figure 6 – Socket-sealing-ring dimensions

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NOTE: (1) All dimensions are in inches.
(2) Internal bracket dimensions and positioning will vary with the type of lock and the lock manufacturer.

Figure 7 – Hole dimensions to accommodate sealing means

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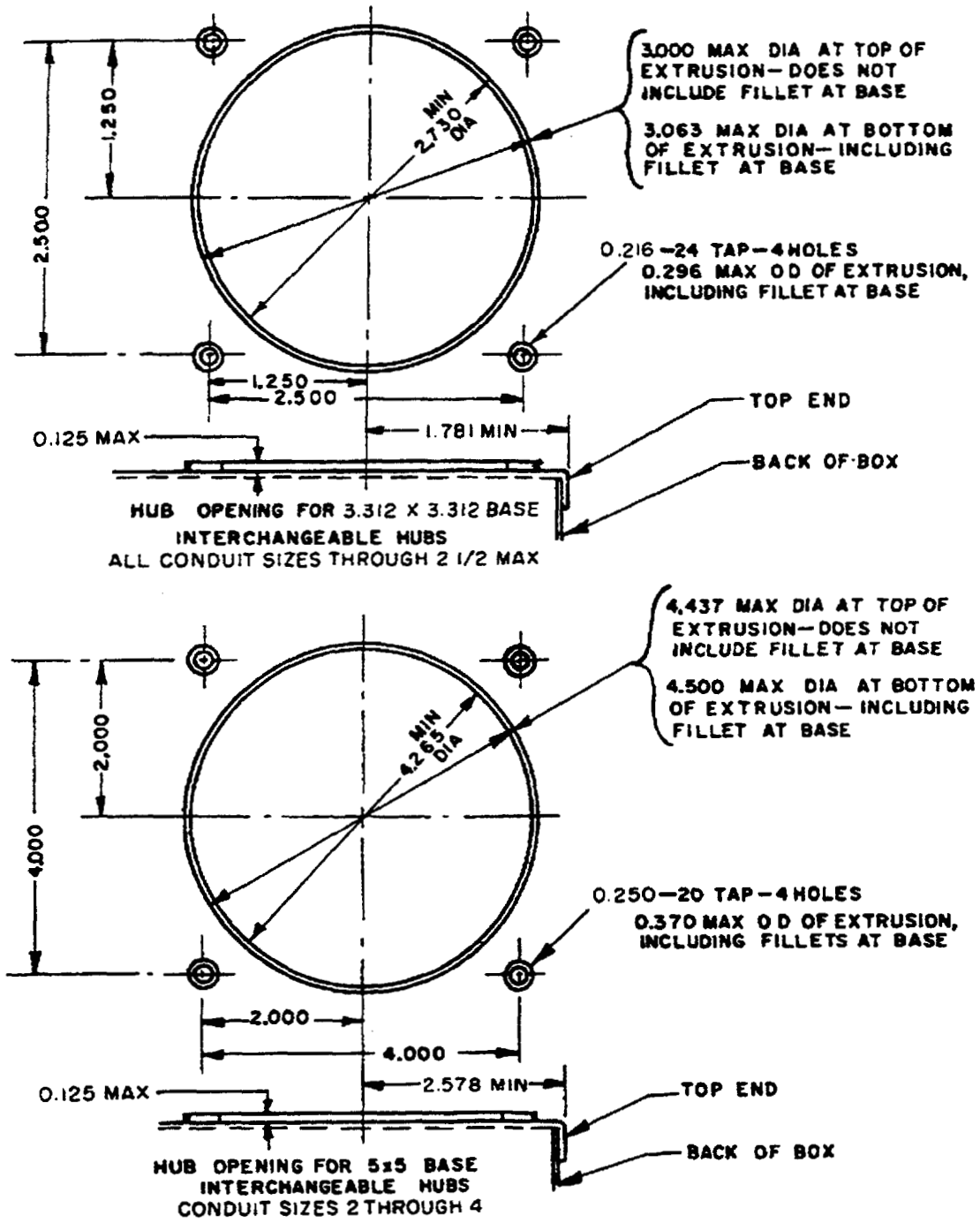


Figure 8 – Provisions for interchangeable gasketless hubs

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Annex
Limiting dimensions and tolerances of watthour meters
(informative)

The following figures, taken from ANSI C12.10-1997, apply specifically to the subject covered by this standard. They are repeated here for ease of reference only.

