ANSI/NEMA OS 2

NONMETALLIC OUTLET BOXES, DEVICE BOXES, COVERS, AND BOX SUPPORTS

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Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports

Published by

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Foreword

The purpose of this Standards Publication is to provide a guide for the types and sizes of nonmetallic boxes and supports that are in general use. The standards present dimensional data needed for the safety and convenience of interchangeability with associated equipment. All items, when properly installed and properly used, contribute to safety.

Properly manufactured boxes and covers are, however, only one factor in minimizing the hazards, which may be associated with the use of electricity. The reduction of hazards involves the joint efforts of various equipment manufacturers, the system designer, the installer, and the user. Information is provided herein to assist users and others in the proper selection of boxes and covers.

The manufacturer has limited or no control over the following factors, which are vital to a safe installation:

a. Environmental conditions
b. System design
c. Equipment selection and application
d. Installation
e. Operating practices
f. Maintenance

This publication is not intended to instruct the user of the boxes and covers with regard to these factors, except insofar as suitable equipment to meet needs can be recognized in this publication.

These standards are necessarily limited to defining the construction requirements for the products covered herein. The publication has been promulgated with a view towards reducing the hazard to persons and property when boxes and covers conforming with these standards are properly selected and installed in accordance with the National Electrical Code.

This Standards Publication has been reviewed with input obtained from independent testing laboratories and major consumer representatives.

The publication will be reviewed periodically by the Outlet and Switch Box Section of NEMA so that it will be kept up to date with advancing technology. Comments are welcomed and should be sent to:

Vice President, Engineering
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209

OS 2-2003 revises and supersedes OS 2-1998.

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Arlington Industries, Inc.—Scranton, PA
Bowers, A Subsidiary of Thomas & Betts—Memphis, TN
Bridgeport Fittings, Inc.—Bridgeport, CT
CANTEX INC.—Mineral Wells, TX
Cooper B-Line—Highland, IL
Cooper Crouse-Hinds—Syracuse, NY
EGS Electrical Group—Skokie, IL
Erico, Inc.—Solon, OH
Hubbell Incorporated—Bridgeport, CT
Lamson & Sessions—Cleveland, OH
O-Z/Gedney, A Unit of General Signal Corp.—Terryville, CT
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Section 1
GENERAL

1.1 SCOPE

This Standards Publication covers those general-purpose nonmetallic outlet boxes, device boxes, covers, and supports that are widely used by the consumer. These items (covered by UL 514C) are designed to facilitate the pulling of wires, to protect and facilitate wiring splices and taps, to provide a means of mounting and protecting wiring devices, and to provide a connection for nonmetallic sheathed cable, nonmetallic tubing (Loom), rigid nonmetallic conduit, and electrical nonmetallic tubing or other approved raceways.

Excluded from this Standards Publication are the following: "conduit bodies" and similar types of boxes; cabinets or cutout boxes; floor boxes; flush device cover plates; boxes, plates, and covers designed for use with surface metal or surface nonmetallic raceway systems only; and boxes larger than 1650 cm^3 (100 cu. in.) in volume, except multiple gang device boxes.

1.2 NORMATIVE REFERENCES

The following publications are adopted in part, by reference in this publication, and are available from the organizations below. Unless otherwise noted, references are to the most recent edition.

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1867
Rosslyn, VA 22209

NEMA OS 3 *Selection and Installation Guidelines for Electrical Outlet Boxes*

National Fire Protection Association
Batterymarch Park
Quincy, MA 00269

ANSI/NFPA 70 *National Electrical Code®*

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

ANSI/UL 514C *Standard for Nonmetallic Outlet Boxes, Flush Device Boxes and Covers*

1.3 DEFINITIONS

blank cover: An outlet box cover having no knockouts or openings, other than those used to mount to a box. These covers complete the enclosure.

blank/knockout cover: An outlet box cover that contains a knockout which can be removed to accommodate a fitting for a pendant cord, etc. When left in place it may serve as a blank cover.

box (electrical): Part of an enclosure provided with means for mounting a cover, cover-plate, accessory, etc.

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box extender: An accessory installed in or on a box that is mounted in a finished structure. The box extender rests on the edge of the existing box (fixed depth) or extends into the box (adjustable depth). It is not mechanically secured to the box. The flange of the box extender, if provided, rests on the finished surface.

box support: A means (e.g. bracket) for securing an outlet or device box to the building structure or finished surface. Supports can be an integral part of the box, attached to the box, or entirely separate.

bracket: A box support for securing an outlet box or device box in place in walls or ceilings, or to wall studs, building structures, or structural members.

cable box: An outlet box typically provided with clamps for use with metallic or nonmetallic cables or flexible nonmetallic tubing, or any combination of said cables and tubing. (See outlet box.)

clamp: A part of or an accessory to a cable box to secure flexible nonmetallic tubing (Loom) or cable to the box.

concrete box: An outlet box especially intended for support in concrete, typically constructed to allow end-to-end extension and the application of covers on two sides. This box is not intended for floor installation.

conduit box: An outlet box designed with circular knockouts for conduits or fittings.

device box: A box which is designed to receive and support switches, receptacles, and similar devices. The term “device box” includes the following specific types:

a. Single gang—fixed sides, accommodates a single device
b. Two gang—fixed sides, accommodates up to two devices
c. Three gang—fixed sides, accommodates up to three devices
d. Four gang—fixed sides, accommodates up to four devices
e. Gangable—permits the removal of one or both sides of the box to join (or gang) as many sections as required

device mounting covers: A device box cover that provides a mounting platform for a wiring device. The device is mounted on top of the cover. The cover may be raised. These covers are also sometimes referred to as mud rings. A wallplate is required to complete the enclosure.

exposed work cover: A device box cover that is typically raised having cutouts to accept and support wiring devices. The devices are mounted to the underside of the cover. These covers also complete the enclosure.

flush-mounted box: A box that is so designed as to have a minimal front projection from the surface surrounding the box opening.

hung-ceiling box: A box that consists of a ring and a back plate with supporting bars for use with rigid nonmetallic conduit, electrical nonmetallic tubing, flexible nonmetallic tubing, or nonmetallic sheathed cable above suspended ceilings.

junction box: A junction box with a volume of 100 cu. in. or less is considered an outlet box.

knockout: A portion of the wall of a box that can be removed readily in order to provide an opening for the entry of tubing, conduit, or cable.

listed: Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and

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whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

outlet box: a box used in an electrical wiring system for containing wire, taps, splices, or devices. It has provisions for the entry of conduit, tubing, or cable assemblies and for the attachment of a separate cover, which is used to close the box or provide support for the devices or fixtures.

NOTE–The function of an outlet box, when completely closed by a cover or part of a wiring device acting as a cover, is to guard live parts against outside incidental contact, to protect the surrounding environment from faults occurring within the outlet box, to permit inspection of the wiring system, and to provide a safe means for replacement of wiring devices. Normally, outlet boxes have provisions for the entrance of conductors through nonmetallic conduit, cable, or tubing. Outlet boxes also have a provision for fastening covers, which are separate or a part of a wiring device. The fastening means is not a hinge and provides for future removal. An outlet box also provides one or more of the following:

a. Support for luminaire (fixture) assemblies and lampholders
b. Access to the raceway system for which it is designed
c. Extension of existing raceway or wiring systems
d. Grounding continuity via the wiring system for which it is designed
e. Utilization of accessories such as fixture studs, clamps, bar hangers, extension rings, and such.

outlet box cover: A cover which is intended to close the face of a box.

surface-mounted box: A box designed and intended to be mounted on a surface and to be exposed to sight rather than recessed in a wall, ceiling, or partition.

thermoplastic resins: Plastics that repeatedly can be softened by heating and hardened by cooling through a temperature characteristic of the plastic, and in the softened state can be shaped by flow into articles by molding or extrusion.

thermosetting resins: Plastics, which in their final state as finished articles, are substantially infusible and insoluble. They are often liquids at some state of their manufacture or processing, which are cured by heat, catalysis, or other chemical means. After being fully cured, thermosets cannot be resoftened by heat.

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Section 2
GENERAL STANDARDS

2.1 MATERIAL

The products addressed by the standard may be molded from thermosetting or thermoplastic resins.

2.2 CORROSION PROTECTION

2.2.1 All ferrous metal surfaces outside the box such as brackets, ears, and adjustable bar hangers used in conjunction with a nonmetallic box shall be protected against corrosion by a zinc coating of 0.13 mm (0.0005 in.) average thickness, and a minimum thickness of 0.0102 mm (0.0004 in.).

2.2.2 The zinc coating of any ferrous metal clamp, grounding plate, or strap that is installed inside the box, shall be not less than 0.0038 mm (0.00015 in.) average thickness, and a minimum thickness of 0.0025 mm (0.0001 in.).

2.2.3 Equivalent corrosion protection provided by an alternate corrosion protection system, other than zinc, is acceptable.

Exception: The cut edges, punched holes, and threaded surfaces of tapped holes of a part formed from galvanized stock do not need additional protection.

NOTE–See UL 514A for method of determining compliance.

2.2.4 Screws of ferrous metal material shall be protected against corrosion by a zinc coating.

2.3 SCREWS

The most common screws used in conjunction with outlet boxes, device boxes, and covers are shown in Table 2-1.

Table 2-1
SCREWS COMMONLY USED IN CONJUNCTION WITH OUTLET BOXES, DEVICE BOXES, AND COVERS

Nominal Size	Device Mounting Screws	Cover Mounting and Luminaire Support	Ceiling Suspended Fan Support	Ground Screws	Bar Hanger
6-32	X	—	—	—	—
8-32 or larger	—	X	X	X	X

Ferrous screws shall have visible corrosion protection. The heads of grounding screws shall be identified by a green color.

2.4 OPENINGS

2.4.1 Cable-Size Knockouts

Cable-size knockouts provided in boxes shall be so designed that they can be removed without deforming the box. The openings created from their removal shall be free of sharp and jagged edges,

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which could destroy the integrity of the cable installation. The clearance between the knockout and the opening shall be not more than 0.76 mm (0.030 in.).

2.4.2 Knockouts for Conduit or Tubing

2.4.2.1 A knockout shall effectively cover the opening in which it is located to afford protection practically equivalent to that of the box walls. The knockouts shall be formed so that they can be easily removed without deforming the box or cover in which they are located. The clearance between the knockout and the opening shall be not more than 0.76 mm (0.030 in.). Knockout openings shall be located in flat surfaces of the boxes so that connected wiring systems are able to be properly installed.

2.4.2.2 The diameters for 5 nominal sizes of knockouts shall be as shown in Table 2-2.

Table 2-2
DIAMETER OF KNOCKOUTS

Trade Size of Knockout	Diameter, mm (In.)		
	Nominal	Minimum	Maximum
1/2 (16)	22.225 (0.875)	21.819 (0.859)	23.012 (0.906)
3/4 (21)	28.169 (1.109)	27.788 (1.094)	28.981 (1.141)
1 (27)	34.925 (1.375)	34.519 (1.359)	35.712 (1.406)
1-1/4 (35)	44.044 (1.734)	43.663 (1.719)	44.856 (1.766)

2.4.3 Clamps

Boxes intended for use with cable shall be designed to provide clamps for securing the cable, in accordance with the National Electrical Code®.

2.5 SUPPORTS

2.5.1 Boxes shall be so designed that they can be securely fastened in place without depending on the support furnished by any system of wiring. A box support provided as a part of a box shall be so designed and constructed as to provide ample strength and rigidity.

2.5.2 A box support that is provided separately shall be so designed and constructed as to securely attach to the box for which it is intended and shall be capable of supporting a mass of 23 kg (50 lbs.) for 5 minutes without breaking or pulling loose from the box. The means necessary to attach the support to the box shall be provided with the support.

2.5.3 Provision for supporting a device within the box shall be independent of the means used to support the box.

2.5.4 Sheet steel supporting ears shall not be less than 0.91 mm (0.036 in.) in thickness (or equivalent in strength) and suitably attached to the box.

2.6 BOXES FOR SUPPORTING EQUIPMENT OR ACCESSORIES

A box that is intended to provide a means for support for equipment such as a luminaire (lighting fixture), ceiling-suspended fan or other accessory from the box, shall be so designed and equipped to withstand the mechanical forces to which it is likely to be subjected during normal use.

NOTE–See UL 514C for method for determining compliance.

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2.6.1 Boxes for Luminaire Support

A box that is intended to support a luminaire weighing more than 2.7 kg (6 lbs.) shall include at least two 8-32 mounting screws.

2.6.2 Boxes for Ceiling-Suspended Fan Support

A box that is intended to support a ceiling-suspended fan, with or without accessories, shall include at least two 8-32 or 10-32 screws.

2.7 DEVICE BOXES

A box intended to house a wiring device, such as a switch or receptacle, shall be so designed and constructed to provide secure mounting of the device as intended.

2.8 BOXES AND MOUNTS FOR OTHER DEVICES AND ACCESSORIES

A box or mount for other devices, accessories or wiring methods, such as Class 2, telecommunications and information technology, or other low voltage systems, shall be so designed and constructed to permit the secure mounting of the device accessory or wiring method as intended.

2.9 BOXES FOR HIGH AND LOW VOLTAGE CIRCUITS

2.9.1 A box intended to house both conductors of power, lighting, or Class 1 (high voltage) circuits and conductors or cables of communications, Class 2, Class 3 or conductive and nonconductive optical fiber cable (low voltage) circuits shall be provided with a means for isolating the high voltage and low voltage circuits and devices into discrete wiring compartments.

2.9.2 Means for isolating wiring compartments may be furnished separately.

2.10 MARKING

2.10.1 General

Boxes and covers shall be marked with the name or trademark of the manufacturer and volume capacity in cubic centimeters (cm^3) or cubic inches as required by the National Electrical Code®. The marking shall be readily visible after the installation of the box.

2.10.2 Boxes for Supporting Equipment and Accessories

A box intended to support a luminaire weighing up to 50-pounds (23 kg) shall be marked “FOR LUMINAIRE SUPPORT” or “FOR FIXTURE SUPPORT” or similar. This marking may be placed on the smallest unit container in which the box shipped.

A box intended to support a luminaire or ceiling-suspended fan or other accessory shall comply with the marking requirements in UL 514C.

2.10.3 CABLE CLAMPS

A clamp furnished as part of a box shall be marked to indicate its intended use.

NOTE–Refer to UL 514C for markings.

2.11 GROUNDING

Boxes may be provided with integrally attached ground straps intended to ensure ground continuity between metal covers, metal face plates, or wiring devices such as switches or receptacles, which may not be of the grounding-type.

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Section 3
SPECIFIC REQUIREMENTS

3.1 GENERAL

The drawings in this section give minimum and maximum dimensions to assure safe inter-changeability with other components.

