HEXSEALS® & E-SEELS®

10A 250 VAC
30A 125 VAC
1-1/2 HP
125-250 VAC

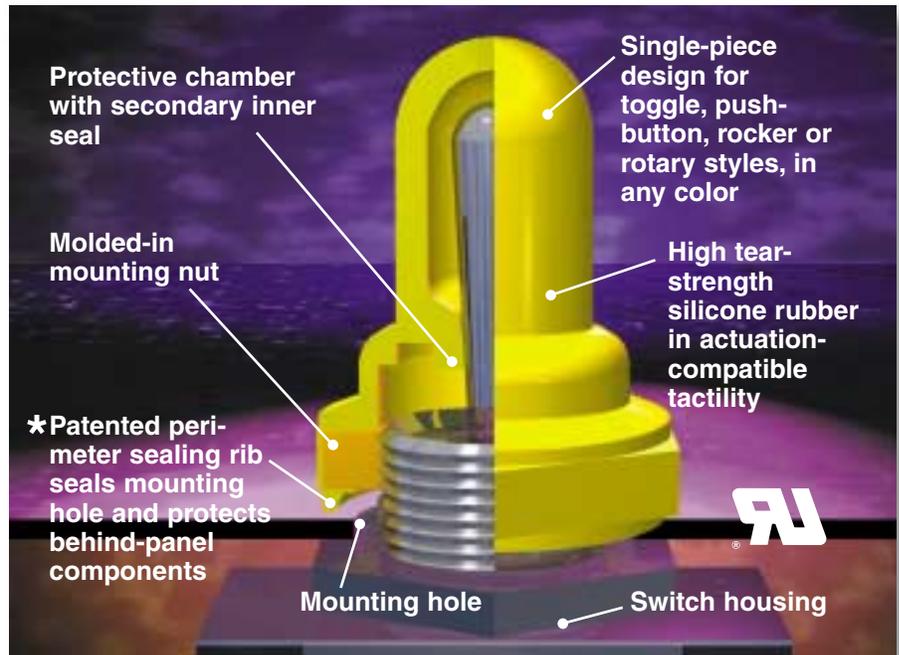# Environmental Sealing Boots for Switches & Potentiometers

APM HEXSEAL

Why Environmental Protection Is Needed

In many applications ordinary electrical and/or electronic switches and potentiometers are susceptible to damage from water, oil, dust, dirt, salt spray, fungus and other environmental contaminants. Often, even factory-sealed, panel-mounted switches and potentiometers do not protect behind-panel circuitry from the entry of such hostile contaminants through the panel cutout in which the component is mounted. When reliability and survival in such hazardous environments is required, APM HEXSEAL's broad range of environmental sealing boots provide cost-effective, long-term protection.

HOW APM'S SEALING BOOTS PROTECT

APM's sealing boots are designed to protect your switches and potentiometers from hostile environments without compromising, or interfering with, the unit's basic operation. Each seal is made from tough, high tear-strength elastomer resistant to most chemicals, lubricants, acids and solvents.

Protective chamber with secondary inner seal

Molded-in mounting nut

✱Patented perimeter sealing rib seals mounting hole and protects behind-panel components

Mounting hole

Single-piece design for toggle, push-button, rocker or rotary styles, in any color

High tear-strength silicone rubber in actuation-compatible tactility

Switch housing

Standard colors are black and grey. Boots can be color-matched to panel/function coding.

And each remains flexible over a wide operating temperature range … with many units rated at –94°F to +400°F.

Most toggle, pushbutton and rotary shaft models feature a molded-in mounting nut, thus serving as both a reliable seal and mechanical mounting. In addition each HEXSEAL® and E-SEEL® features an integral proprietary sealing rib which serves to seal the panel cutout in which the component is mounted … thus protecting behind-panel circuitry from leakage or blow-by.

Full toggle, pushbutton and rocker switch boots completely envelop the front-of-panel switch mechanism, providing reliable protection even under high-pressure washdowns. Rotary shaft and half toggle/pushbutton seals (in which the actuator protrudes) are designed to snugly hug the actuator to protect against entry of moisture, oil, dirt, dust, and other contaminants.

EMI/RFI and Armored Protection. For EMC-sensitive applications, APM offers a number of boots with a built-in, knitted Monel EMI/RFI shield. This integral shield guards against spurious signals entering or leaving equipment

through the switch mounting hole. Armored toggle and pushbutton switch seals are also available for those instances where severe mechanical abuse is anticipated.