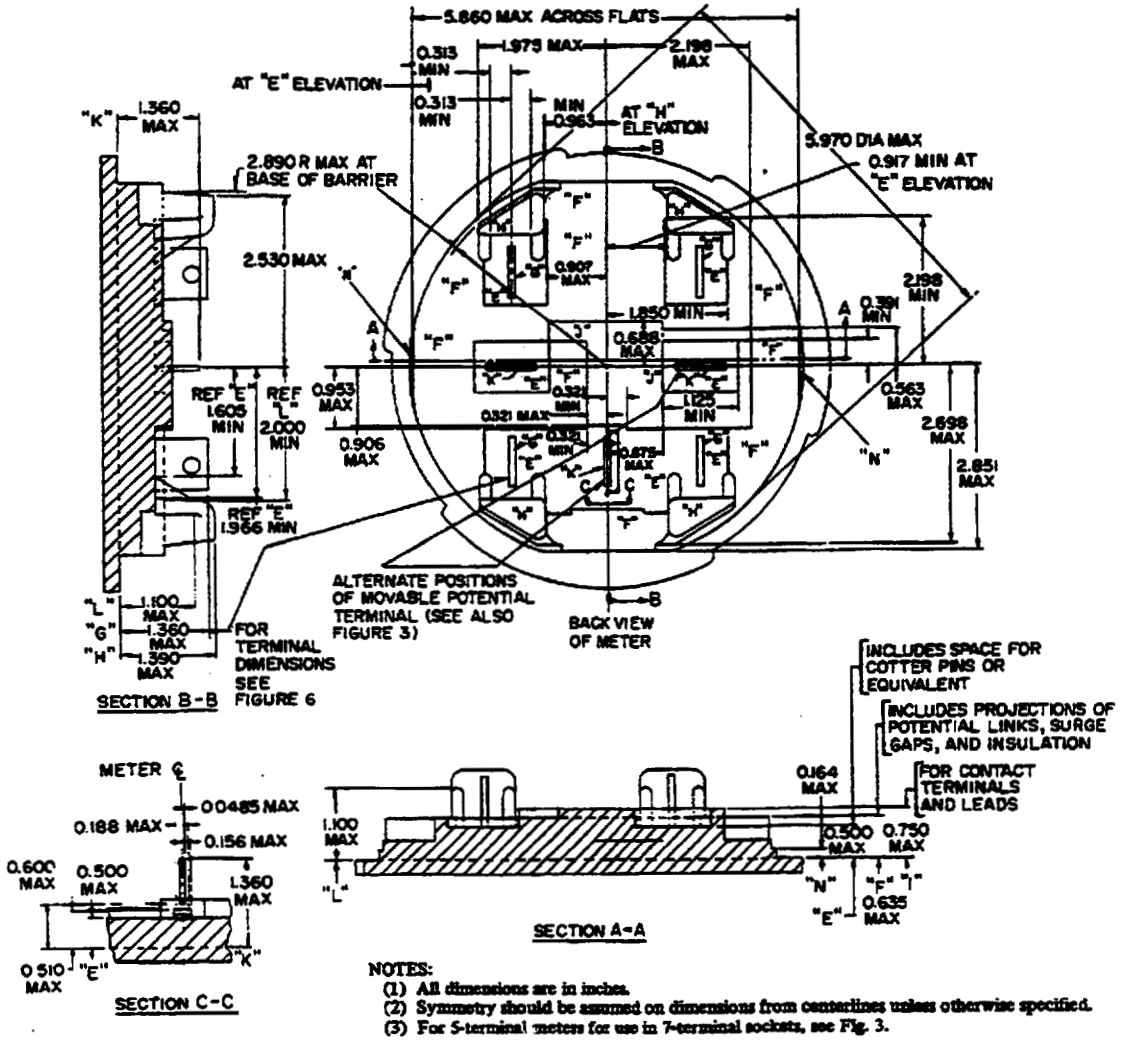