Specific details and dimensions for outlet boxes, device boxes, covers, box supports, and accessories should be obtained from the manufacturer.

Overall device box sizes, other than those specified in this standard, may be provided for specific applications.

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c. COVERS FOR OUTLET AND DEVICE BOXES		
1. **Flush or Surface Mounted**		
3-¼, 3-½" Round or Octagonal Blank	3-14	22
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4" Square Single Device	3-24	32
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**May be factory assembled to a bar hanger, mounting bracket or include a ground strap*

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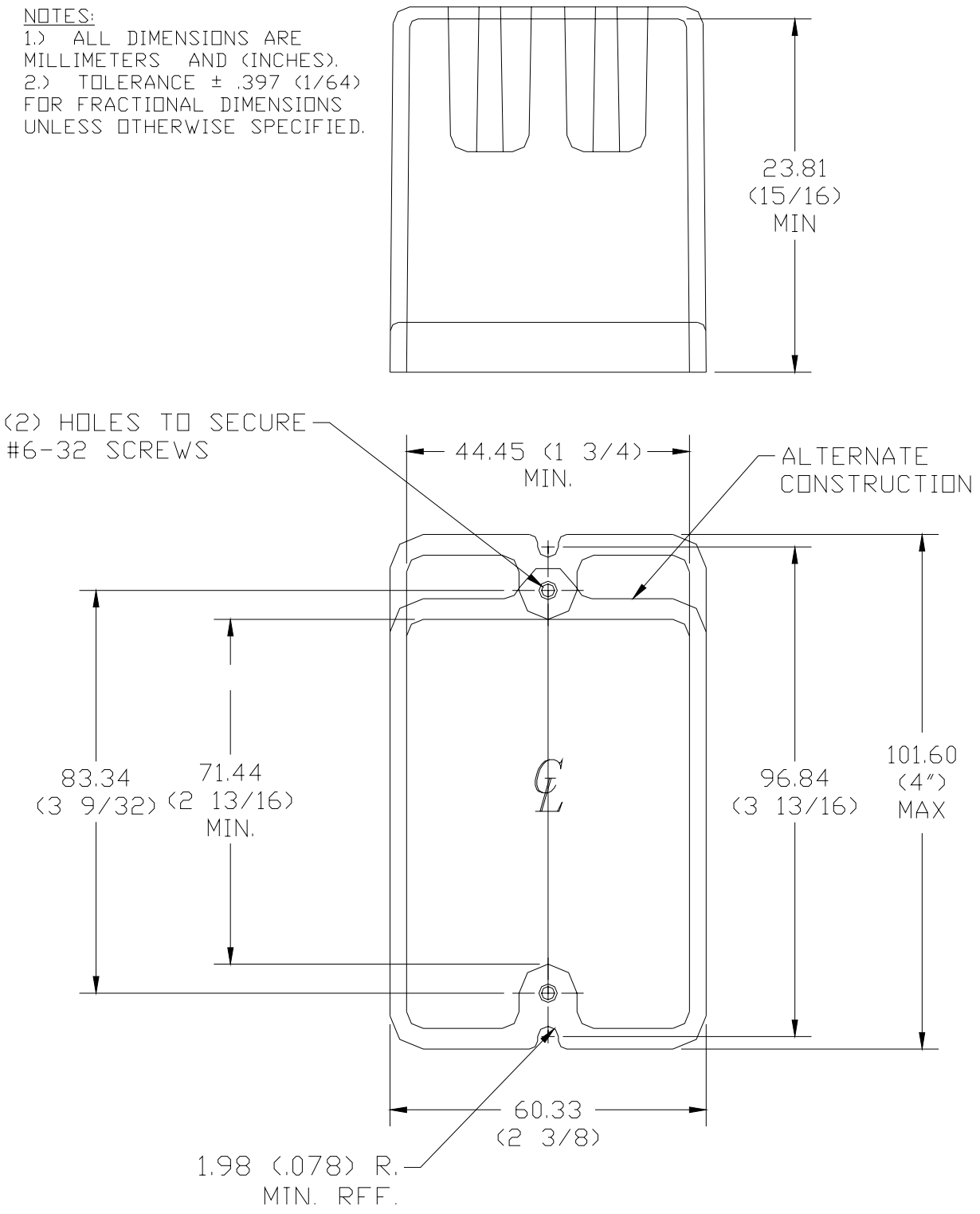


Figure 3-1
SINGLE GANG FLUSH OR SURFACE MOUNTED NONMETALLIC DEVICE BOX
(No knockout locations are shown.)

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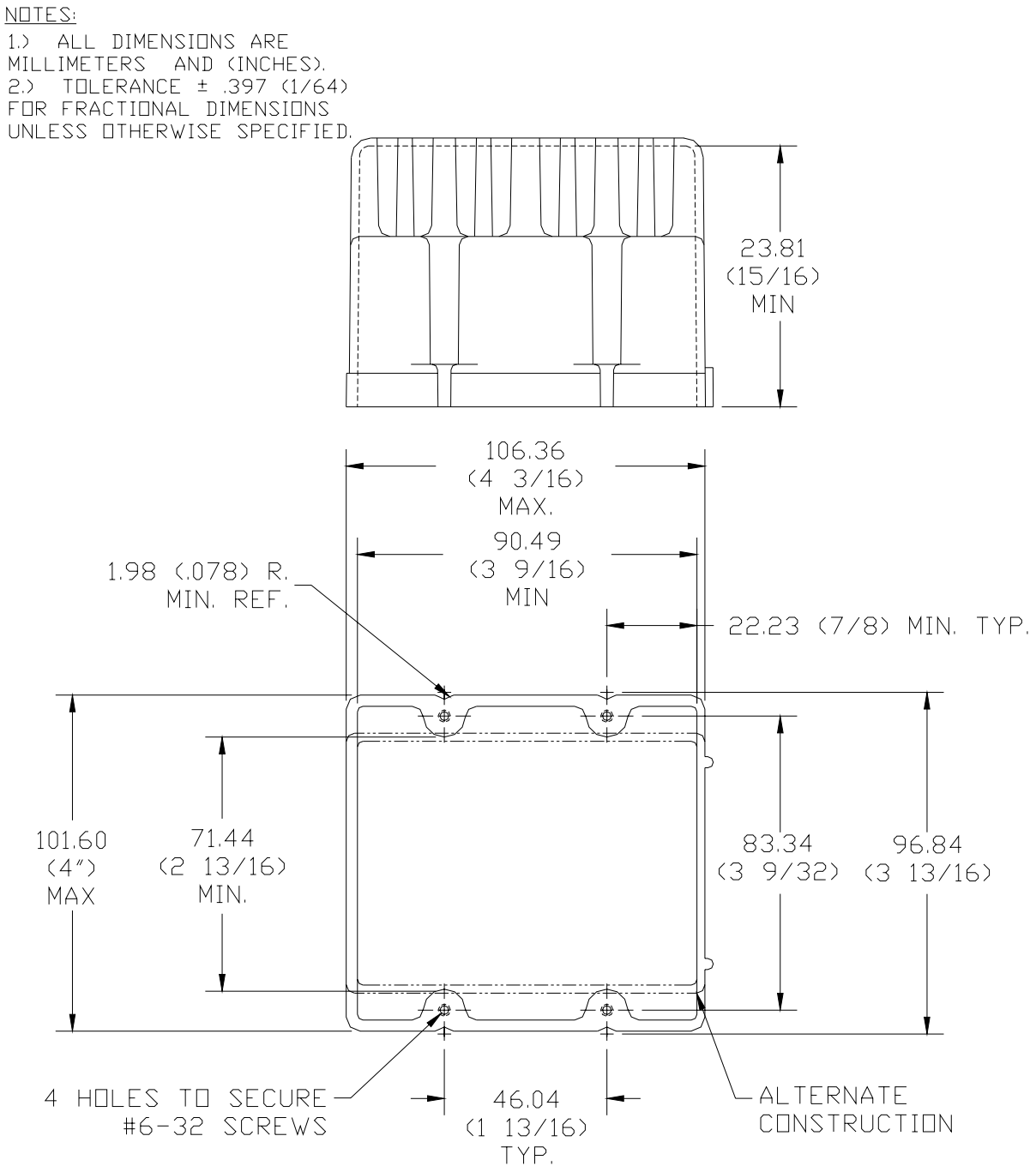


Figure 3-2
TWO GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX

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NOTES:
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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

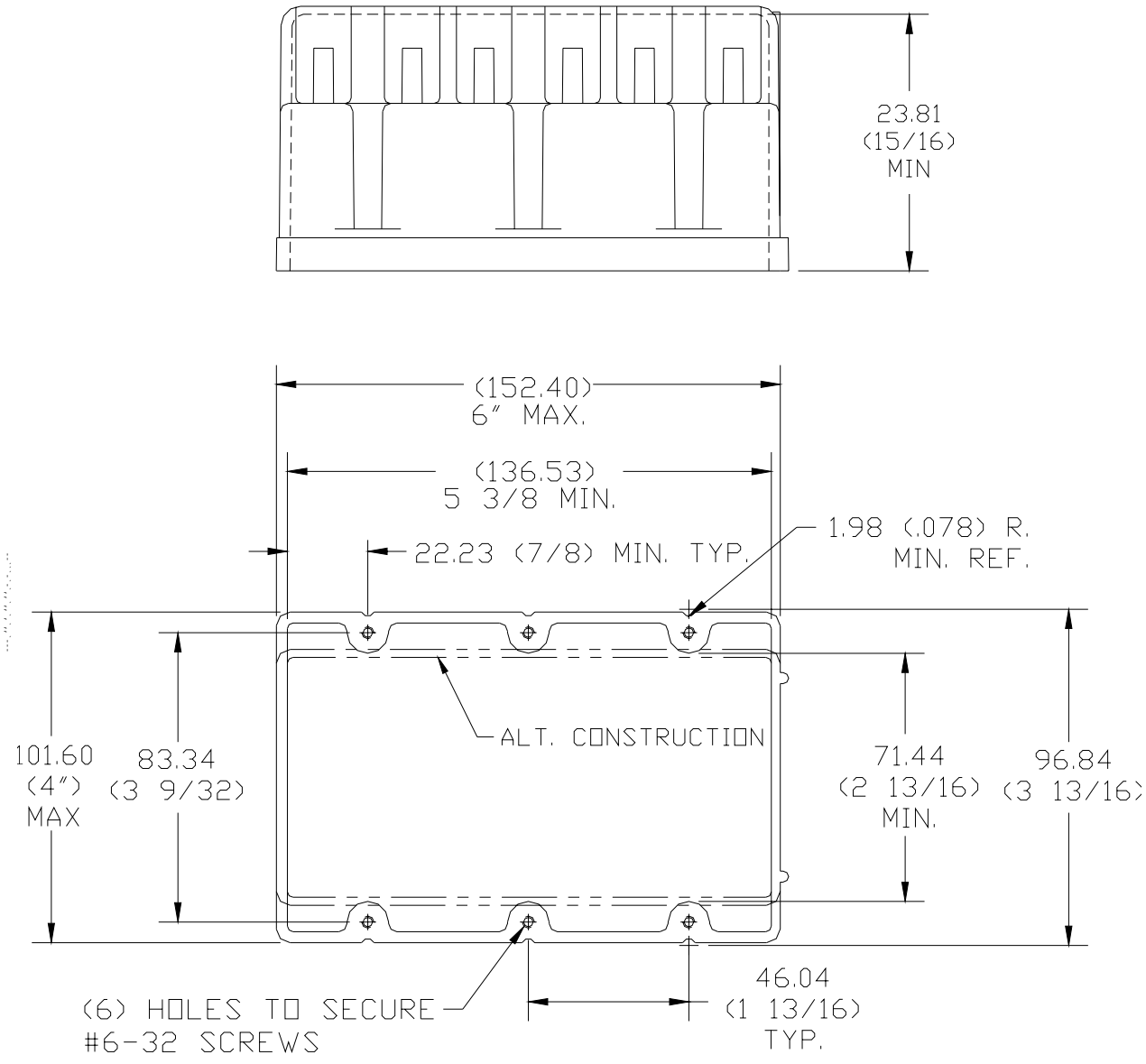


Figure 3-3
THREE GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX

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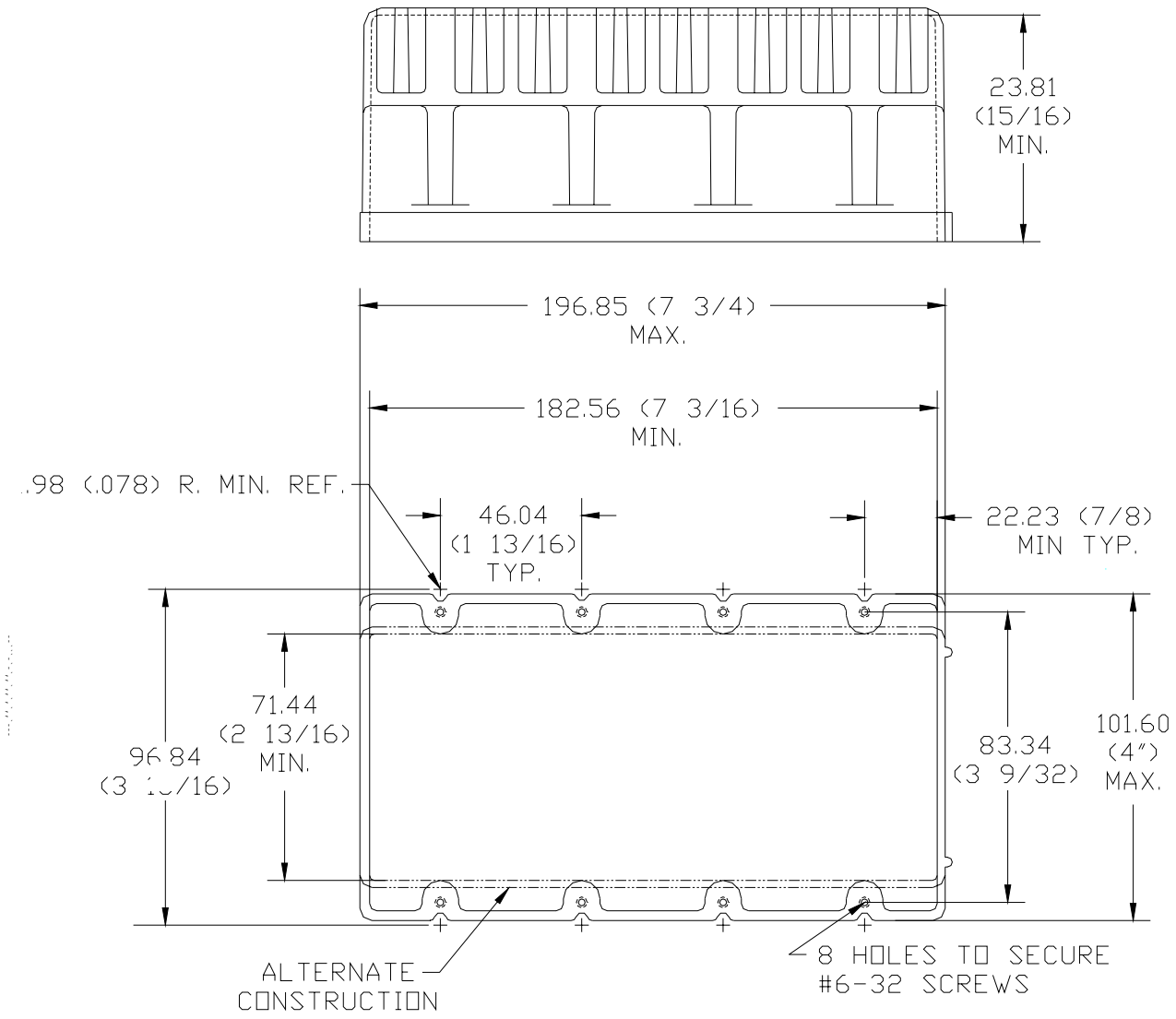