Millions in Use. APM HEXSEAL's environmental sealing boots represent more than 50 years of research and product development. Working closely with both switch users and manufacturers, APM has developed an extensive family of standard and custom boots for toggle, pushbutton, rocker and rotary switches. Today APM's environmental seals are used around the world in a wide variety of industrial, commercial, and military applications. We would be pleased to help you select a standard unit, or discuss a custom design to satisfy your unique application needs.

Custom Designs. Should your requirement call for boots not shown in this catalog, please contact us for design assistance. The solution often lies in an inexpensive variation of a standard product.

All standard EMI/RFI boots feature a knitted Monel shield

Protects against:

- **Washdowns**
- **Salt water**
- **Oil and grease**
- **Dust and dirt**
- **Corrosion**
- **Fungus**
- **Cleaning solvents**
- **Acids**
- **Ozone**
- **Other harmful environmental contaminants**

Typical Applications

- Marine/boating instruments
- Chain saws
- Power tools
- Machine tools
- Food processing equipment
- Chemical processing equipment
- Spas/hot tubs
- Floor polishers
- Vacuum cleaners
- Carpet cleaning systems
- Lawn tractors
- Garden power tools
- Off-road construction equipment
- Portable test instruments
- Forklift trucks
- Golf carts
- Snowmobiles
- Jet skis
- Mobile compressors
- Airline jetways
- Snow blowers
- Farm equipment
- Commercial laundry equipment
- Construction elevators
- Woodworking equipment
- Navigational equipment
- Industrial control panels
- Paint-spraying equipment
- Automotive/truck exterior control systems
- Outdoor fuel dispensing systems
- Tennis ball feeding machines
- Mopeds/motorcycles
- Medical equipment
- Ski lift control panels
- Industrial/commercial power washers
- "Crosswalk" control panels
- Water pumping equipment
- Ground support equipment
- Wireless communications equipment
- Waste treatment equipment
- Aircraft instrument panels
- Pressure washers
- Hand-held lanterns
- Or any application requiring environmental protection for panel-mounted switches or potentiometers

Features and Benefits

- **UL and CSA-recognized HEXSEALS and E-SEELS** … facilitate easier agency "listing" of the equipment in which they are used.

- **MIL-qualified** … most HEXSEALS are QPL approved under MIL-B-5423.

- **Rugged silicone rubber material** … resists tearing and most environmental contaminants. Won't discolor, yellow, crack, or dry out.

- **Perimeter sealing rib** … seals the panel cutout in which the switch or potentiometer is mounted.

- **Secondary inner seal** … on many full toggle switch boots protects against entry of contaminants in the event the upper portion of the boot is cut, torn, or punctured.

- **High-strength rubber-to-metal bond** … assures rubber will not peel away from the mounting nut.

- **Pre-lubricated half-toggle, dual-seal full toggle, and rotary shaft boots** … for easier installation on large diameter actuators.

- **Vibration-resistant mounting** … resists switch loosening due to vibration/shock.

- **Wide operating temperature range** … assures long-term performance in the toughest thermal environments.

- **Black color** … E-SEELS feature black anodized hardware and black silicone rubber for aesthetic compatibility.

- **Wide range of available colors** … in addition to standard gray, black, and clear transparent models, units can be molded in an array of colors to meet your needs.

- **Made in USA** … to insure continuity of service throughout the year.

3 Performance Levels to Choose From

APM HEXSEAL offers three distinct switch seal families from which to choose to meet your application's price and performance requirements.

HEXSEALS®

MILITARY-QUALIFIED INDUSTRIAL GRADE

- QPL-listed versions available.
- High tear-strength silicone rubber per ZZ-R-765
- Single-piece design
- –94°F to +400°F temperature range
- Suitable for military and industrial applications
- UL-listed and CSA-certified

E-SEELS®

INDUSTRIAL-COMMERCIAL GRADE

- UL-listed and CSA certified
- High tear-strength silicone rubber
- Single-piece construction
- –80°F to +400°F temperature range
- Suitable for industrial and commercial applications

SNAP-SEELS®

COMMERCIAL-CONSUMER GRADE

- Neoprene rubber
- Two-piece design
- –65°F to +300°F temperature range
- Suitable for commercial and consumer applications

Radio remote crane and hoist controls

Accurate GPS navigation and mapping systems

Portable water quality instruments

ELEC-TRA-MATE® electric fishing reels


Boat switch panels

Washdown industrial motor speed and torque controls

Rotary Shaft Seals For Switches & Potentiometers

HEXSEAL® and E-SEEL® rotary shaft seals are molded from a high tear-strength silicone rubber bonded to a built-in mounting nut. Each seal surrounds the rotary shaft and forms a watertight and dust-tight seal against the shaft and front panel surface.
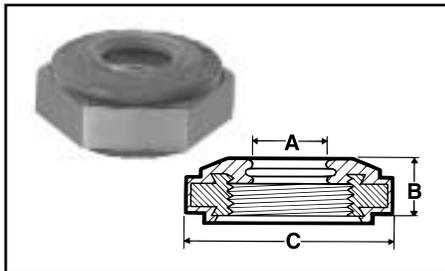
SPECIFICATIONS