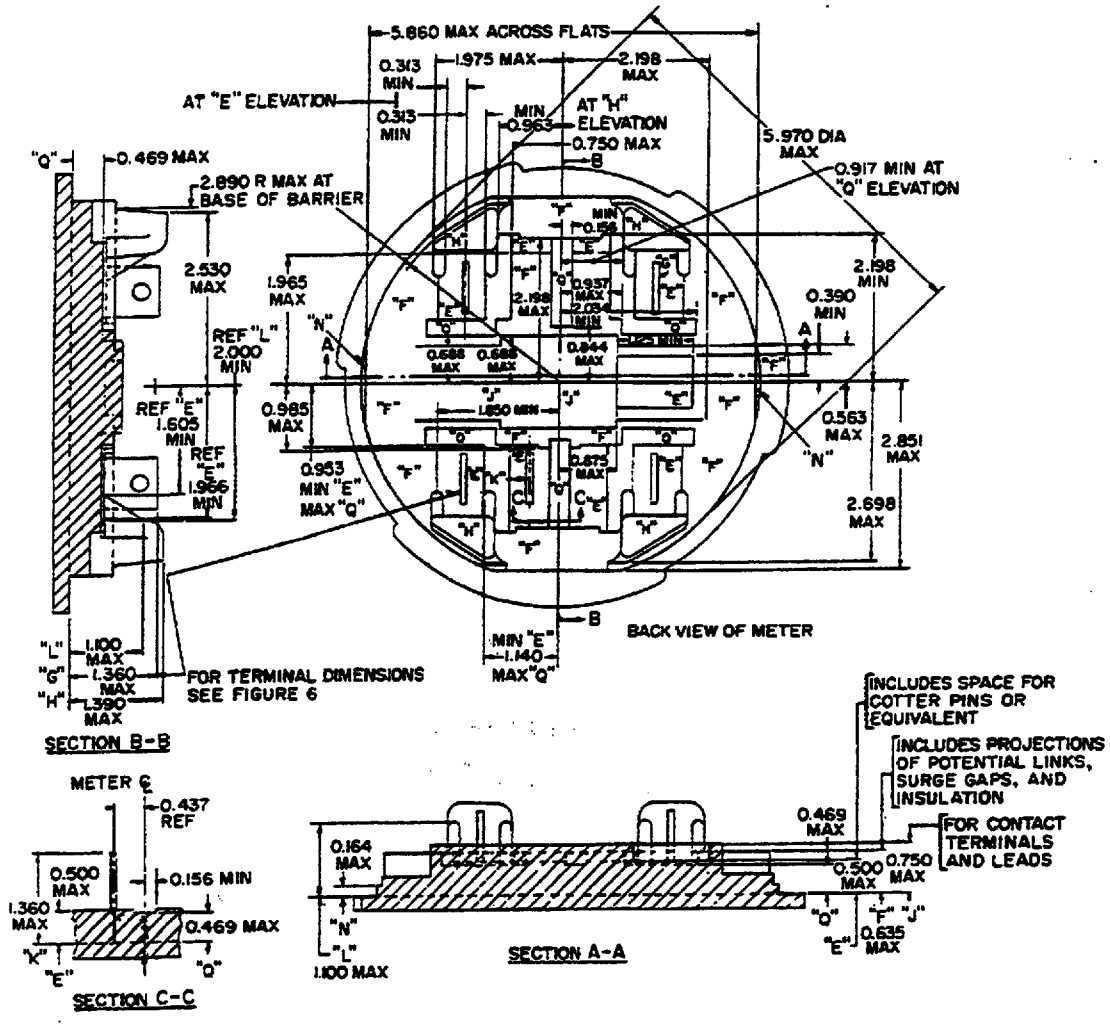