Figure 3-4
FOUR GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX

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3.) REFER TO FIG. 3-27 FOR ALTERNATE EAR CONFIGURATIONS

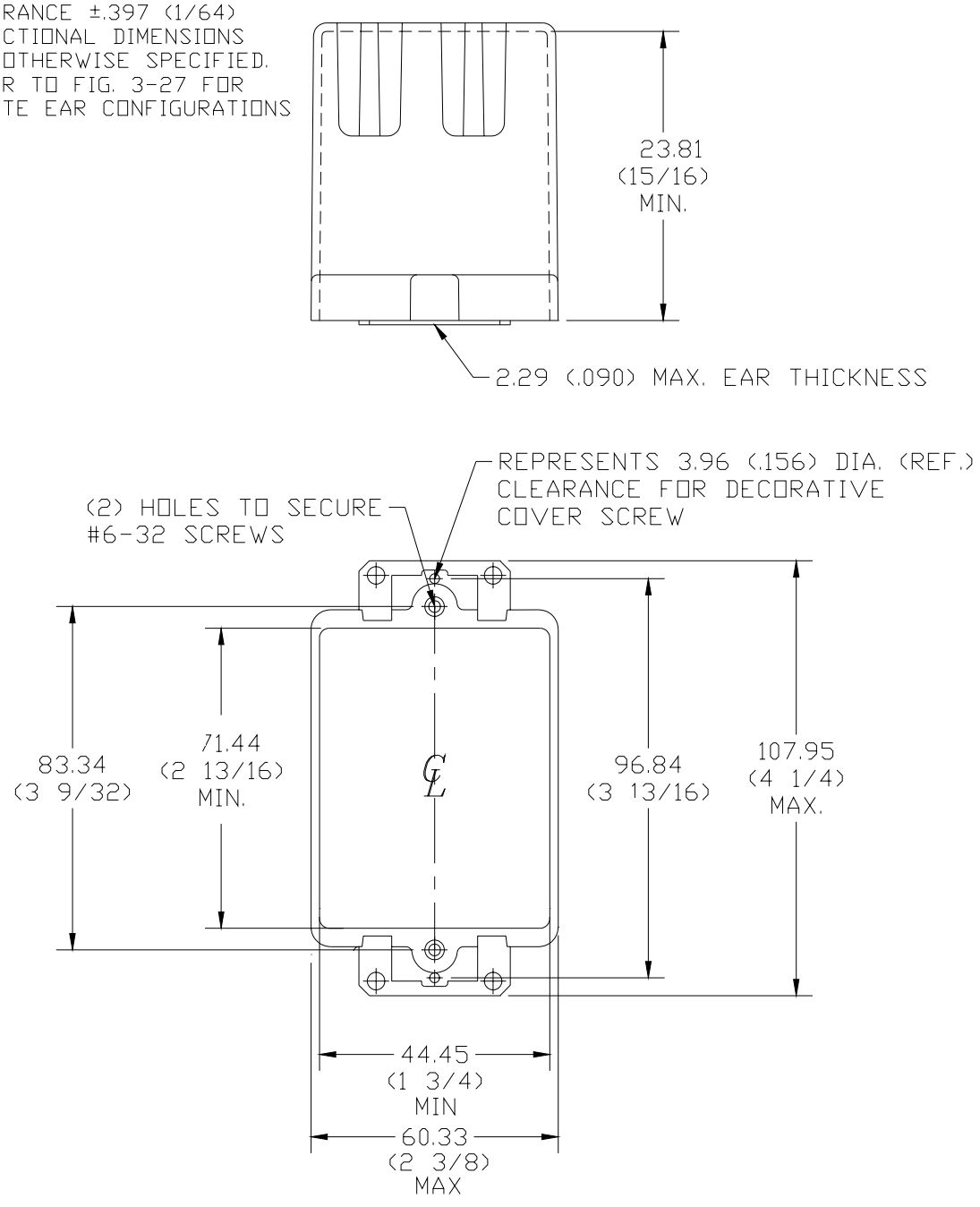


Figure 3-5
SINGLE GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX WITH PLASTER EARS

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.
3.) REFER TO FIG. 3-27 FOR ALTERNATE EAR CONFIGURATIONS.

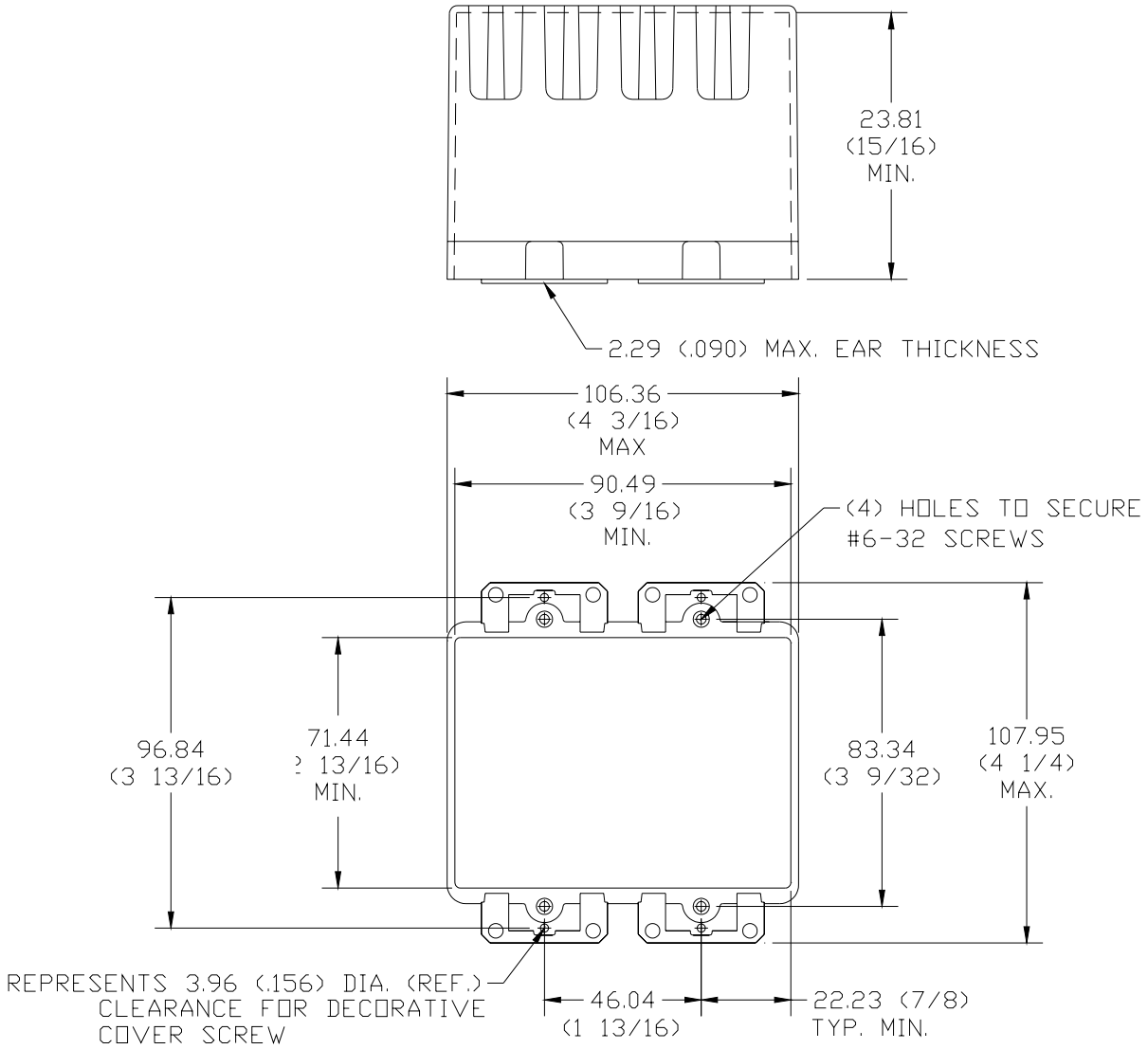


Figure 3-6
TWO GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX WITH PLASTER EARS

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NOTES:
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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.
3.) REFER TO FIG. 3-27 FOR FOR ALTERNATE EAR CONFIGURATIONS.

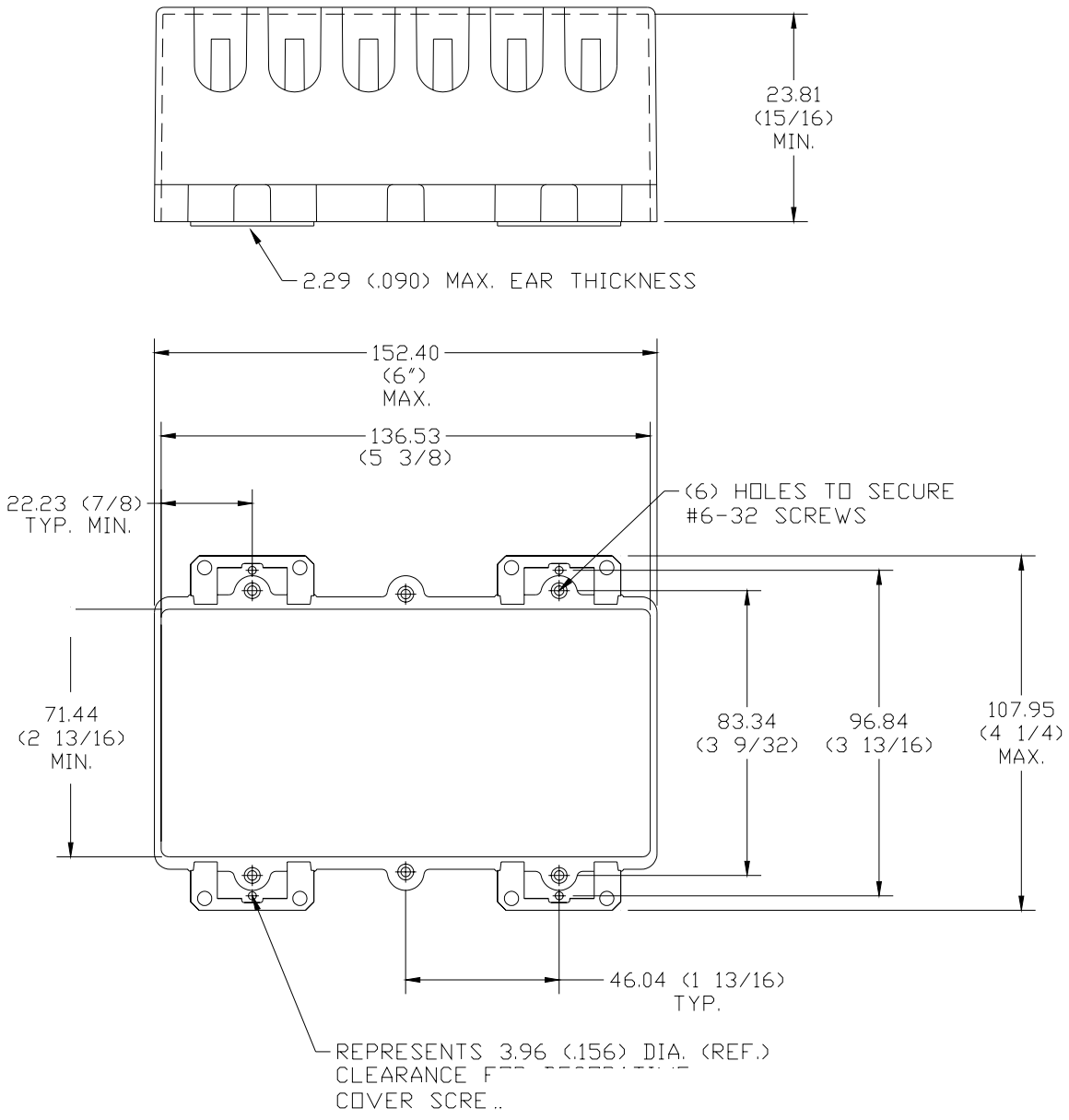
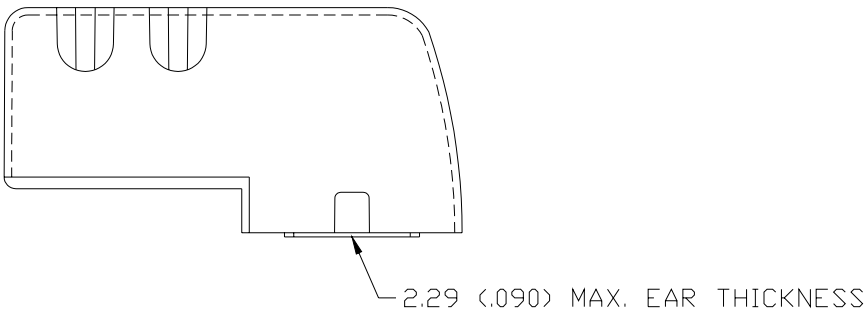


Figure 3-7
THREE GANG FLUSH MOUNTED NONMETALLIC DEVICE BOX WITH PLASTER EARS

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3.) REFER TO FIG. 3-27 FOR ALTERNATE EAR CONFIGURATIONS.



