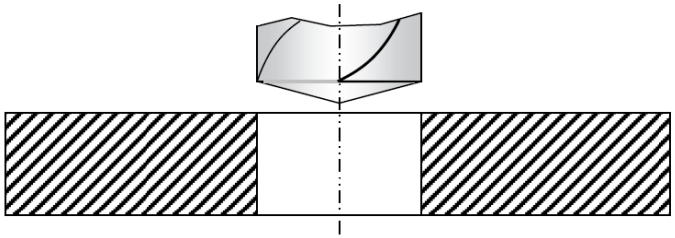
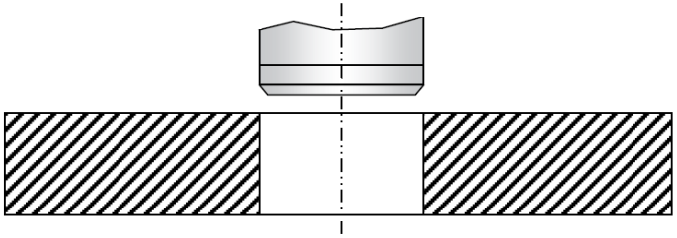
Drill Bushing Installation Data

Explained below are the basic steps to installing a drill bushing. Because there are many different situations that bushings are used in and many variables associated with the installation, no definite rules can substitute for the skill and judgment of the experienced tool-maker. If you have any questions about the proper use or installation of any of our products, please be free to contact our technical support team.

Step 1



Step 2



Hole Drilling and Preparation

Drill hole using the 'jig boring data' (see next page) to determine the correct size of the hole also keeping in mind interference fits, hole roundness, and alignment (see below). Always drill holes using a jig borer or reamer. Next lubricate the inside diameter of the mounting hole and the outside diameter of the bushing. Lubrication is important because bushings that are installed without lubrication may pick up metal and score the mounting hole during installation. Lubricated bushings are also more easily removed with less chance of damaging the jig-plate.

Inserting The Bushing

Use an arbor press to press the bushing into the jig-plate whenever possible. If not, use some other method such as drawing the bushing into the jig-plate with two washers and a nut and bolt. A hammer should only be used if no other method is possible, and never directly strike the bushing with the hammer; use a block to take the blows of the hammer. Whichever method is used be sure to maintain centerline perpendicularity, otherwise inaccuracy may result in the production operation.

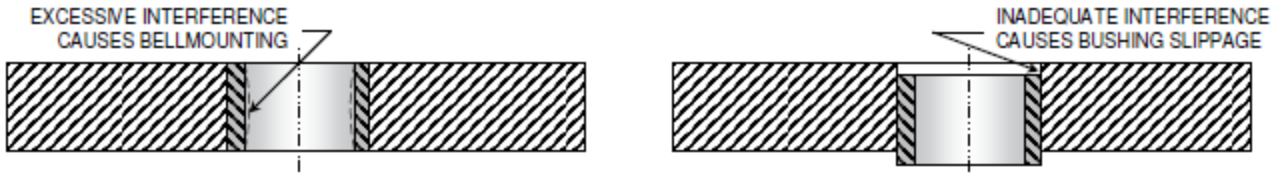
Important Installation Information

Mounting Holes: An important point to consider is the roundness of the mounting hole. Because bushings tend to assume the shape of the hole they are pressed into, it is recommended that all mounting holes be jig bored or sized with a reamer to ensure roundness. An ordinary twist drill will seldom produce a hole that is accurately sized and truly round.

Interference Fits: In any press fit installation, metal is displaced. Usually, a combination of bushing closure and jig plate distortion results; therefore the best practice is to use the minimum interference necessary to retain the bushing in the jig plate. In most installations diametric interference of .0005 to .0008" is adequate for installation of press fit bushings or liners.

Chip Clearance: To maximize hole accuracy and minimize drill bending, mount drill bushings as close to the workpiece as possible while still allowing adequate chip clearance. The necessary clearance depends on workpiece material and chip stringiness. Materials such as cast iron that produce fine chips require about 1/2 times drill diameter for chip clearance. Materials that produce long stringy chips, such as cold-rolled-steel and aluminum, require at least one-drill-diameter clearance. Direct workpiece contact is usually not recommended. Chips can escape only up through the drills flutes, drill bearing length is shortened by the drill points length, and drill-withdrawal burrs can raise the jig plate. Direct contact may be necessary in some instances, though, for example when drilling sloped surfaces. Reamer bushings can be mounted much closer than drill bushings, due to much finer chips, for more-accurate hole finishing.

To avoid jig-plate distortion, do not use excessive interference fits on press-fit bushings. The table below shows the recommended hole sizes in unharded steel or cast iron jig-plates. Remember to always prepare installation holes using a jig borer or reamer. Standard chucking reamer (with a plus tolerance) usually produce installation holes to the tolerance shown in the table. Other factors to consider are: 1) headed bushings require less interference to resist drilling thrust; 2) longer bushings in thick plates require less interference; 3) bushings with thinner walls are more prone to distortion; and 4) less ductile jig-plate material require less interference.



