

# Low voltage bushings for pad-mounted distribution transformers

## Technical information guide

ABB low voltage bushings terminate a transformer's internal low voltage leads at the tank wall and provide a standard threaded stud for connections to the external low voltage circuit.



### Description

ABB low voltage bushings are molded from a high temperature, glass-reinforced nylon resin system (Dupont Zytel HTN™). The nylon body is molded around a copper stud. The copper stud is terminated at one end with a spade terminal which is used to make the internal transformer connections. The other end of the stud is threaded to accept various connectors which are used to connect to the external low voltage circuit. The bushings are available in two stud sizes: 0.625 inch diameter and 1.00 inch diameter.

### Ratings

Conductor Diameter (inches)	Voltage Rating (volts)	BIL Rating (kV)	Current Rating (amperes)
0.625	600	30	600
1.00	600	30	1400

### Test proven quality and reliability

The ABB low voltage bushings have passed a series of design tests which were designed to verify ratings, suitability for use on pad-mounted distribution transformers, and long term reliability.

- 1) Seal integrity test
- 2) Full wave impulse test
- 3) Low frequency voltage withstand test
- 4) Conductor stud torque test
- 5) Cantilever load test
- 6) Thermal cycle test
- 7) Temperature rise test

In addition to the design testing, the following routine production tests are done on an audit basis:

- 1) Dimension check
- 2) Visual inspection
- 3) Leak test

### Interchangeable

The ABB low voltage bushings have been designed to be dimensionally interchangeable with the majority of similar bushings available on the market. Included in these interchangeable dimensions are: the bolt circle for the integral mounting flange, the tank wall hole size, the conductor stud diameter, and the external thread size.

### Compact design

The bushings have been designed to minimize the space required inside of the transformer. For both bushings, the dimension from the inside surface of the tank wall to the end of the stud has been reduced. This reduction may allow the transformer designer to reduce the volume of the transformer tank to save both oil and steel.

# Technical information

## Integral flange

The mounting flange on the bushings is molded as an integral part of the bushing. This eliminates the need for a separate mounting flange and, in the case of a metal mounting flange, the associated electrical losses created by the induced current in the flange.

## Compression limited gasket designs

The integral flange of the bushing has a molded-in gasket seat to ensure proper gasket location and compression during mounting. The gasket surfaces provide controlled compression and containment of the highly resilient Buna-N gasket.

## Conductor length

Bushings are available with a standard or extended length thread design.

## Proven nylon body

These ABB bushings are molded from a glass-reinforced, high temperature nylon resin (Dupont Zytel HTN). The Zytel HTN resin is a highly reliable thermoplastic that fulfills the required application needs for strength, temperature stability and low moisture absorption. The resin system retains its mechanical and electrical properties in the high temperature environment associated with pad-mounted distribution transformer applications.

## Certification

To certify the product ratings, production samples of the bushings were tested. The tests were conducted in accordance with ANSI/IEEE standards where applicable.

## Design tests

The design tests were divided into (3) three categories:

- 1) Dielectric tests (impulse test and 60 Hz withstand test)
- 2) Mechanical strength tests (leak test, stud interface strength test and cantilever test)
- 3) Environmental tests (thermal cycle test, oil compatibility test)

## Dielectric tests

### Impulse test

The purpose of this test is to verify the impulse withstand of the bushing. Sample bushings were subjected to three positive and three negative full wave impulses. The voltage impulse used was the standard 1.2 x 50  $\mu$ s wave having the crest value of the specified voltage. The withstand voltage level of the bushings are well above the BIL rating of 30 kV. Samples successfully passed 36 kV test levels. Samples also successfully passed chopped wave tests well above the rating of 36kV.

## Low frequency / 60 Hz withstand test

The purpose of the low frequency withstand test is to verify the integrity of the insulation structure of the bushing at operating frequency. Bushing samples were tested at 12 kV for one minute and then allowed to rest for one minute. They were then retested for another minute. All samples passed this test.