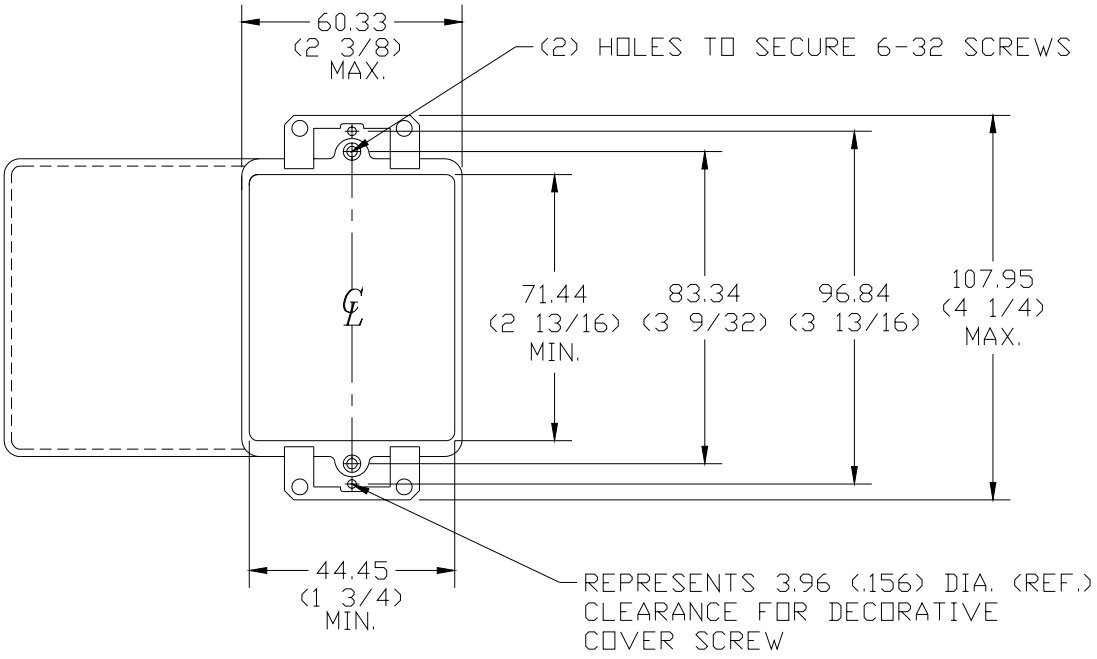


Figure 3-8
SINGLE GANG OFFSET FLUSH MOUNTED NONMETALLIC DEVICE BOX WITH PLASTER EARS

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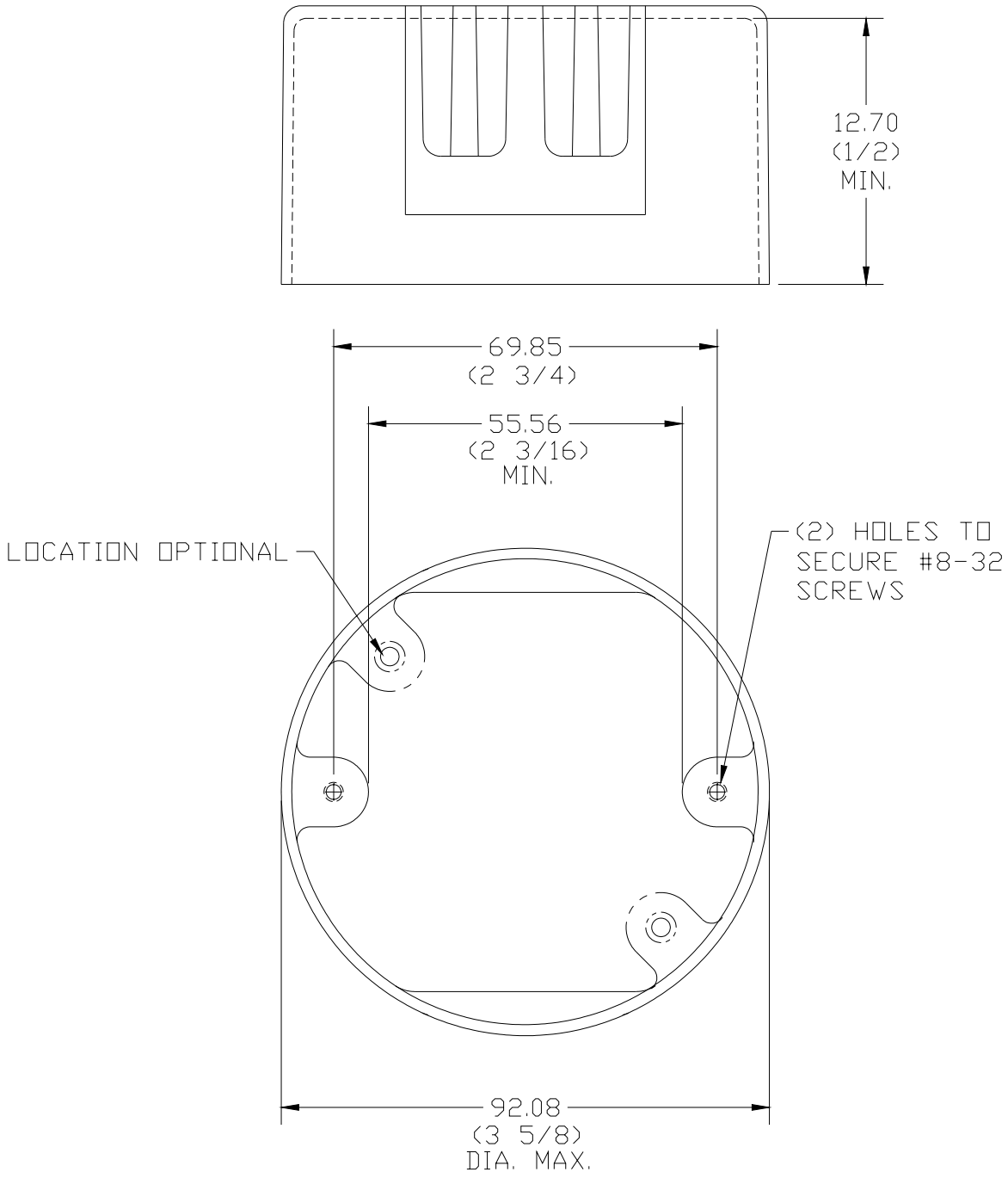


Figure 3-9
NOMINAL 3-1/4" / 3-1/2" ROUND OR OCTAGONAL NONMETALLIC DEVICE BOX

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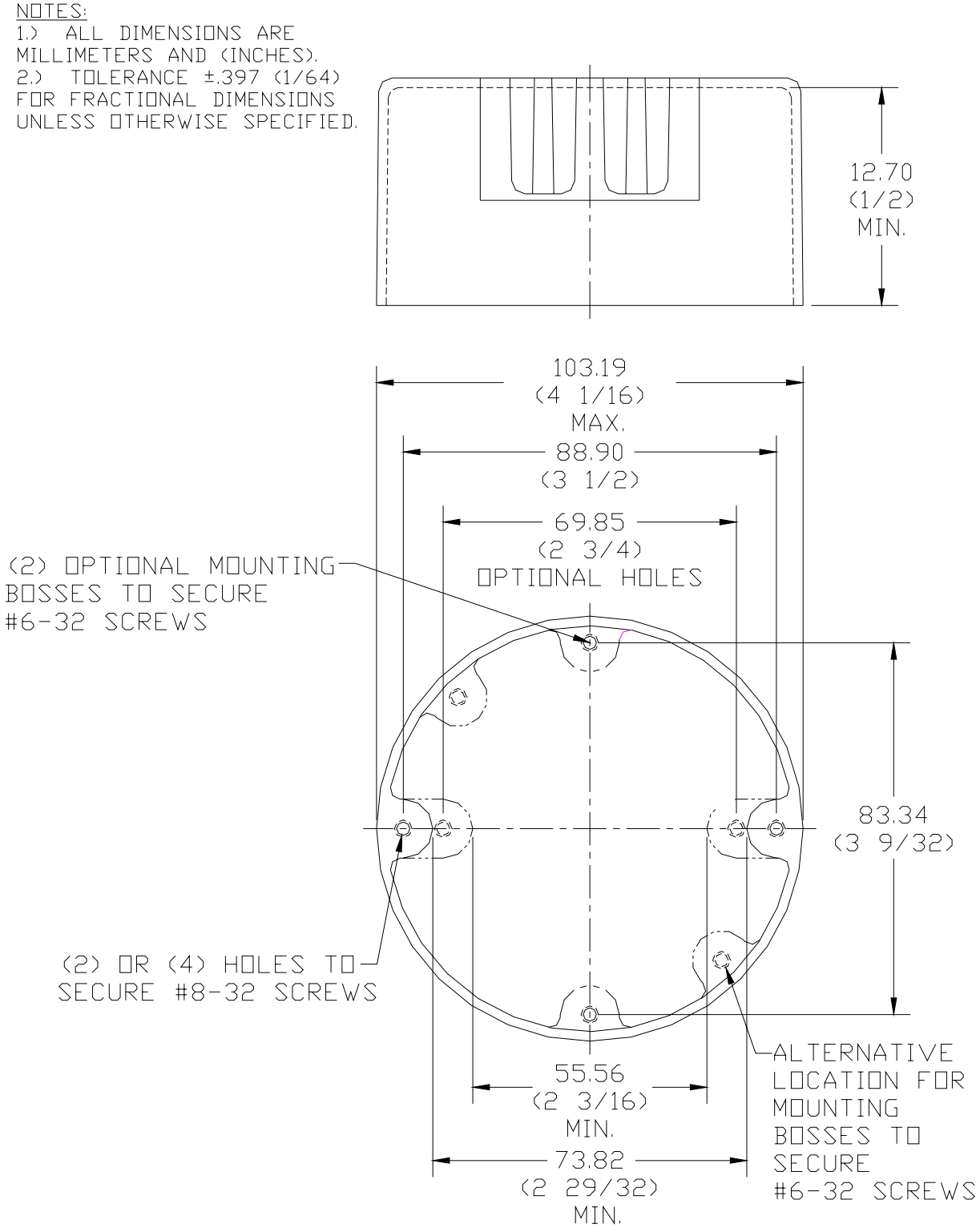


Figure 3-10
NOMINAL 4" ROUND OR OCTAGONAL NONMETALLIC DEVICE BOX

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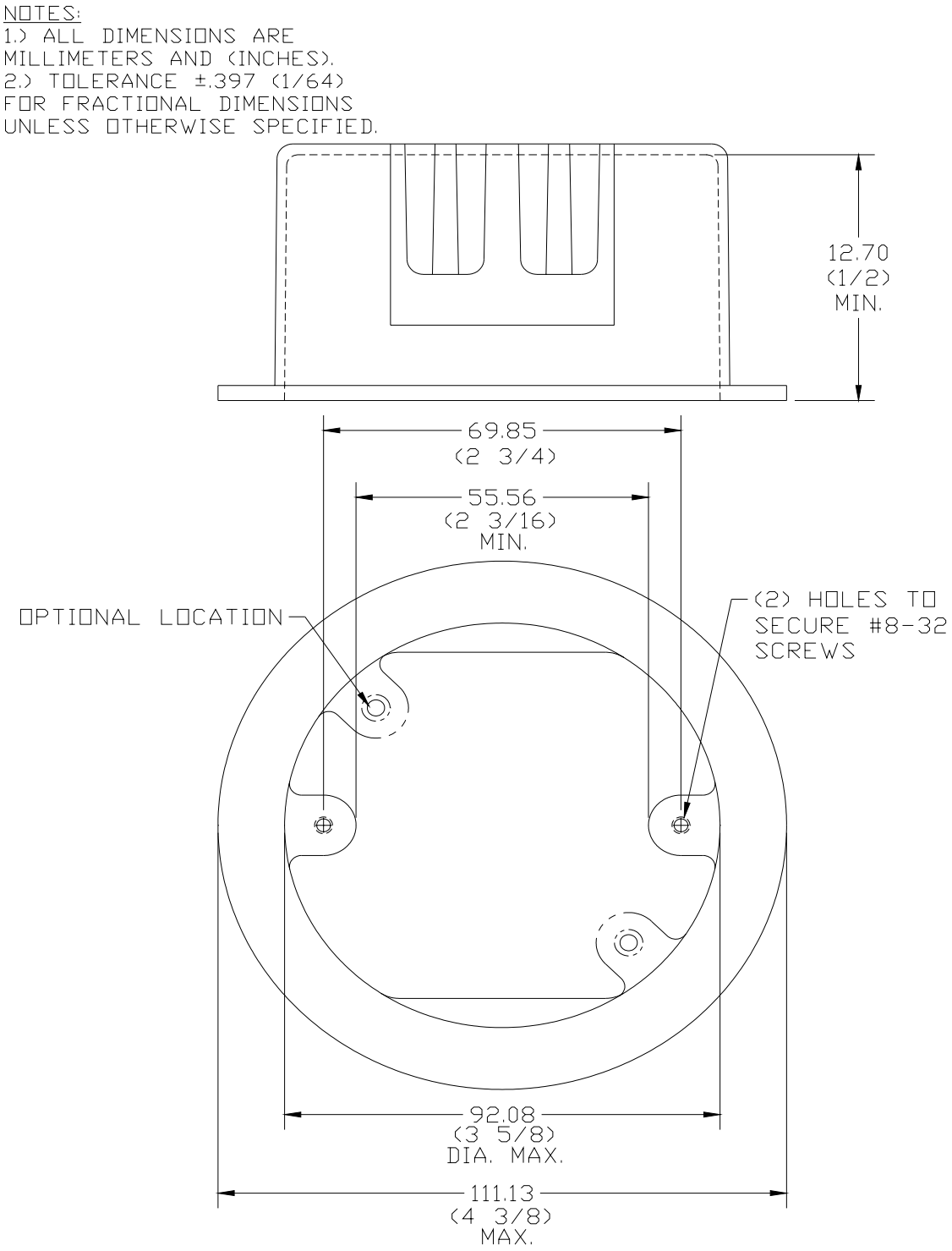