Figure A1 – Envelope of surfaces that project into socket for 4- to 6-terminal meters

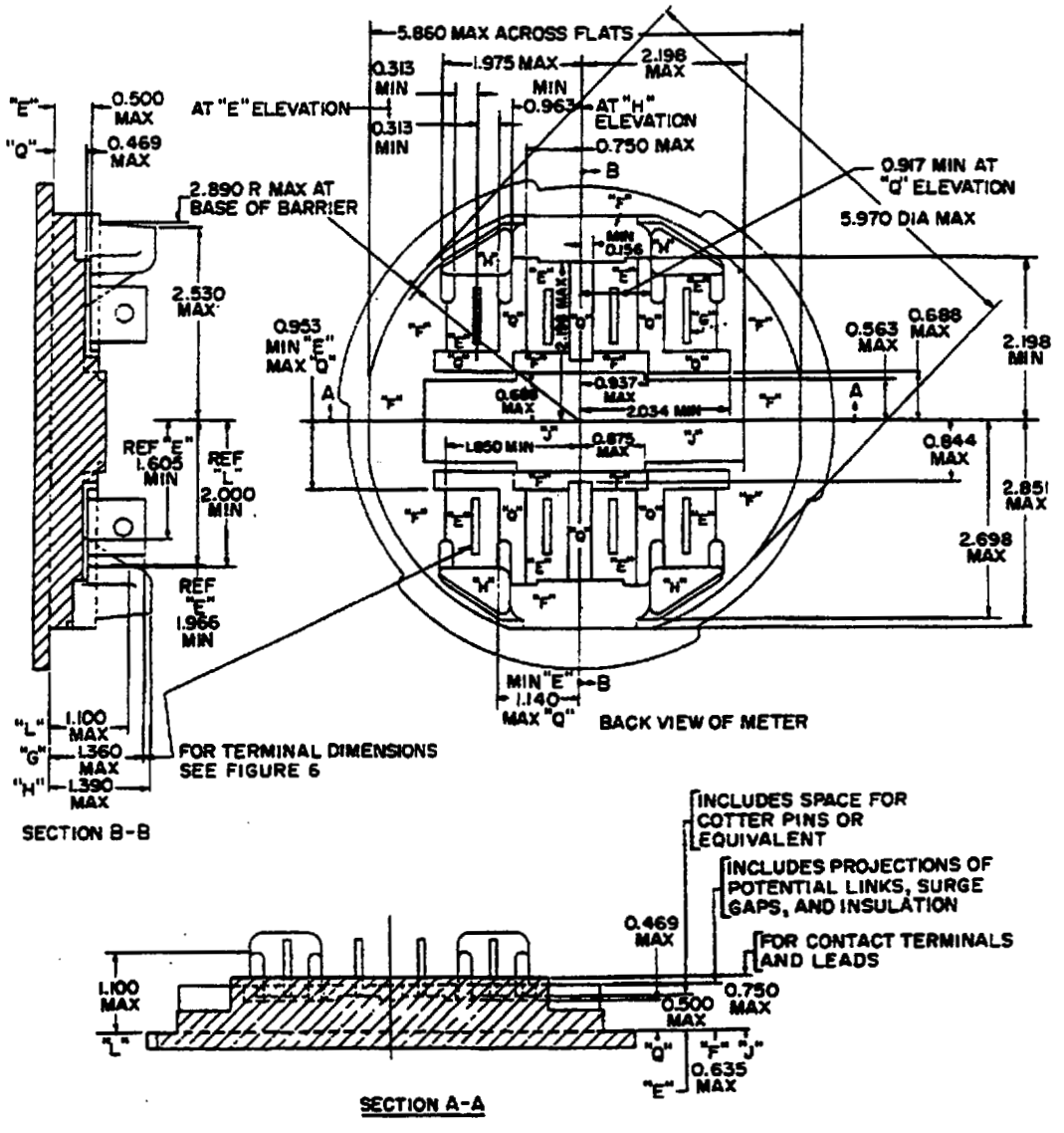
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NOTES:
(1) All dimensions are in inches.
(2) Symmetry should be assumed on dimensions from centerlines unless otherwise specified.