Material: HEXSEALS: Silicone rubber conforms to ZZ-R-765 Class III, GR 60 (unless otherwise specified)
E-SEELS: Silicone rubber polymer type ASTM D 1418
Mounting Nut: HEXSEALS: Brass, nickel-plated
E-SEELS: Brass, black oxide
Temperature Range: HEXSEALS: –94°F to +400°F
E-SEELS: –80°F to +400°F
Pressure Range: Exceeds 15 psi internal and 1500 psi external
Operational Life: 50,000 actuations, minimum
Shelf Life: In excess of 25 years
Resistant to: Salt spray, sunlight, ozone, weather, fungus and most acids and lubricating oils
Military Approvals: Most HEXSEALS are QPL-approved under MIL-B-5423 (see QPL listing on page 5)
Agency Recognition: E-SEELS and HEXSEALS are UL-listed to UL Std. 50 types 1-13, and meet CSA standards
Installation: Please see installation instructions on page 14.
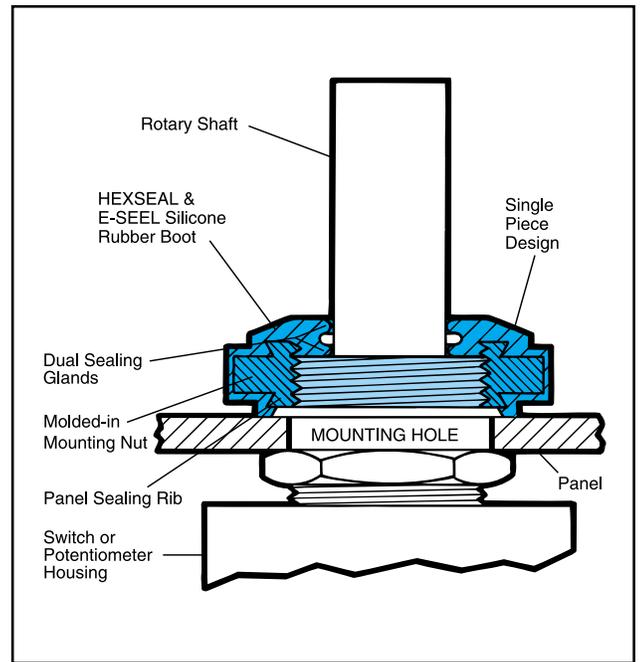
HOW TO ORDER

Specify APM boot part number and, if necessary, the appropriate bushing adaptor part number (please see page 14).

Rotary Shaft
HEXSEAL & E-SEEL Silicone Rubber Boot
Single Piece Design
Dual Sealing Glands
Molded-in Mounting Nut
MOUNTING HOLE
Panel Sealing Rib
Panel
Switch or Potentiometer Housing

FIGURE 21

Rotary Shaft Seals — Figure 21

Thread Size	A Shaft Size		B Height		C Flat		Military Part Number	APM Boot Part Number	Color*	HEXSEAL	E-SEEL
	inch	mm	inch	mm	inch	mm					
1/4-28NF2B	.125	3.18	.219	5.56	.375	9.53	—	N9042 x 1/8	Gray	•	
1/4-32NEF-2B	.125	3.18	.219	5.56	.375	9.53	M5423/09-03	N9040 x 1/8	Gray	•	
3/8-32NEF-2B	.125	3.18	.219	5.56	.500	12.70	M5423/09-01	N9030 x 1/8	Gray	•	
3/8-32NEF-2B	.188	4.78	.219	5.56	.500	12.70	—	N9030 x 3/16	Gray	•	
3/8-32NEF-2B	.250	6.35	.219	5.56	.500	12.70	M5423/09-02	N9030 x 1/4	Gray	•	
3/8-32NEF-2B	.250	6.35	.359	9.12	.500	12.70	—	N9033 x 1/4	Gray	•	
15/32-32NS-2B	.250	6.35	.219	5.56	.625	15.88	M5423/09-04	N9060 x 1/4	Gray	•	
1/2-32NS-2B	.250	6.35	.219	5.56	.625	15.88	M5423/09-06	N9063 x 1/4	Gray	•	
5/8-24NEF-2B	.375	9.53	.219	5.56	.750	19.05	M5423/09-05	N9065 x 3/8	Gray	•	
5/8-24NEF-2B	.500	12.70	.219	5.56	.750	19.05	—	N9065 x 1/2	Gray	•	
3/8-32NEF-2B	.250	6.35	.219	5.56	.500	12.70	—	C1332/40	Black		•

*Other colors available. Please consult factory.