Figure 3-11
NOMINAL 3-1/4" / 3-1/2" ROUND OR OCTAGONAL NONMETALLIC DEVICE BOX WITH FLANGE

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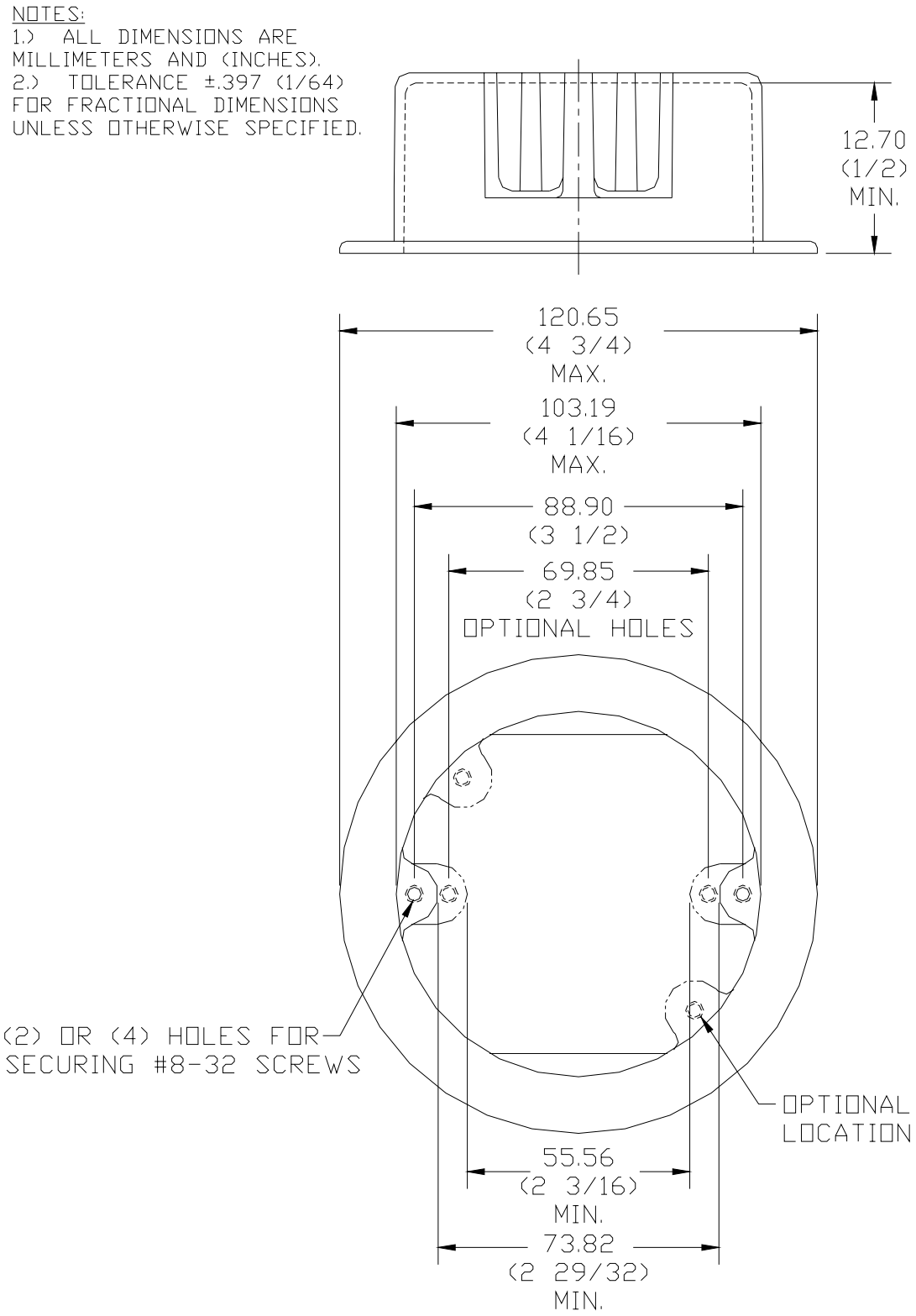


Figure 3-12
NOMINAL 4" ROUND OR OCTAGONAL NONMETALLIC DEVICE BOX WITH FLANGE

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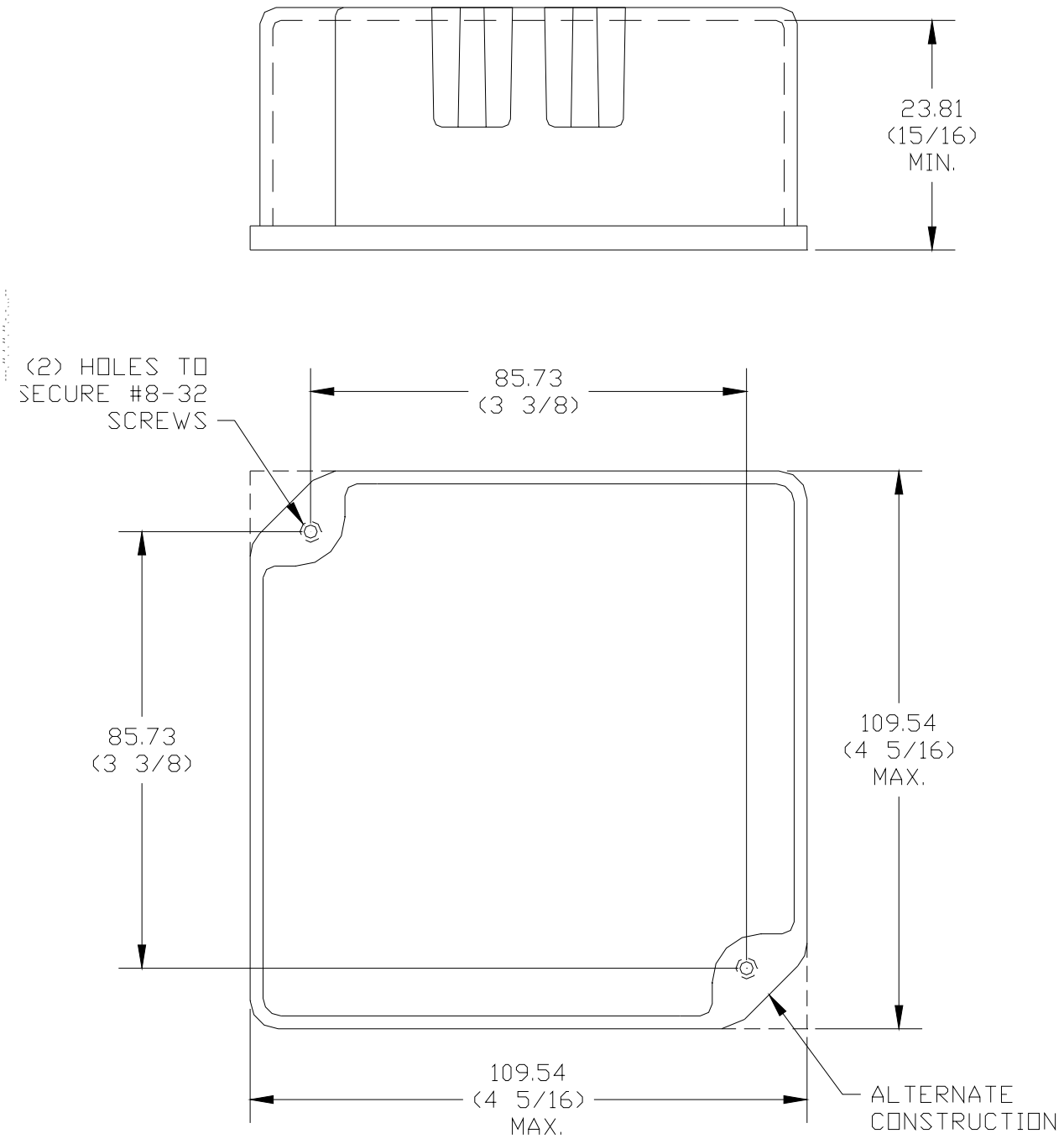


Figure 3-13
NOMINAL 4" SQUARE NONMETALLIC DEVICE BOX

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

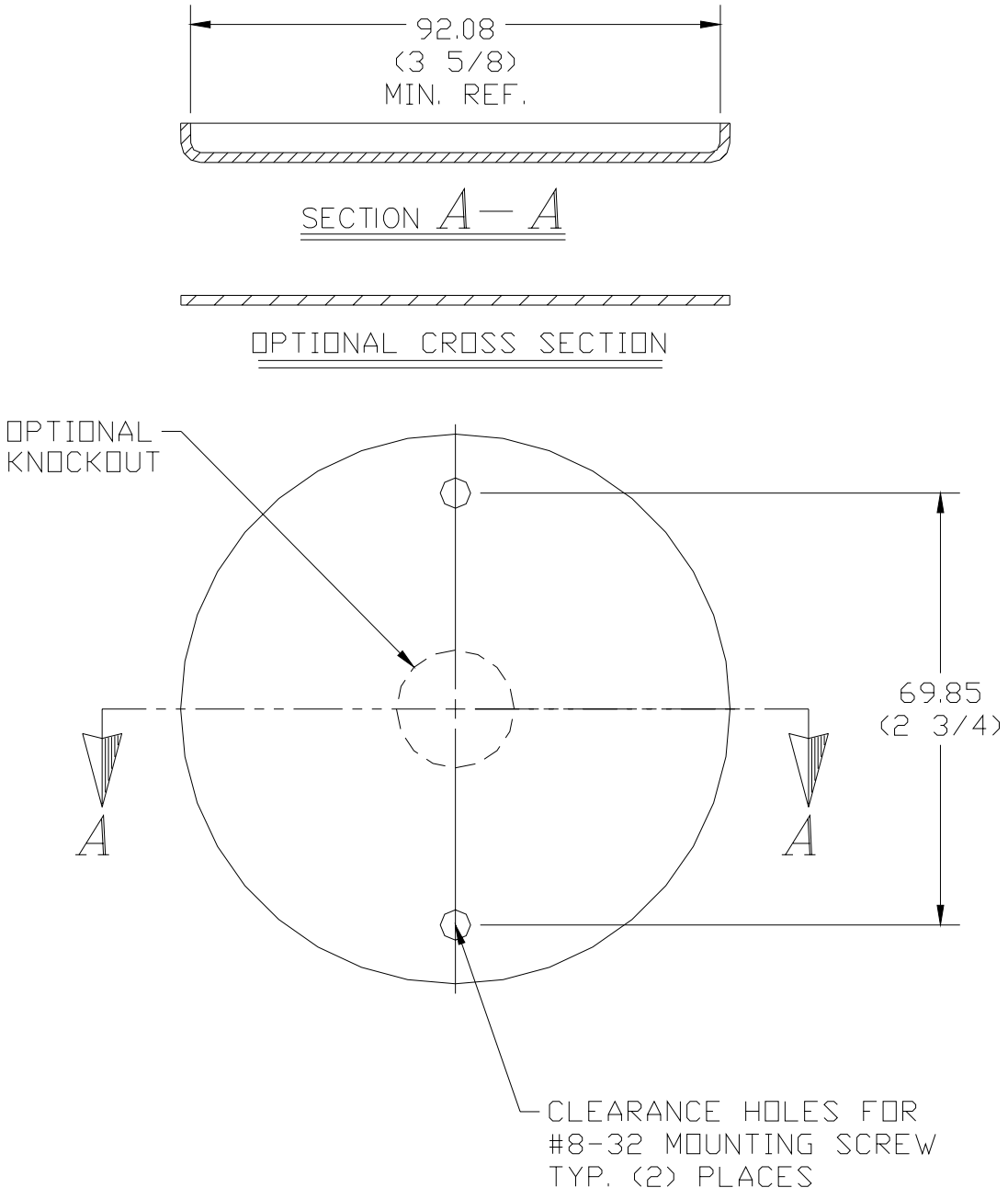
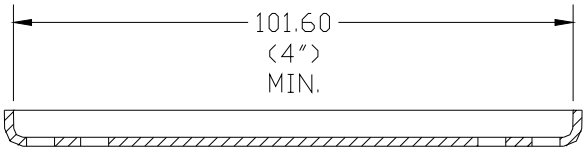