Technical Data

Concentricity: The bushing OD is ground concentric to the ID to within .0003 TIR for ID sizes from 1/8 to 1/2" (3 to 12mm), unless otherwise indicated. For larger or smaller sizes, concentricity is within .0005 TIR. Ungrounded bushings are concentric to within .006 TIR. On counterbored bushings, concentricity applies only over the drill-bearing length.

Counterbore: Bushings with small holes are counterbored leaving correct drill-bearing to facilitate lubrication, chip clearance, binding, and heat buildup. Bushings normally counterbored may be ordered without counterbore by specifying 'NCB'.

Radius and Lead: All bushings feature a polished and blended radius at the drill entrance end for smooth drill entry and proper alignment, preventing wear and breakage. All press type bushings feature a concentric ground lead and a 45° chamfer to ensure proper alignment during installation.

Material: Standard drill bushings are manufactured from 1144 stress proof steel, heat treated to RC 62-64 ID hardness. Other materials are available including tungsten carbide, 52100 steel, A2 tool steel, D2 tool steel, M2 tool steel, 416 stainless steel, 440C stainless steel, 17-4PH aircraft grade stainless steel, 303 stainless steel, 660 bronze, Ampco 18 bronze, Ampco 21 bronze, Oilite, and brass.

Specials and Customs

There are six ways a drill bushing can be labeled as special. They are:

1) Special ID - Special ID sizes include any ID size that is not a standard fractional, number, letter, or metric drill size. The special ID size may be within listed ID range, smaller than listed range, or larger than listed range (Thin-wall).
2) Special OD - We can provide OD's to your specifications.
3) Special length - Special length also includes extra length.
4) Special tolerances - Special tolerances are ID, OD, and ID/OD concentricity tolerances.
5) Special alterations - There are many ways drill bushings can be altered, some ways include milled angles, ground flats, special OD or ID grooves, etc. We welcome your custom requirements!
6) Special material - Bushings are available in many different materials, the following heat-treated materials are readily available: 52100 steel, A2 Tool Steel, D2 Tool Steel, M2 Tool Steel, 303 Stainless Steel, 416 Stainless Steel, 440C Stainless Steel, and 17-4PH Aircraft-Grade Stainless Steel.

Harcourt Engineering Productivity Solutions™

DRILL BUSHING INSTALLATION DATA

ANSI STANDARD SIZES

NOMINAL BUSHING SIZE (OD)	JIG BORE HOLE SIZE	BUSHING OD PRESS FIT TYPE	BUSHING OD SLIP FIT TYPE
5/32	.1565-.1570	.1578-.1575	-
3/16	.1880-.1883	.1891-.1888	.1875-.1873
13/64	.2037-.2040	.2046-.2043	-
1/4	.2507-.2510	.2516-.2513	.2500-.2498
5/16	.3132-.3135	.3141-.3138	.3125-.3123
3/8	.3757-.3760	.3766-3763	.3750-.3748
13/32	.4069-.4072	.4078-.4075	-
7/16	.4382-.4385	.4392-.4389	.4375-.4373
1/2	.5007-.5010	.5017-.5014	.5000-.4998
9/16	.5632-.5635	.5642-.5639	.5625-.5623
5/8	.6257-.6260	.6267-.6264	.6250-.6248
3/4	.7507-.7510	.7518-.7515	.7500-.7498
7/8	.8757-.8760	.8768-.8765	.8750-.8748
1	1.0007-1.0010	1.0018-1.0015	1.0000-.9998
1-1/8	1.1257-1.260	1.270-1.267	1.1250-1.1247
1-1/4	1.2507-1.2510	1.2520-1.2517	1.2500-1.2497
1-3/8	1.3757-1.3760	1.3772-1.3768	1.3750-1.3747
1-1/2	1.5007-1.5010	1.5022-1.5018	1.5000-1.4997
1-3/4	1.7507-1.7510	1.7523-1.7519	1.7500-1.7497
2-1/4	2.2507-2.2510	2.2525-2.2521	2.2500-2.2469
2-3/4	2.7507-2.7510	2.7526-2.7522	2.7500-2.7496

METRIC STANDARD SIZES

NOMINAL BUSHING SIZE (OD)	ACTUAL (OD)	JIG BORE HOLE SIZE
4	4.027-4.019	4.000-4.012
5	5.027-5.019	5.000-5.012
6	6.027-6.019	6.000-6.012
7	7.032-7.023	7.000-7.015
8	8.032-8.023	8.000-8.015
10	10.032-10.023	10.000-10.015
12	12.039-12.028	12.000-12.018
15	15.039-15.028	15.000-15.018
18	18.039-18.028	18.000-18.018
22	22.048-22.035	22.000-22.021
26	26.048-26.035	26.000-26.021
30	30.048-30.035	30.000-30.021
35	35.059-35.043	35.000-35.025
42	42.059-42.043	42.000-42.025
48	48.059-48.043	48.000-48.025
55	55.072-55.053	55.000-55.030
62	62.072-62.053	62.000-62.030
70	70.078-70.059	70.000-70.030
78	78.078-78.059	78.000-78.030
85	85.093-85.071	85.000-85.035
95	95.093-95.071	95.000-95.035
105	105.101-105.079	105.000-105.035
115	115.101-115.079	115.000-115.035
125	125.117-125.092	125.000-125.040