## Mechanical strength tests

### Leak tests

The purpose of the leak test is to ensure that, over the life of the bushing, no leak will develop between the copper stud and the nylon resin body. The bushings were tested using a helium leak detector. The sensitivity of the helium leak detector is  $1 \times 10^{-5}$  atm cc/sec. The bushings were attached to a leak test fixture which mates the bushing such that any leak will be detected if helium passes into the detector through the bushing. All bushings passed with no indication of leaks.

### Stud interface strength test

The purpose of this test is to verify that no damage will result when terminals are connected or removed from the bushings. The bushings were mounted in a manner simulating a typical transformer installation, then a nut was threaded onto the copper stud and 50 foot-pounds of torque was applied. For the 0.625 inch diameter copper stud bushing, the stud will fail before the 50 foot-pound level is reached. For the 1.00 inch diameter copper stud bushing, the 50 foot-pound torque test was repeated 20 times.

Finally, the bushings were leak tested to verify that the seal between the copper stud and the nylon resin body was not damaged. Both the 0.625 and 1.00 inch low voltage bushings successfully passed this test.

### Cantilever test

This test demonstrates the ability of the bushing to withstand the stresses generated when attaching a lead to the conductor. With the bushings mounted in a manner to simulate its application on a transformer, an extension was threaded onto the bushing stud and a load applied until failure.

The 0.625 inch bushing was mounted so that one of the mounting holes is at the 6 o'clock position. Then a cantilever load was applied, resulting in the stud yielding before the bushing body failed.

The 1.00 inch bushing withstood 280 foot-pounds when mounted with one of mounting holes in the 12 o'clock position and withstood 375 foot-pounds when mounted with one of the mounting holes in the 6 o'clock position.

# Technical information

## Environmental test

### Thermal cycle test

The purpose of the thermal cycle test is to verify the integrity of materials used in the bushing over the expected service life of the bushing. The previously leak tested bushings were subjected to 20 thermal cycles in air. Each thermal cycle consists of the following:

- 1) 1-hour transition to 140 °C
- 2) 2-hour hold at 140 °C
- 3) 1-hour transition to -40 °C
- 4) 1-hour hold at -40 °C

### Oil compatibility test

The purpose of this test is to verify that the bushing does not have any damaging effects on the properties of the oil when the bushing is submerged in the transformer oil. The bushing passes the standard oil compatibility test.