Figure 3-14
FLAT BLANK NONMETALLIC COVER FOR NOMINAL 3-1/4" AND 3-1/2" ROUND OR OCTAGONAL OUTLET BOX

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SECTION $A-A$

OPTIONAL CROSS SECTION

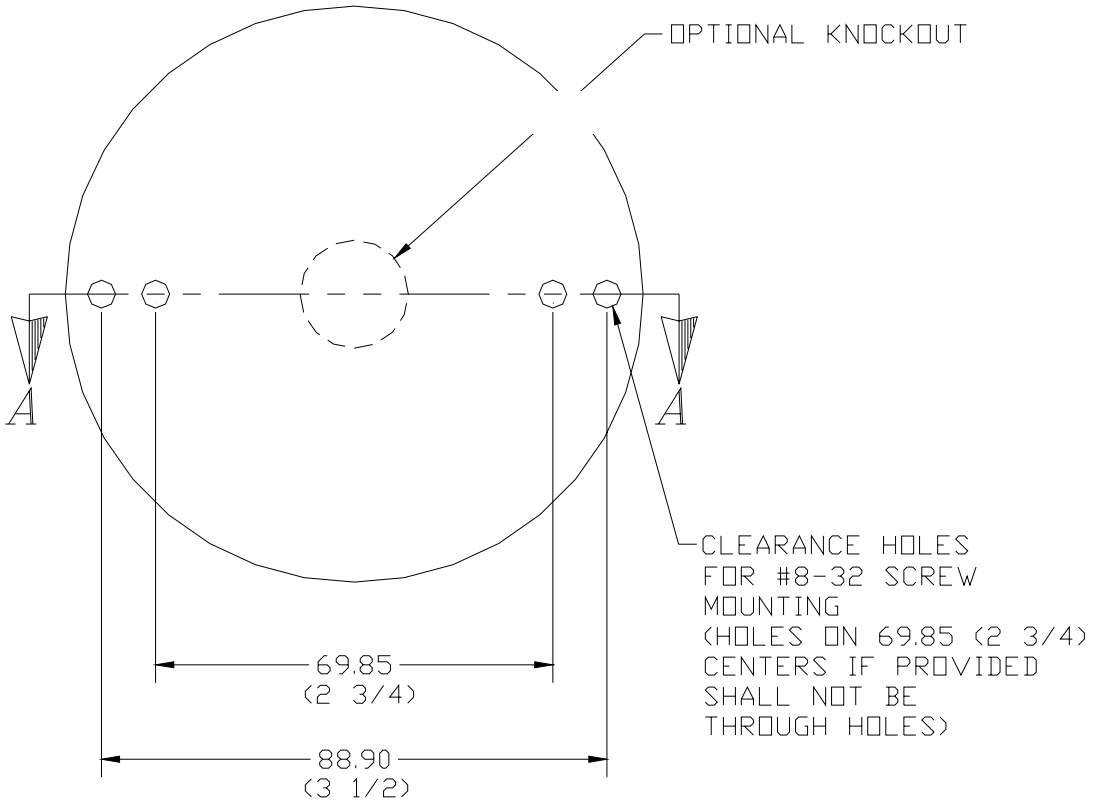


Figure 3-15
FLAT BLANK NONMETALLIC COVER FOR NOMINAL 3-1/4", 3-1/2", AND 4" ROUND OR OCTAGONAL OUTLET BOX

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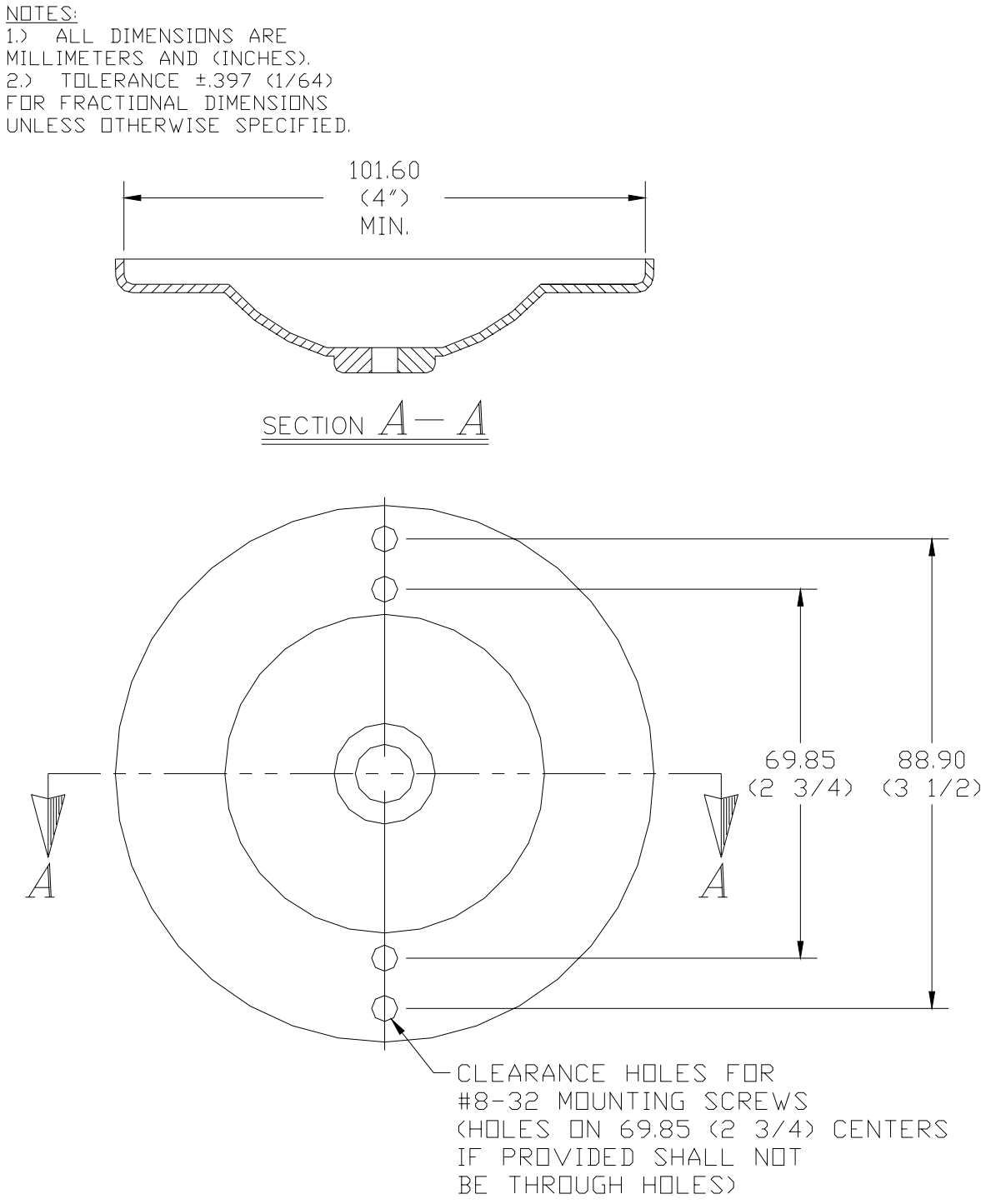


Figure 3-16
RAISED BLANK OR CORD DROP NONMETALLIC COVER FOR 3-1/4", 3-1/2", AND 4" ROUND OR OCTAGONAL OUTLET BOX

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.
3.) SEE FIG. 3-26 FOR ALTERNATE MOUNTING HOLE/SLOT CONFIGURATIONS.

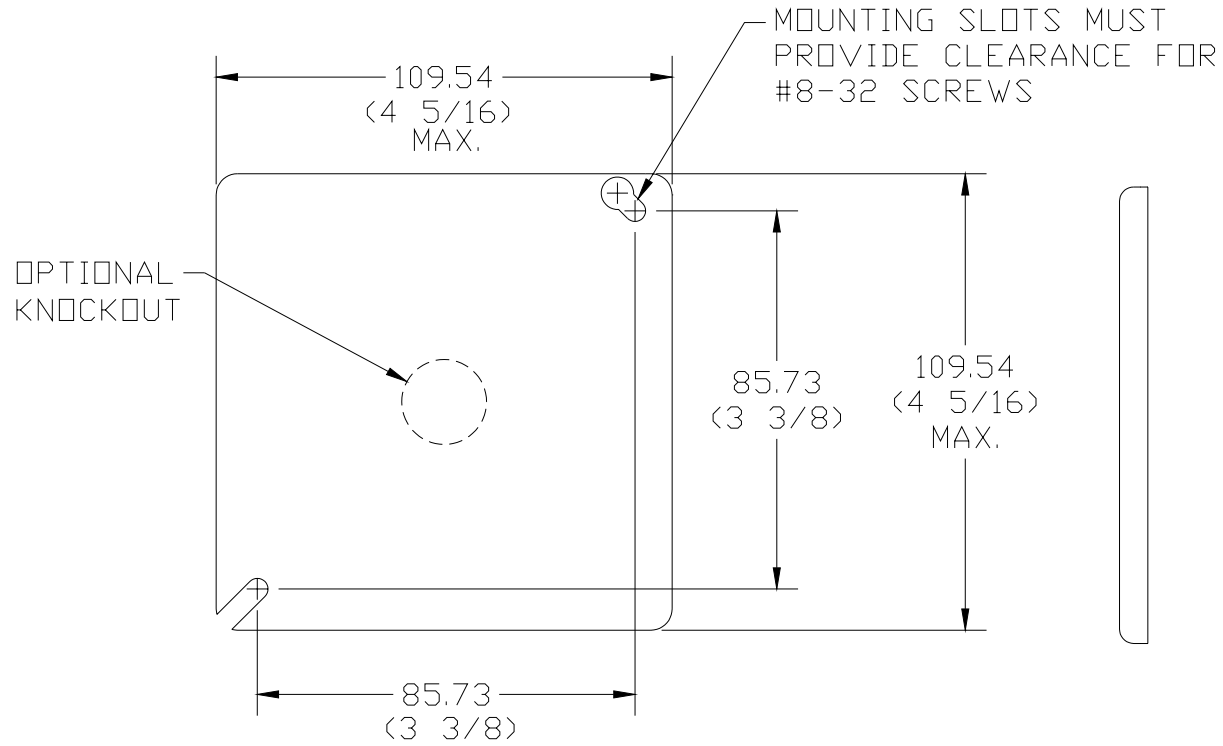


Figure 3-17
FLAT BLANK NONMETALLIC COVER FOR 4" SQUARE OUTLET BOX

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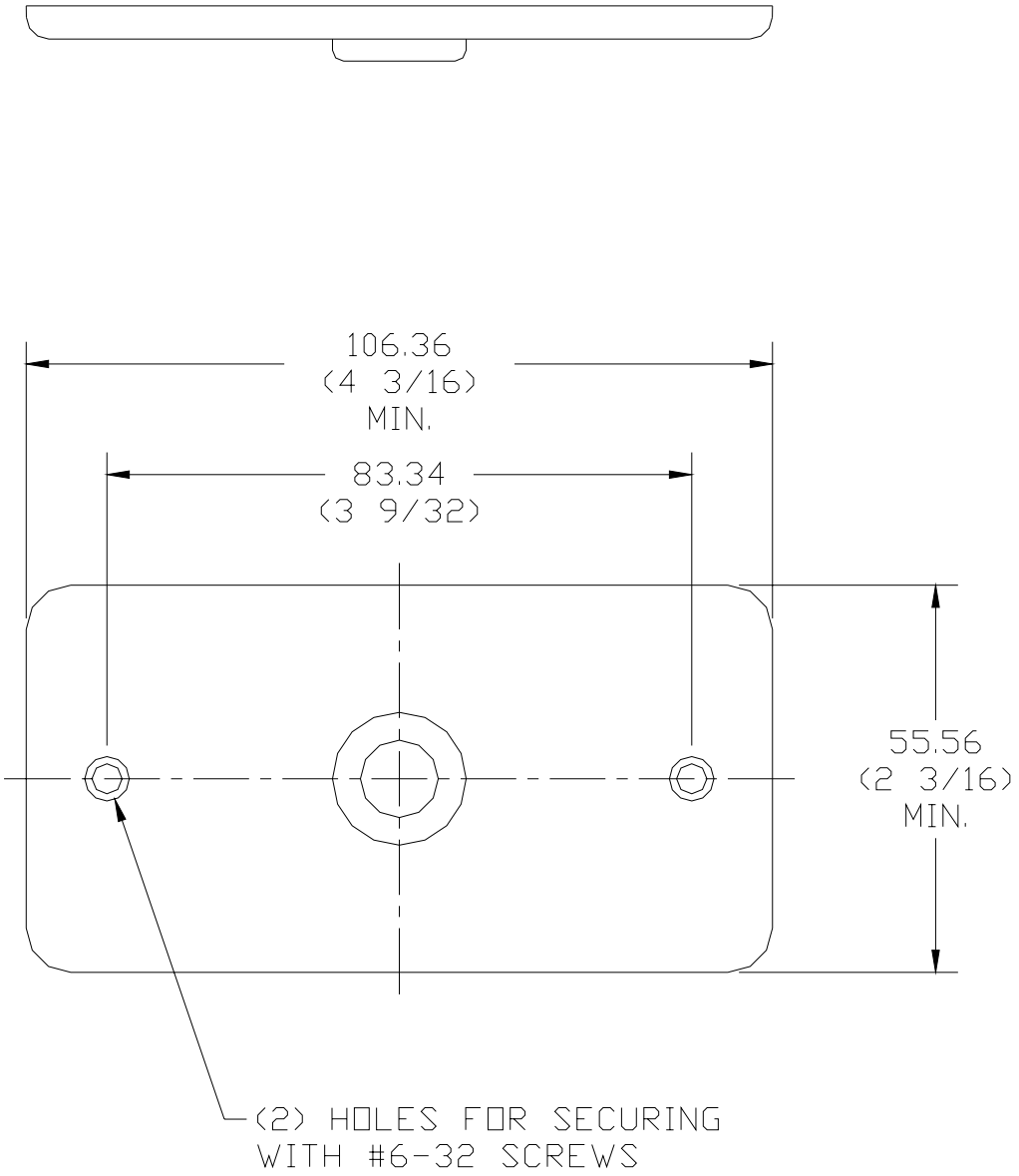