Figure A2 – Envelope of surfaces that project into socket for 5-terminal meters in 7-terminal sockets

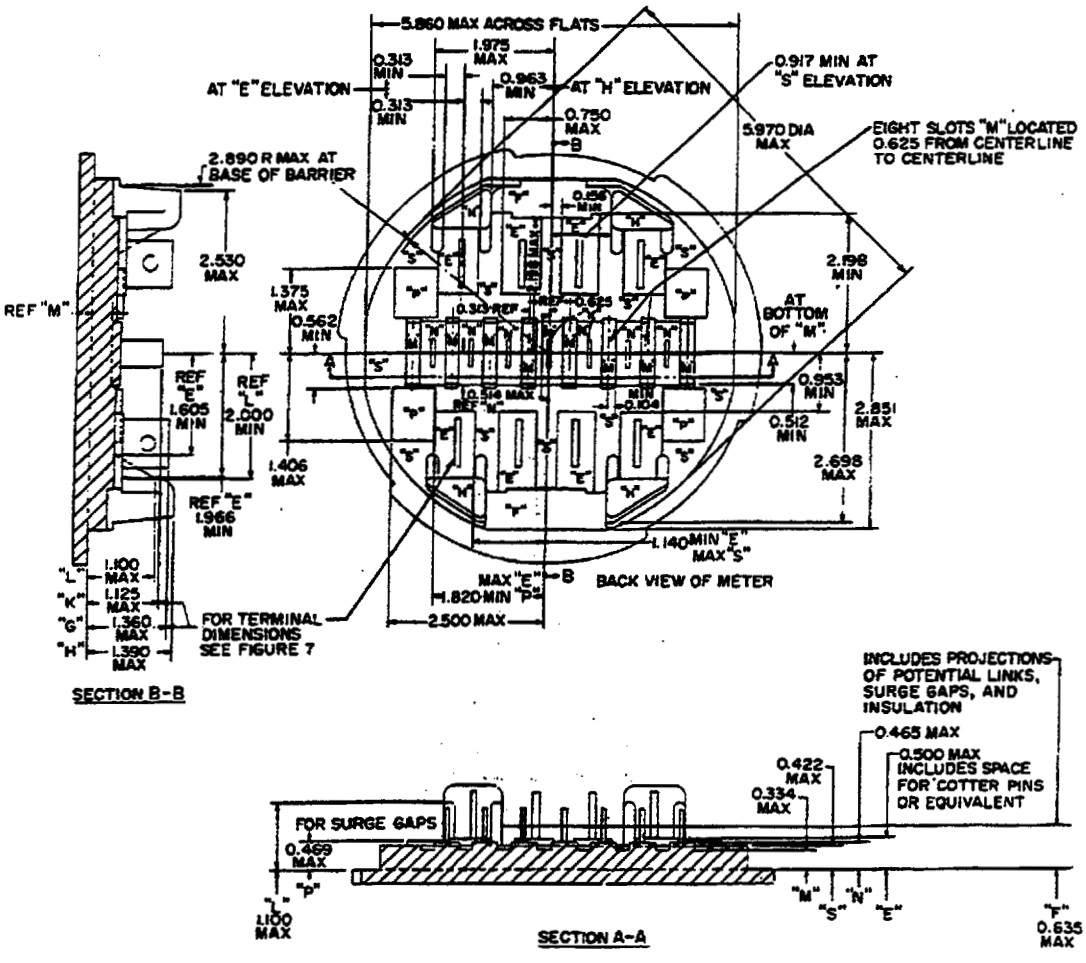
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NOTES:
(1) All dimensions are in inches.
(2) Symmetry should be assumed on dimensions from centerlines unless otherwise specified.

Figure A3 – Envelope of surfaces that project into socket for 7- and 8-terminal meters