FIGURE 22

RFI/EMI Shielded Rotary Shaft Seals — Figure 22
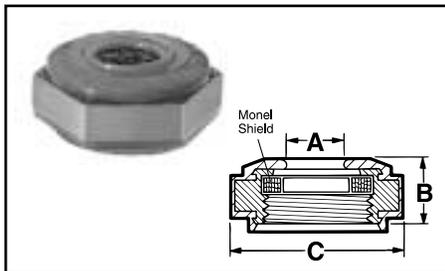
Monel Shield

Thread Size	A Shaft Size		B Height		C Flat		Military Part Number	APM Boot Part Number	Color*	HEXSEAL	E-SEEL
	inch	mm	inch	mm	inch	mm					
1/4-32NF2B	.125	3.18	.219	5.56	.375	9.53	M5423/09-09	N9040 x 1/8 RFI	Gray	•	
3/8-32NEF-2B	.125	3.18	.219	5.56	.500	12.70	M5423/09-07	N9030 x 1/8 RFI	Gray	•	
3/8-32NEF-2B	.250	6.35	.219	5.56	.500	12.70	M5423/09-08	N9030 x 1/4 RFI	Gray	•	
3/8-32NEF-2B	.250	6.35	.359	9.12	.500	12.70	M5423/09-14	N9033 x 1/4 RFI	Gray	•	
15/32-32NS-2B	.250	6.35	.219	5.56	.625	15.88	M5423/09-10	N9060 x 1/4 RFI	Gray	•	
5/8-24NEF-2B	.375	9.53	.219	5.56	.750	19.05	M5423/09-11†	N9065 x 3/8 RFI	Gray	•	
1/2-32NS-2B	.250	6.35	.219	5.56	.625	15.88	M5423/09-12	N9063 x 1/4 RFI	Gray	•	
1/4-28NF-2B	.125	3.18	.219	5.56	.375	9.53	—	N9042 x 1/8 RFI	Gray	•	
3/8-32NEF-2B	.125	3.18	.531	13.49	.625	15.88	—	NLK9030 x 1/8 RFI	Gray	•	
3/8-32NEF-2B	.250	6.35	.531	13.49	.625	15.88	—	NLK9030 x 1/4 RFI	Gray	•	

*Other colors available. Please consult factory. †Inactive for new designs.
All Standard RFI/EMI boots feature knitted Monel wire shields.
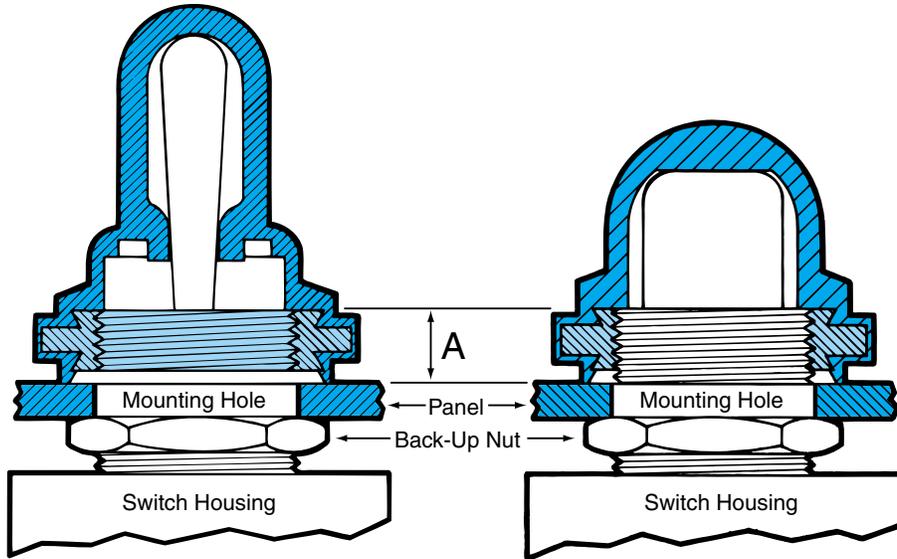