Figure 3-18
NONMETALLIC BLANK OR PENDANT COVER FOR SURFACE MOUNTED DEVICE BOXES

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

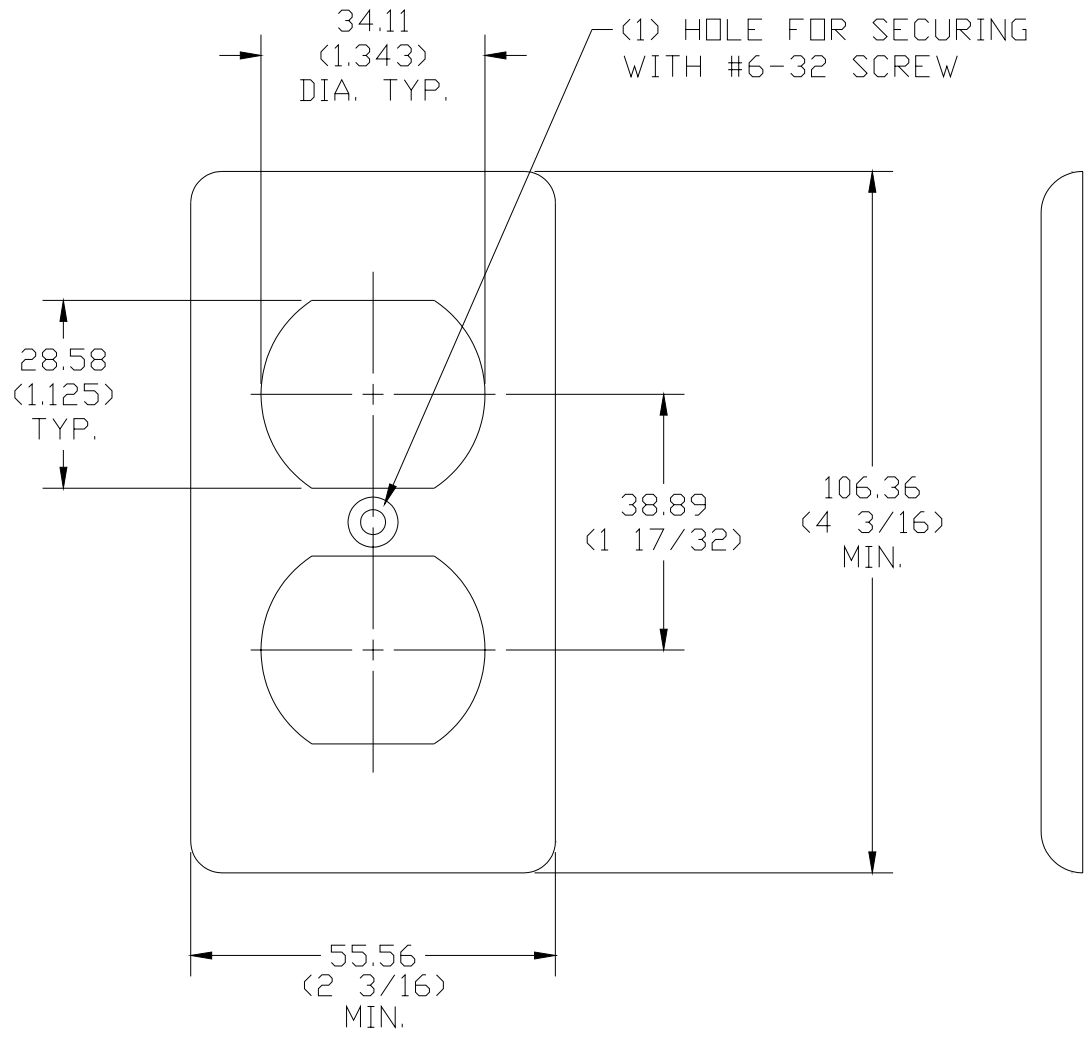


Figure 3-19
NONMETALLIC DUPLEX RECEPTACLE COVER FOR SURFACE MOUNTED DEVICE BOXES

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

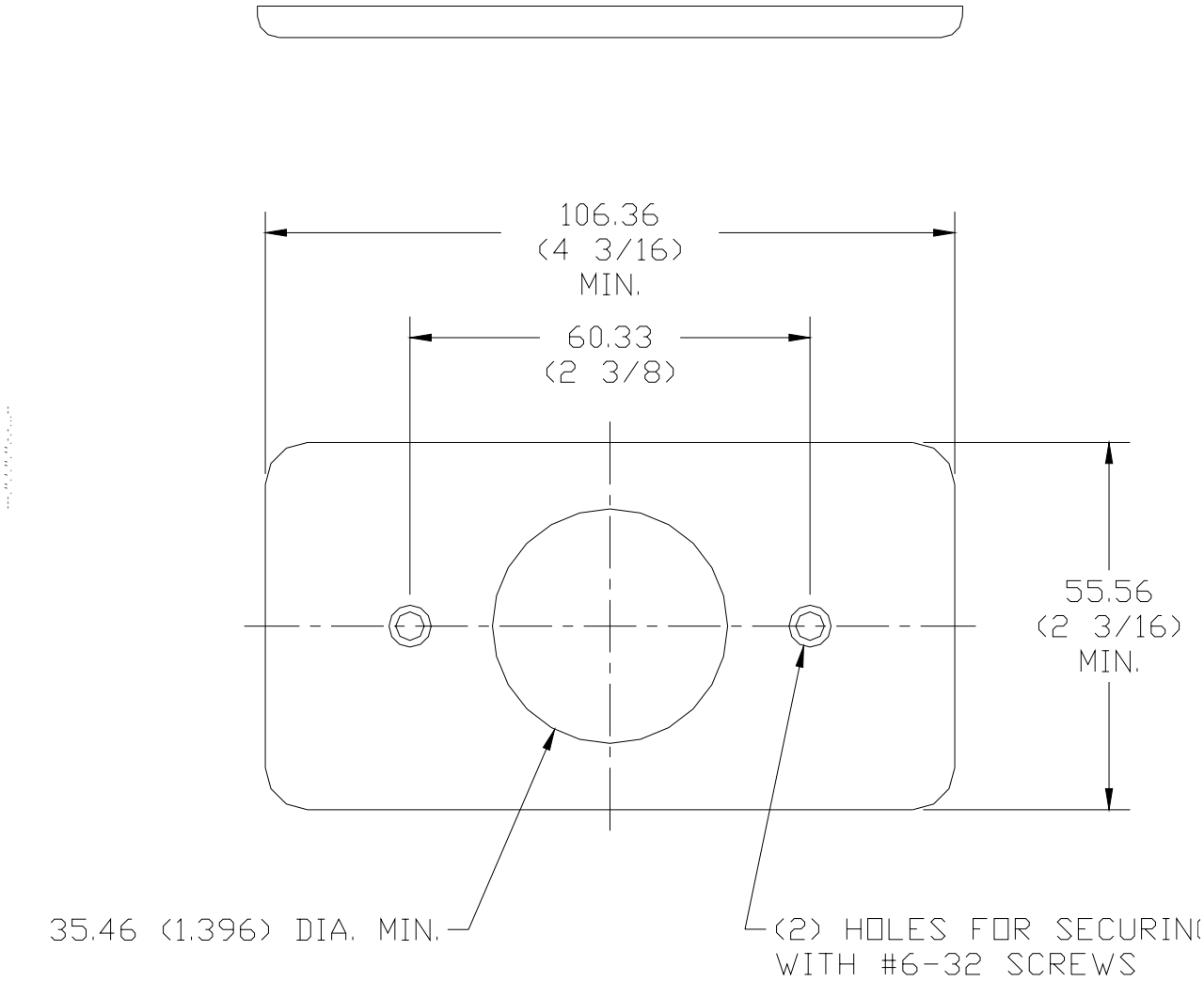


Figure 3-20
NONMETALLIC SINGLE RECEPTACLE COVER FOR SURFACE MOUNTED DEVICE BOXES

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.

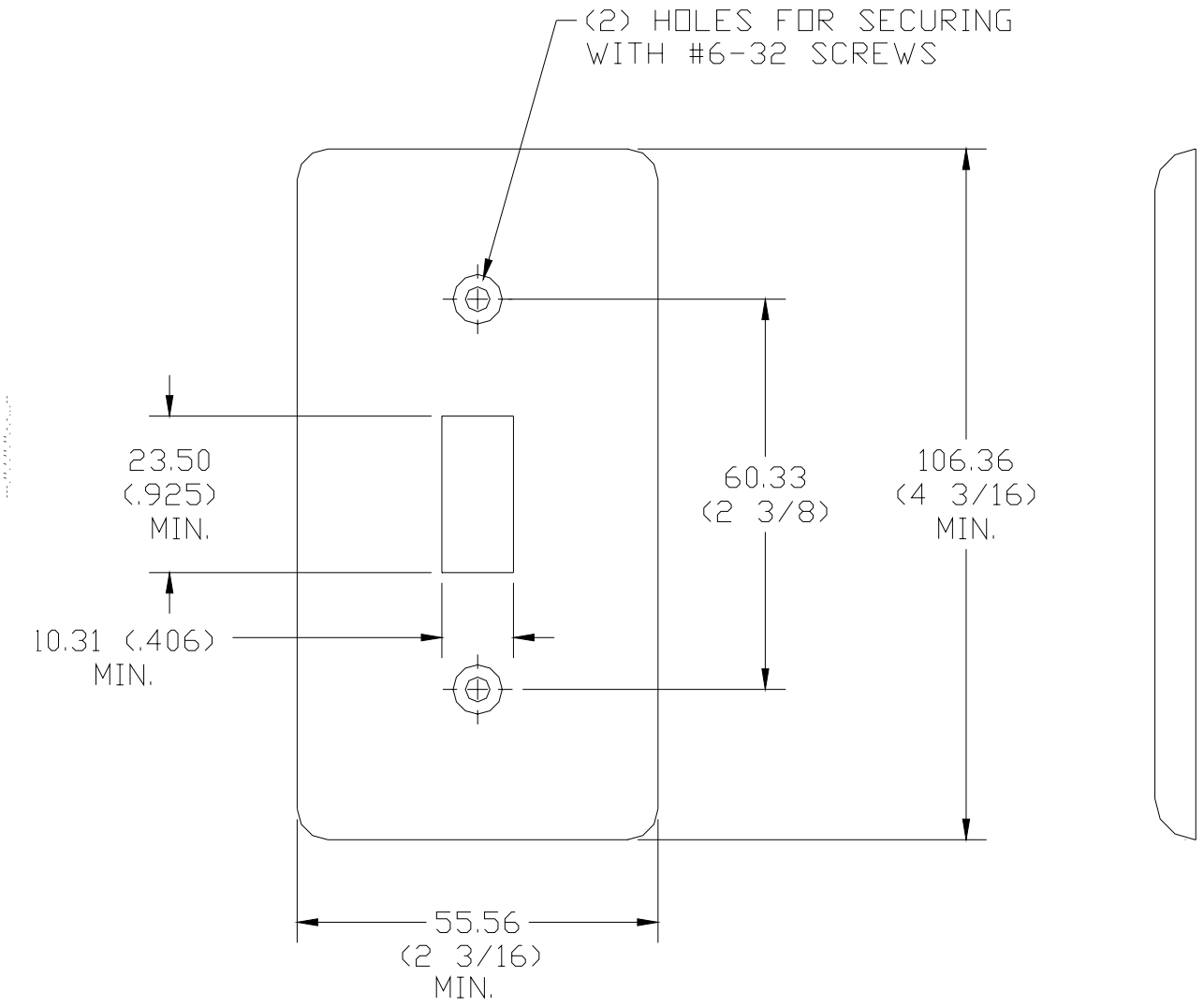
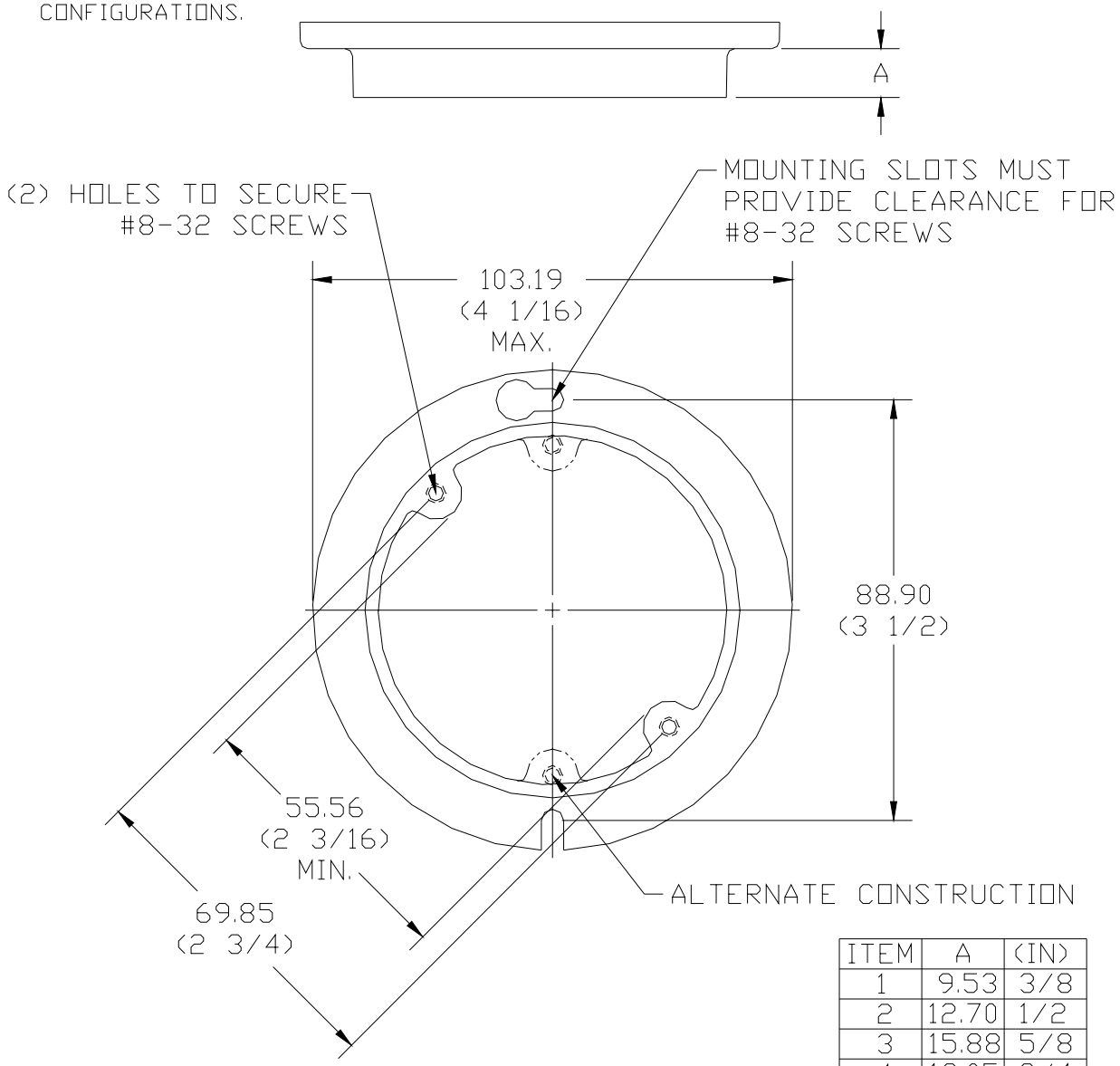


Figure 3-21
NONMETALLIC TOGGLE SWITCH COVER FOR SURFACE MOUNTED DEVICE BOXES

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2.) TOLERANCE ±.397 (1/64) FOR FRACTIONAL DIMENSIONS UNLESS OTHERWISE SPECIFIED.
3.) SEE FIG. 3-26 FOR ALTERNATE MOUNTING HOLE/SLOT CONFIGURATIONS.



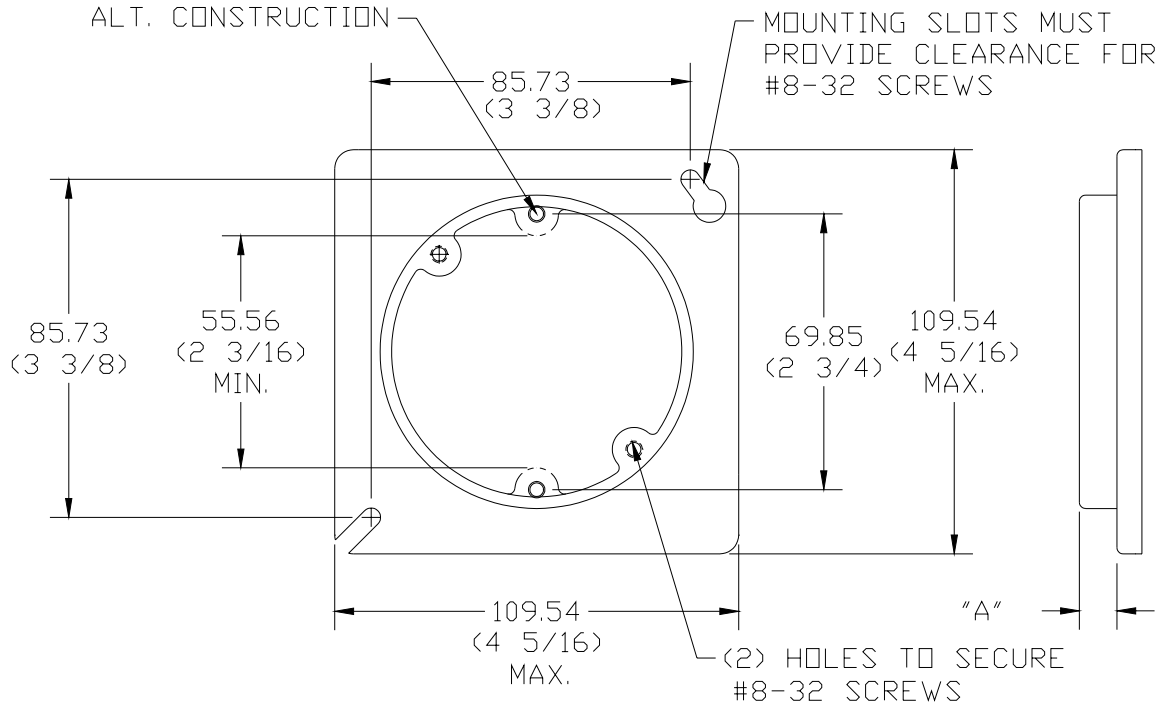
ITEM	A	(IN)
1	9.53	3/8
2	12.70	1/2
3	15.88	5/8
4	19.05	3/4
5	25.40	1
6	31.75	1 1/4

Figure 3-22
RAISED FIXTURE ATTACHMENT NONMETALLIC COVER FOR 4" ROUND OR OCTAGONAL OUTLET BOX

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3.) ALTERNATE MOUNTING HOLE/SLOT CONFIGURATIONS SHOWN IN 3-26 OR ALTERNATE SLOT LOCATIONS SHOWN IN 3-24 MAY BE USED.