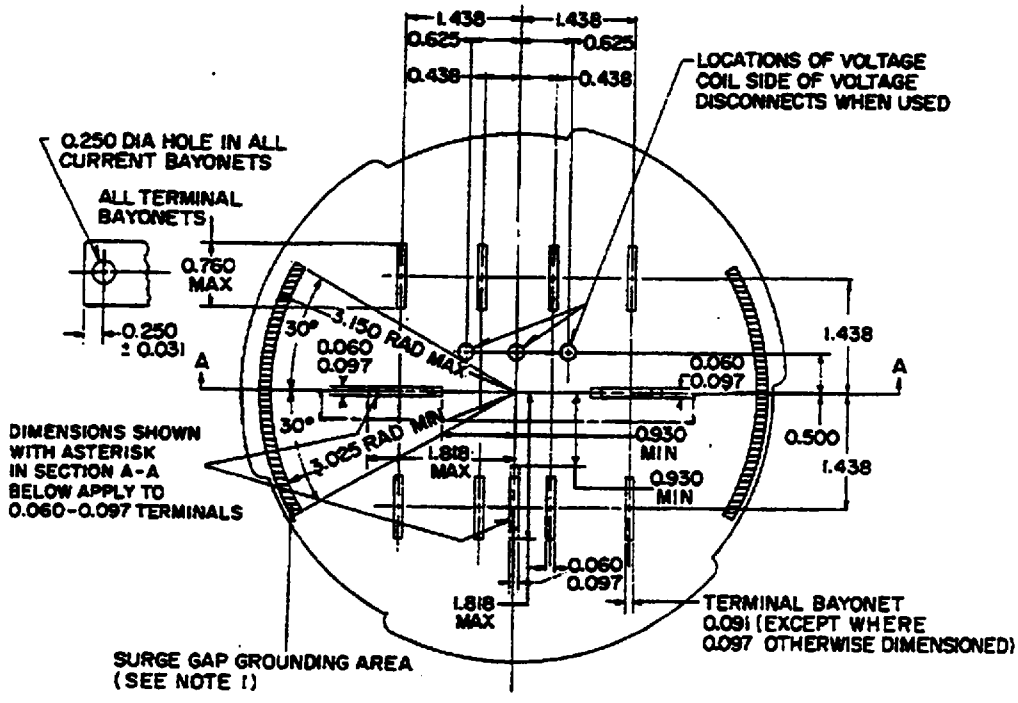
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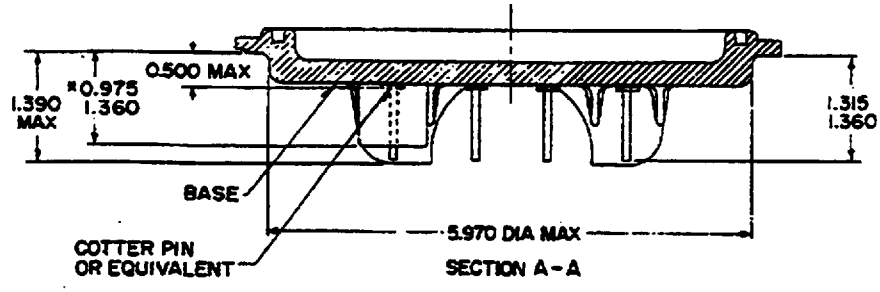


NOTES:
(1) All dimensions are in inches.
(2) Symmetry should be assumed on dimensions from centerlines unless otherwise specified.

Figure A4 – Envelope of surfaces that project into socket for 8-terminal and 13- to 15-terminal meters

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NOTES:

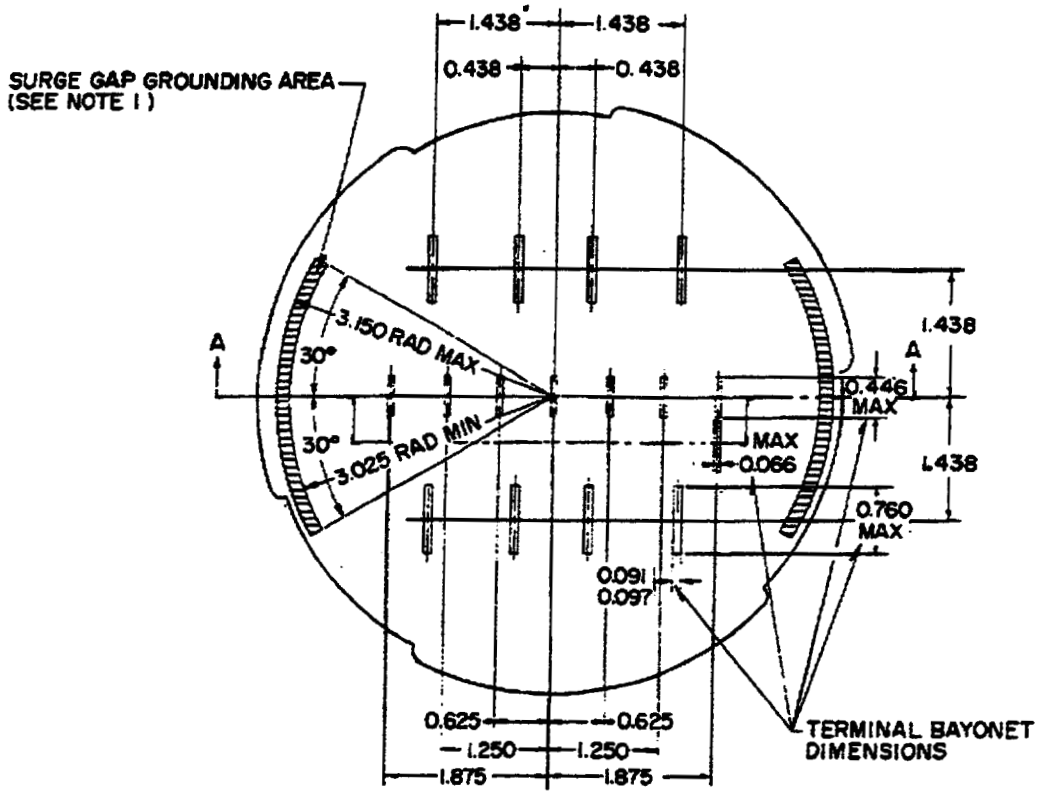
(1) Grounding straps of surge gaps shall fall within the angle shown and be of sufficient length to provide contact surfaces from the minimum to the maximum radii. (Grounding means in the socket shall extend over the full angle shown and be located anywhere between the radii limits.)

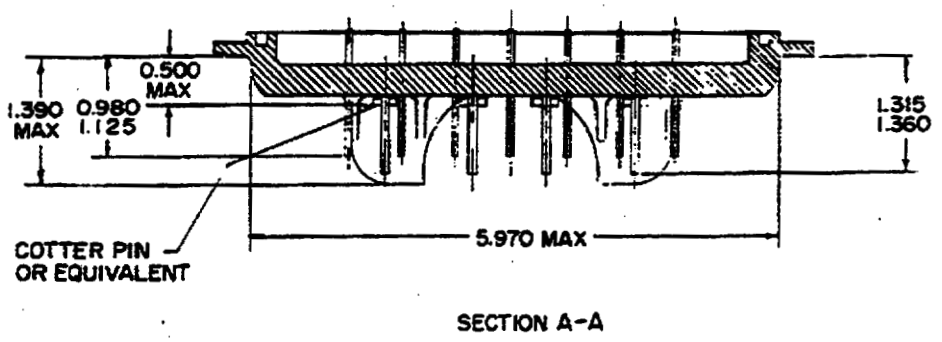
(2) All dimensions are in inches.

(3) Unless otherwise specified, tolerances shall be ± 0.016 inch on single dimensions and ± 0.031 inch on cumulative dimensions.

Figure A5 – Mounting and terminal dimensions for detachable single-stator and multi-stator watthour meters with 4 to 8 terminals

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NOTES:

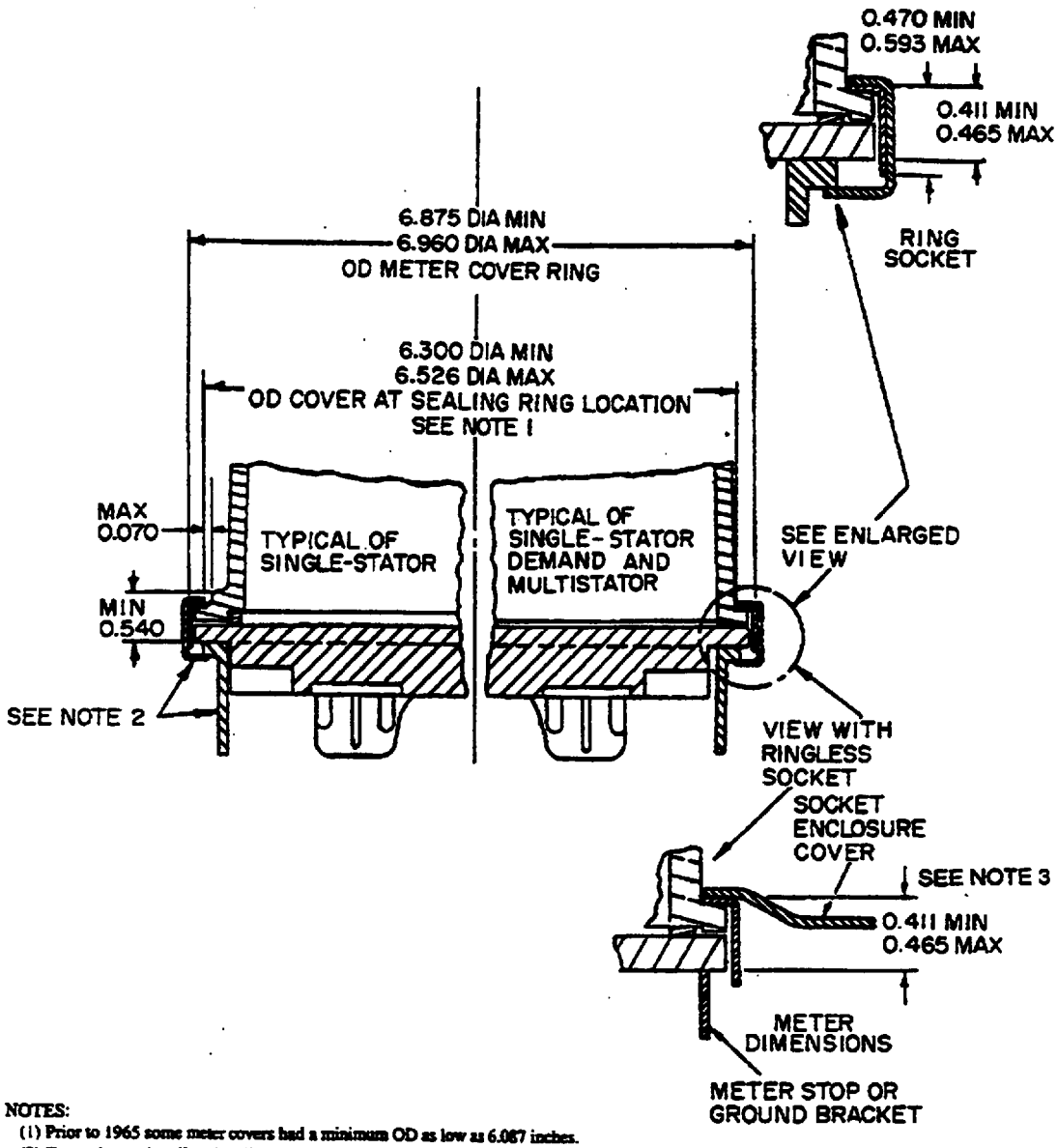
(1) Grounding straps of surge gaps shall fall within the angle shown and be of sufficient length to provide contact surfaces from the minimum to the maximum radii. (Grounding means in the socket shall extend over the full angle shown and be located anywhere between the radii limits.)

(2) All dimensions are in inches.

(3) Unless otherwise specified, tolerances shall be ± 0.016 inch on single dimensions and ± 0.031 inch on cumulative dimensions.

Figure A6 – Mounting and terminal dimensions for detachable multi-stator watthour meters with 8 terminals and 13 to 15 terminals

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NOTES:

(1) Prior to 1965 some meter covers had a minimum OD as low as 6.087 inches.

(2) For socket and sealing ring dimensions, see NEMA Pub. No. EI 17-1968 (R1973) on Watthour Meter Sockets. A standard is currently in preparation that will supersede this document.

(3) For size of watthour meter opening in ringless type meter socket, see 6.11.1 which is in accordance with ANSI/UL 414-1991.

(4) All dimensions are in inches.

Figure A7 – Envelope of round covers for detachable single-stator and multi-stator watthour meters

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