FIGURE 23

Locking Rotary Shaft Seals — Figure 23
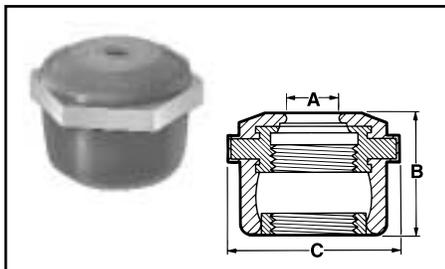
Thread Size	A Shaft Size		B Height		C Flat		Lock Nut O.D.		Military Part Number	APM Boot Part Number	Color*	HEXSEAL	E-SEEL
	inch	mm	inch	mm	inch	mm	inch	mm					
1/4-32NS-2B	.125	3.18	.500	12.70	.500	12.70	.344	8.74	—	NLK9040 x 1/8	Gray	•	
3/8-32NS-2B	.125	3.18	.531	13.49	.625	15.88	.469	11.91	—	NLK9030 x 1/8	Gray	•	
3/8-32NS-2B	.250	6.35	.531	13.49	.625	15.88	.469	11.91	—	NLK9030 x 1/4	Gray	•	

*Other colors available. Please consult factory.
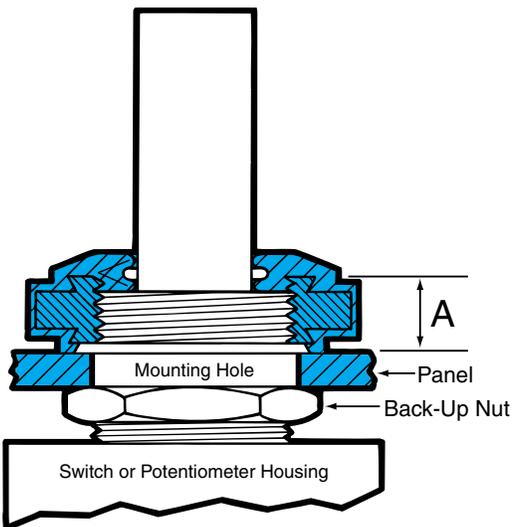
DIMENSIONS FOR REFERENCE ONLY.

11

INSTALLATION INSTRUCTIONS
FOR
THREADED HEXSEAL® & E-SEEL® BOOTS

Panel
Mounting Hole
Back-Up Nut
Switch Housing

Mounting Hole
Switch Housing

A

Mounting Hole
Panel
Back-Up Nut
Switch or Potentiometer Housing

A

For proper installation of these boots, follow these five sequential steps. It is EXTREMELY IMPORTANT that the number of threads on the switch/potentiometer bushing EXPOSED ABOVE THE FRONT PANEL SURFACE be within the recommendation (see chart above). Failure to respect these maximums may result in boot damage (such as tearing).

STEP 1. Remove front mounting nut from switch bushing.
STEP 2. Put threaded bushing through panel.
STEP 3. Adjust back-up nut to allow the specified number of threads to protrude past front of panel (see Dimension "A" above).
STEP 4. If needed, install appropriate bushing adaptor.
STEP 5. Install switch boot in place of front mounting nut.
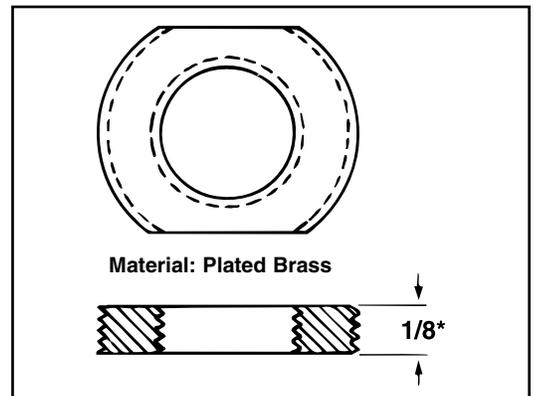
RECOMMENDED INSTALLATION TOOLS:
- Six point hex socket wrench.
- Spintite.
- Adjustable wrench (without serrated jaws).

Threaded Bushing Adaptors

Inside (Bushing) Thread Size (Class 2B)	Outside (Boot) Thread Size (Class 2A)	APM Part Number
3/8-32	15/32-32	2500/1/5*
15/32-32	11/16-32	2500/1/7
1/2-32	11/16-32	2500/1/10
15/32-32	13/16-32	2500/1/8
1/2-24	13/16-32	2500/1/9
5/8-24	13/16-32	2500/1/11
5/8-24	7/8-32	2500/1/12
3/4-32	7/8-32	2500/1/13*
3/4-20	7/8-32	2500/1/14*

*5/32" thick.
Additional sizes, including metric, available. Please consult factory.

Material: Plated Brass

1/8*

*Unless otherwise noted.