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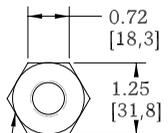
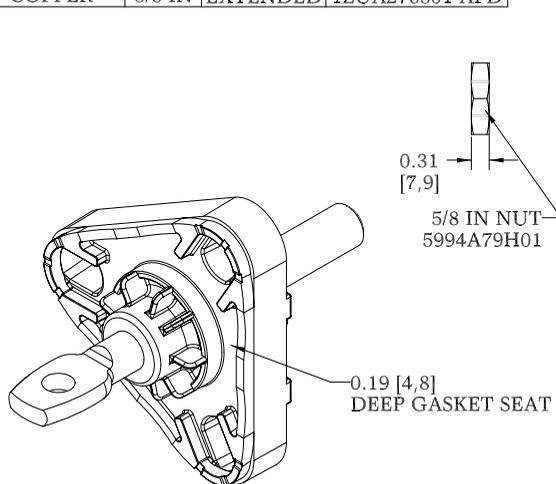
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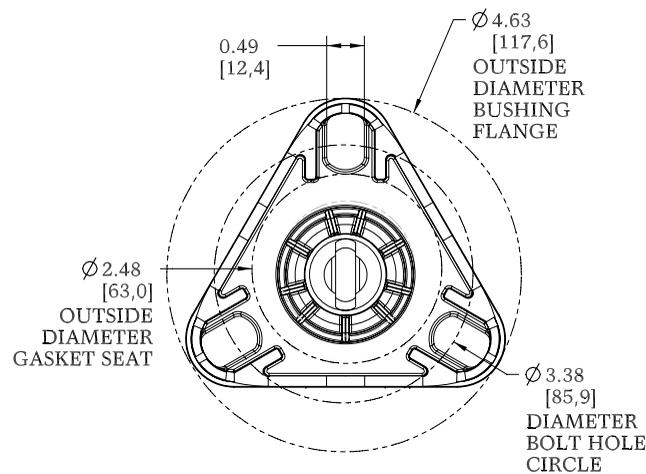
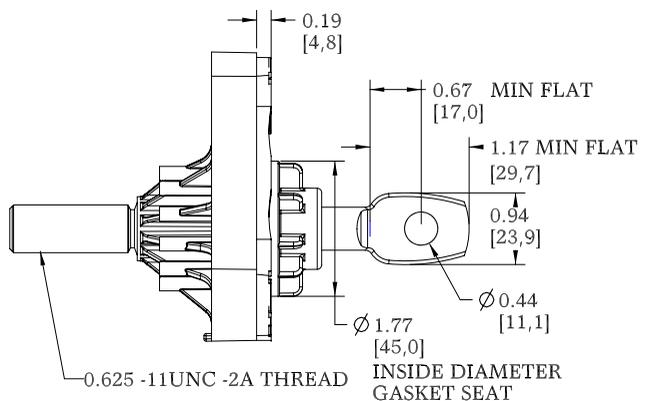
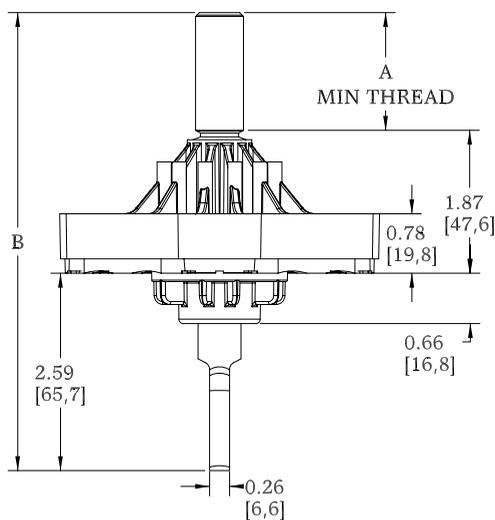
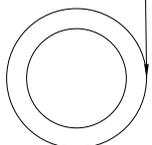
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CONDUCTOR MATERIAL	"A"	THREAD	BUSHING ONLY
COPPER	5/8 IN	STANDARD	1ZUA276301-AFC
COPPER	5/8 IN	EXTENDED	1ZUA276301-AFD

MOUNTING GASKET-  
3A21596H01



NOTE:  
GASKET AND CONTACT NUT  
SOLD SEPARATELY.

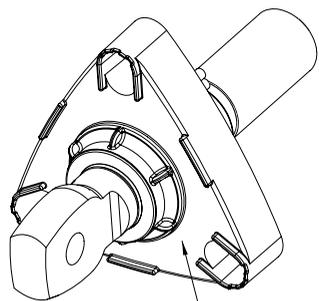


	THREAD	THREADS PER INCH	"A" MIN THREAD	"B"
0.625 [15,8]	STANDARD	11	1.50 [38,1]	6.00 [152,4]
0.625 [15,8]	EXTENDED	11	2.11 [53,6]	6.62 [168,2]

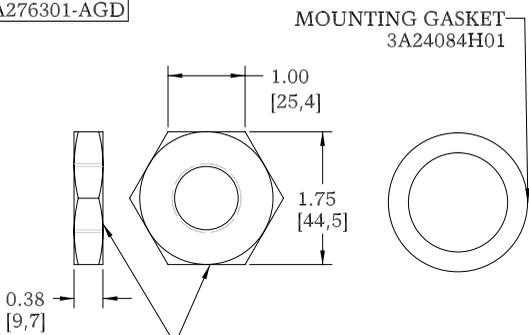
PRIMARY DIMENSIONS ARE INCHES  
SECONDARY DIMENSIONS [ ] ARE MM.

ABB Inc.		
Components & Insulation Material		
TITLE 5/8 IN LV BUSHING OUTLINE DRAWING		
DIMENSION SHEET: 44-892	PAGE: 10A	REVISION: 04
DIMENSIONS ARE IN INCHES.		