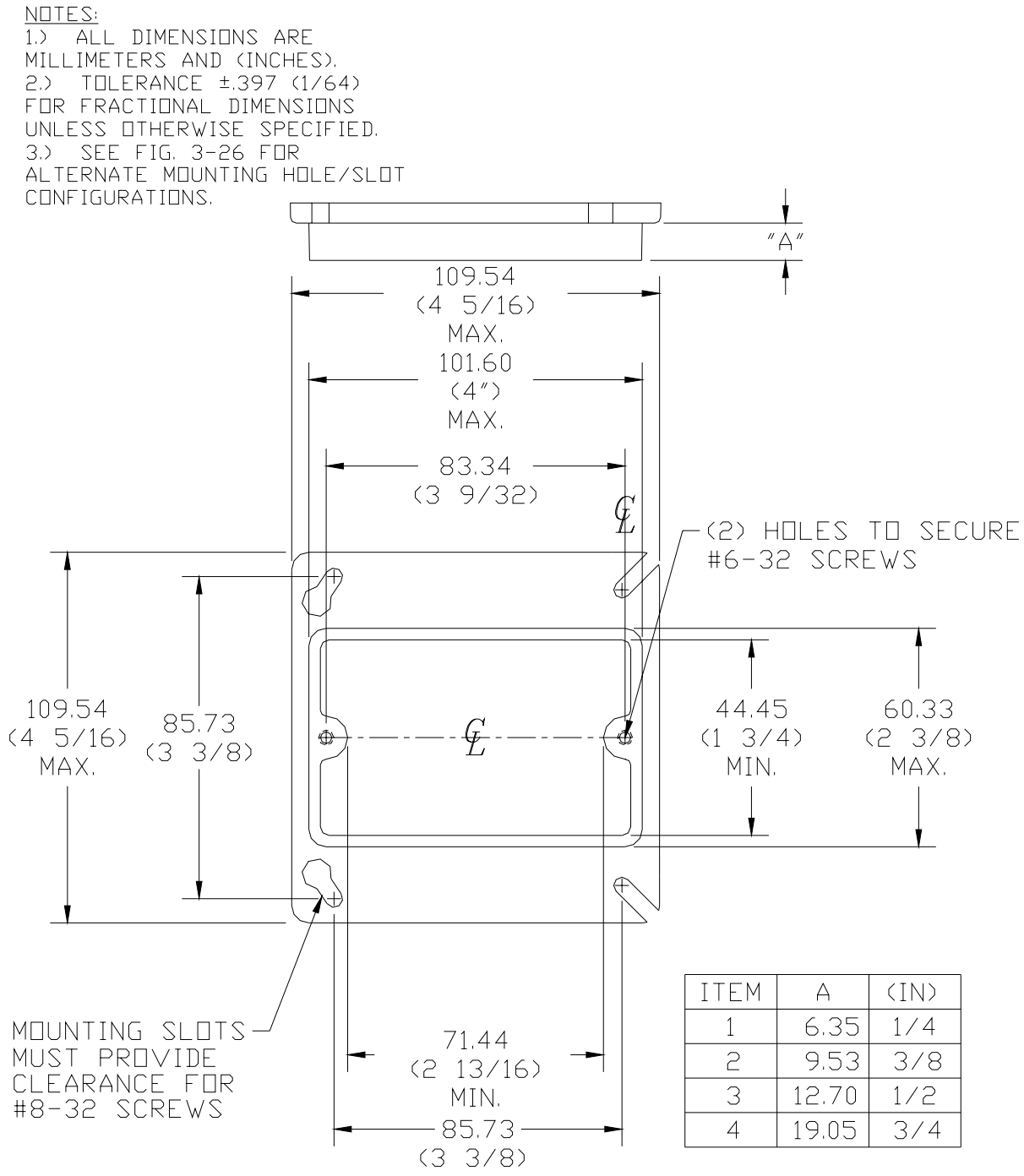


ITEM	A	(IN)
1	9.53	3/8
2	12.70	1/2
3	15.88	5/8
4	19.05	3/4
5	25.40	1"
6	31.75	1 1/4

Figure 3-23
RAISED FIXTURE ATTACHMENT NONMETALLIC COVER FOR 4" SQUARE OUTLET BOX

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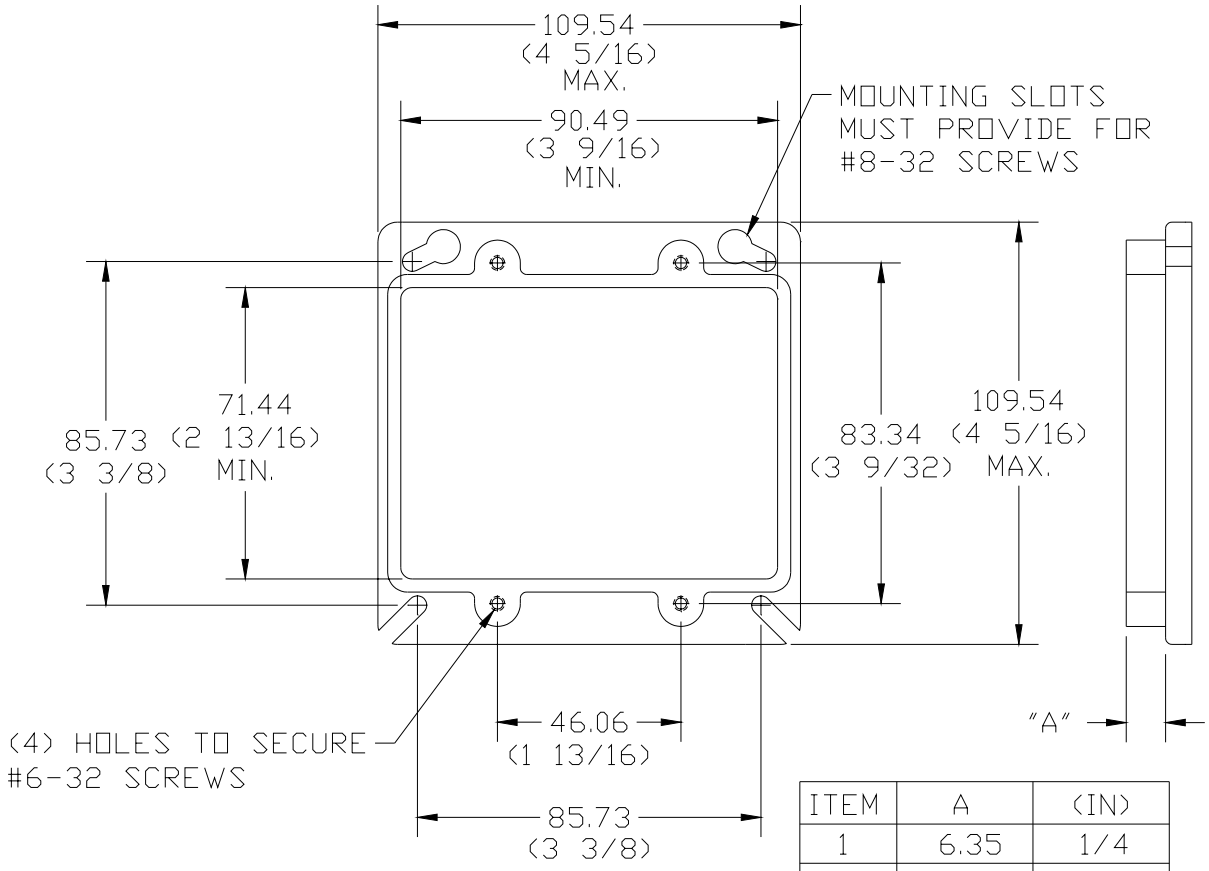
ITEM	A	(IN)
1	6.35	1/4
2	9.53	3/8
3	12.70	1/2
4	19.05	3/4

Figure 3-24
RAISED SINGLE-DEVICE NONMETALLIC COVER FOR 4" SQUARE OUTLET BOX

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3.) SEE FIG. 3-26 FOR ALTERNATE MOUNTING HOLE/SLOT CONFIGURATIONS.



ITEM	A	(IN)
1	6.35	1/4
2	9.53	3/8
3	12.70	1/2
4	19.05	3/4

Figure 3-25
RAISED TWO-DEVICE NONMETALLIC COVER FOR 4" SQUARE OUTLET BOX

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Figure 3-26
ALTERNATE COVER MOUNTING HOLE(S), SLOT(S) CONFIGURATIONS
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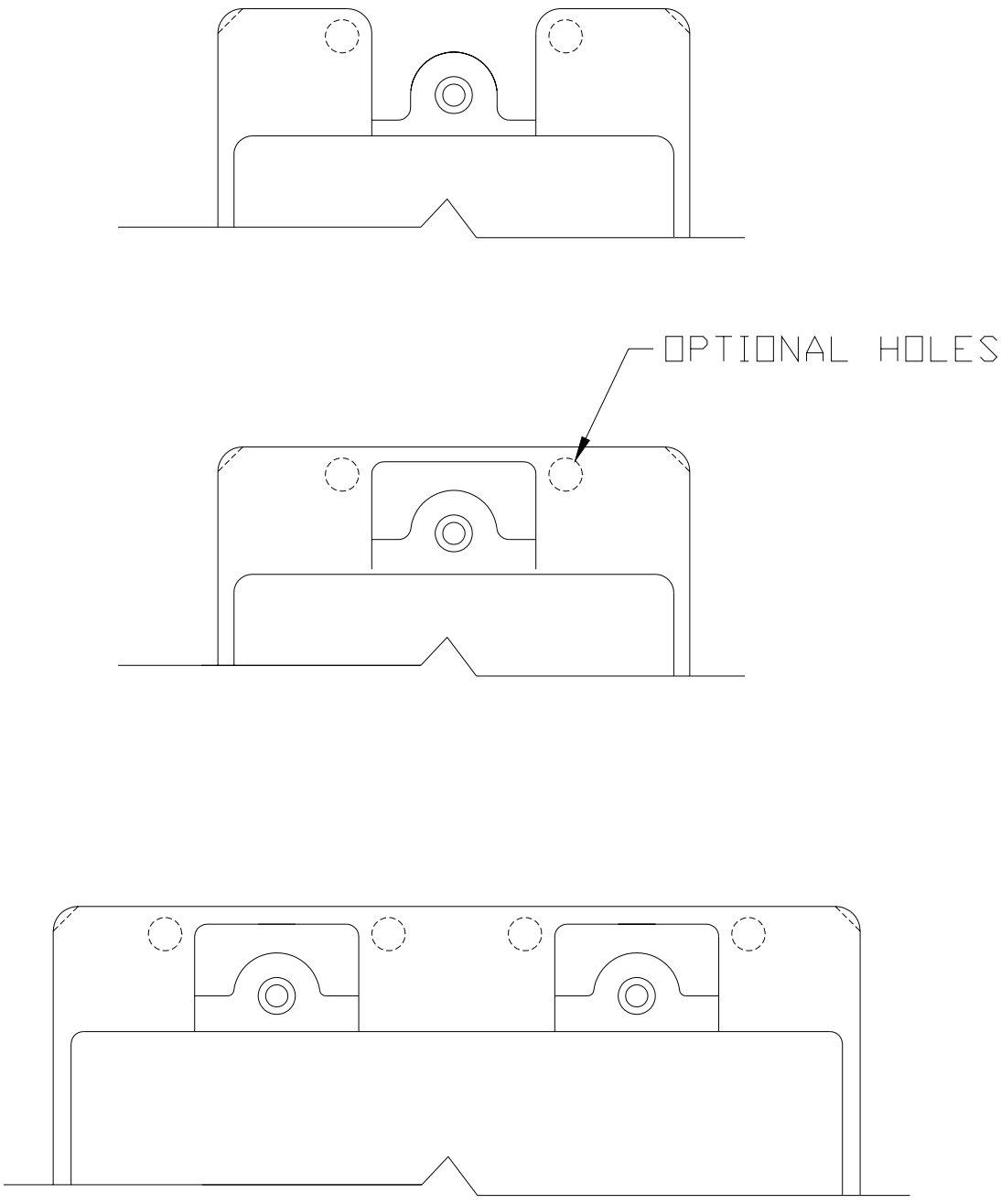


Figure 3-27
ALTERNATE EAR CONFIGURATIONS
(No Scale)

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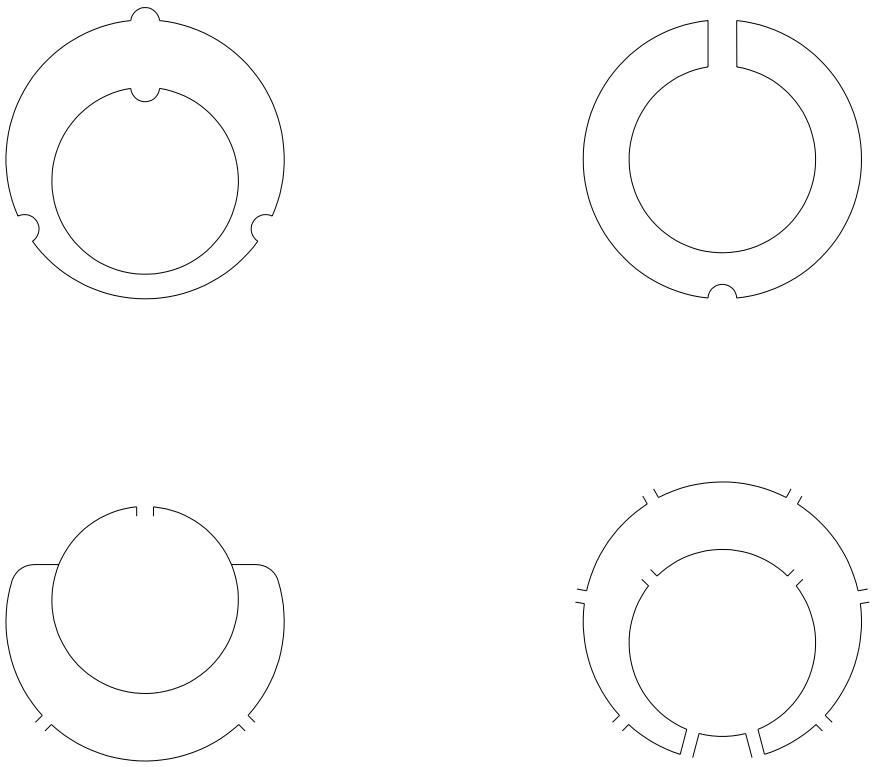


Figure 3-28
ALTERNATE KNOCKOUT CONFIGURATIONS
(No Scale)

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