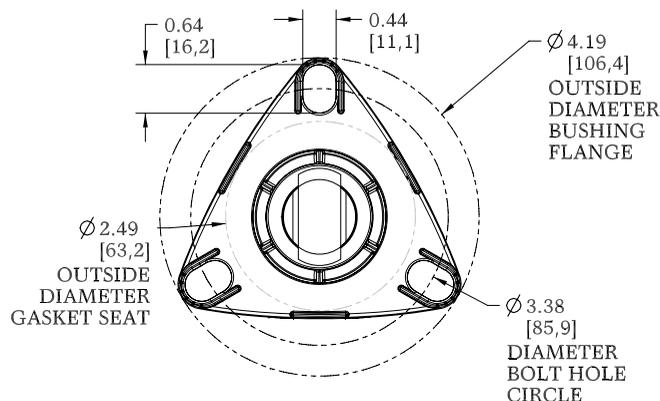
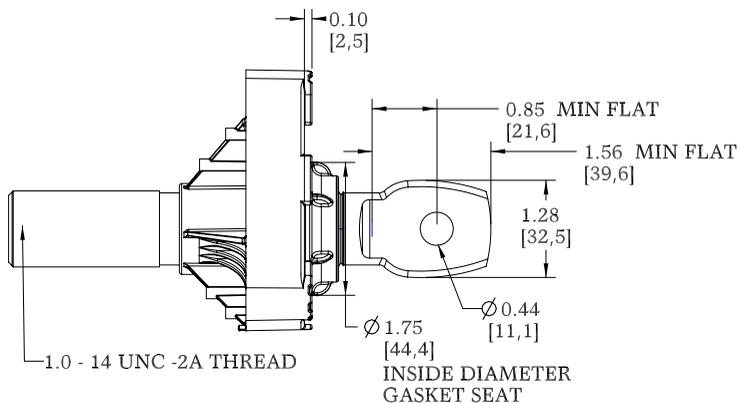
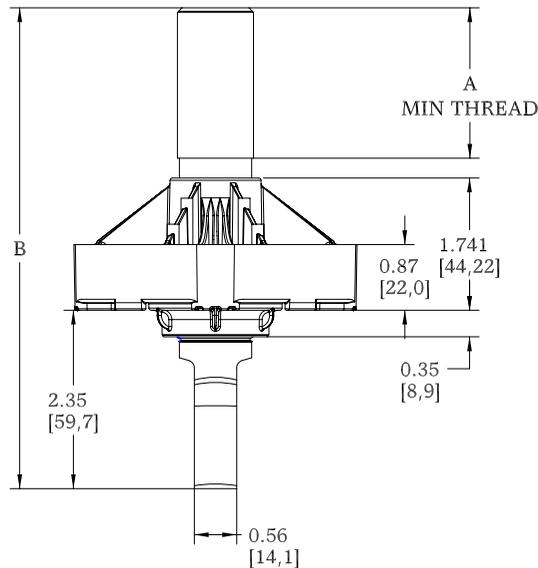
CONDUCTOR MATERIAL	STUD DIAMETER	THREAD	BUSHING ONLY
COPPER	1.00	STANDARD	1ZUA276301-AGC
COPPER	1.00	EXTENDED	1ZUA276301-AGD



0.10  
[2,5]  
DEEP GASKET SEAT



NOTE:  
GASKET AND CONTACT NUT  
SOLD SEPARATELY.



	THREAD	THREADS PER INCH	"A" MIN THREAD	"B"
1.00 [25,4]	STANDARD	14	1.75 [44,45]	6.33 [160,7]
1.00 [25,4]	EXTENDED	14	2.52 [64,0]	7.10 [180,3]

PRIMARY DIMENSIONS ARE INCHES  
SECONDARY DIMENSIONS | | ARE MM.

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TITLE 1 IN LV BUSHING OUTLINE DRAWING		
DIMENSION SHEET: 44-892	PAGE: 10B	REVISION: 03
DIMENSIONS ARE IN INCHES.		

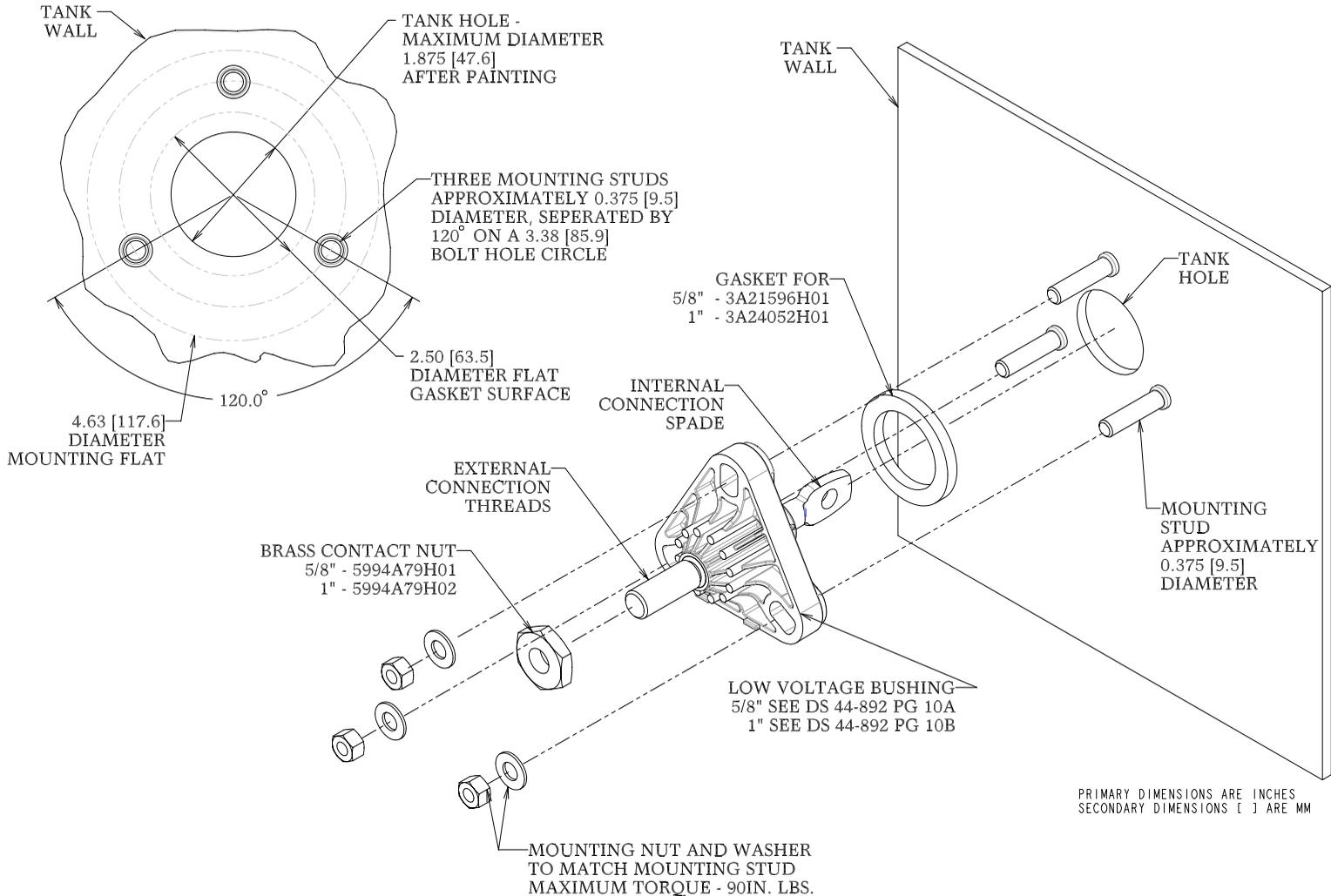


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DIMENSION SHEET:	44-892	PAGE: 11B REVISION: 01
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