## BEARINGS AND BUSHINGS - REMOVAL/INSTALLATION

*EFFECTIVITY: ALL*

1. General

   A. This section gives the procedure to remove and install bearings and bushings as applicable.

   B. The procedures in this section are given in the sequence below. The tasks identified with (♦) are part of the Scheduled Maintenance Requirements Document (SMRD).

| *TASK NUMBER* | *DESCRIPTION* | *EFFECTIVITY* |
|---|---|---|
| 20-10-08-000-801-A | BEARINGS AND BUSHINGS - REMOVAL | ALL |
| 20-10-08-400-801-A | BEARINGS AND BUSHINGS - INSTALLATION | ALL |

TASK 20-10-08-000-801-A
*EFFECTIVITY: ALL*

2. BEARINGS AND BUSHINGS - REMOVAL

A. General

(1) This task gives the procedures to remove bearings and bushings.

B. Zones and Accesses

Not Applicable

C. Tools and Equipment

| *ITEM* | *DESCRIPTION* | *PURPOSE* | *QTY* |
|---|---|---|---|
| Commercially available | Hand-operated press | To remove the bearings and bushings on the wing | |
| Commercially available | Hammer | To remove bearings and bushings on a bench | |
| Commercially available | Punch | To remove the bearings and bushings on a bench | |

D. Auxiliary Items

Not Applicable

E. Consumable Materials

Not Applicable

F. Expandable Parts

Not Applicable

G. Persons Recommended

| *QTY* | *FUNCTION* | *PLACE* |
|---|---|---|
| 1 | Does the task | For on-wing work |
| 1 | Does the task | For on-bench work |

H. Preparation

*SUBTASK 841-002-A*

(1) Make sure that the aircraft is safe for maintenance.

(2) Get access to the fitting where the bearings and bushings are installed.

I. Removal (Figure 401)

*SUBTASK 020-002-A*

(1) Remove retaining rings to loosen bearings, if necessary.

NOTE: Use a pair of pliers to remove the retaining rings that lock the bearing in its housing.

CAUTION: DO NOT USE A HAMMER TO REMOVE BUSHINGS OR BEARINGS ON THE WING. YOU CAN CAUSE DAMAGE TO THE COMPONENTS.

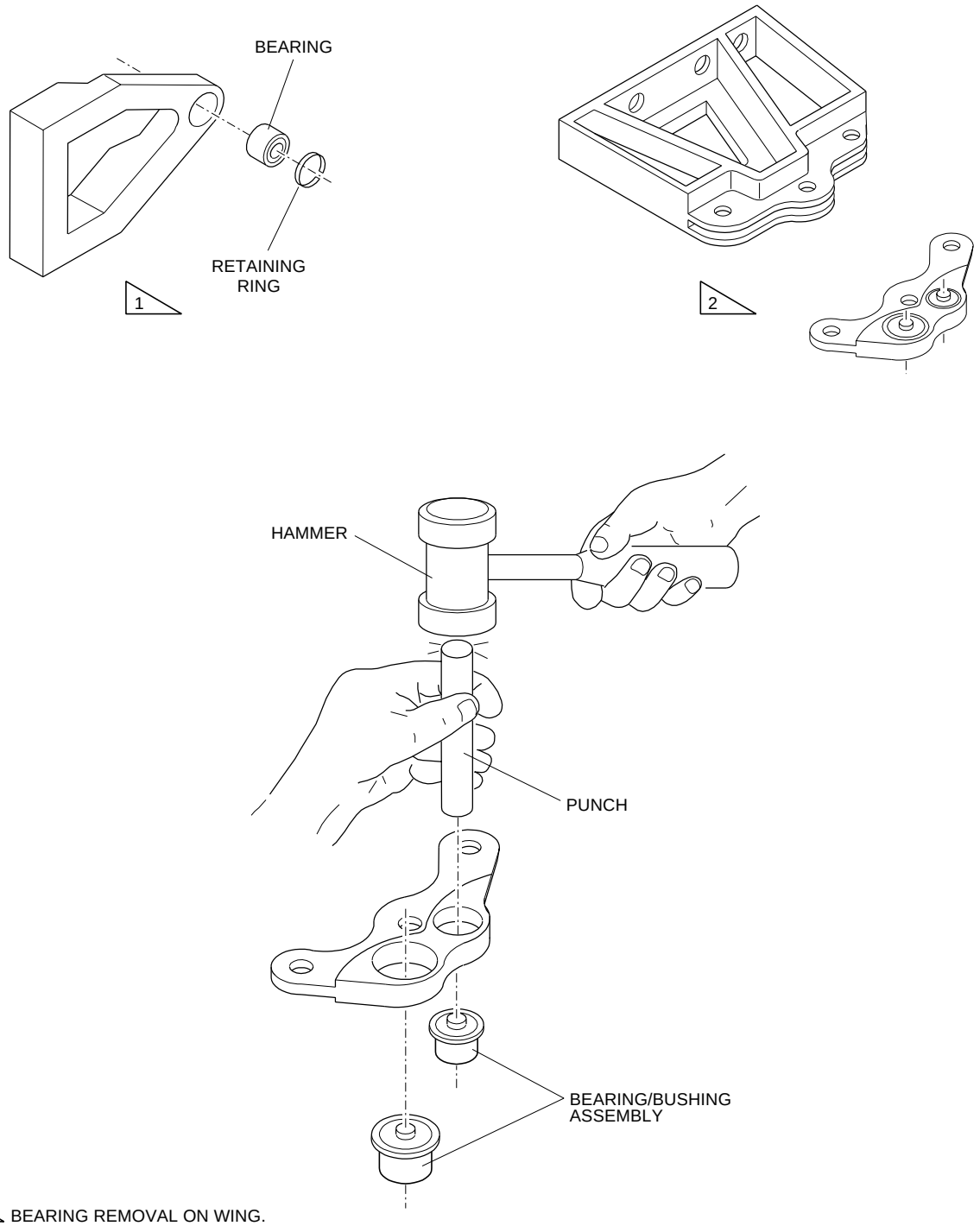
(2) Use a hand-operated press to remove the bearings and bushings from their fittings.

NOTE: Some fittings with bearings and bushings must be put on a workbench for complete disassembly. You can then use a hammer and a punch with the same diameter as that of the bearings and/or bushings.

(3) Discard the bearings and bushings.

*EFFECTIVITY:: ALL*

Bearings and Bushings - Removal
Figure 401




1 BEARING REMOVAL ON WING.

2 BEARING REMOVAL ON BENCH.

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TASK 20-10-08-400-801-A
*EFFECTIVITY: ALL*

3. BEARINGS AND BUSHINGS - INSTALLATION

A. General

(1) This task gives the procedures to install bearings and bushings.

B. Zones and Accesses

Not Applicable

C. Tools and Equipment

| *ITEM* | *DESCRIPTION* | *PURPOSE* | *QTY* |
|---|---|---|---|
| Commercially available | Hand-operated press | To remove the bearings and bushings on the wing | |
| Commercially available | Radial drilling machine | To roll-swage the bearings and bushings | |
| Commercially available | Needle file | To remove excess material and residues from the bushings | |
| Commercially available | Magnifying glass (10x maximum) | To examine for cracks, rough edges, and burrs | |
| Commercially available | Hammer | To remove bearings and bushings on a bench | |
| Commercially available | Punch | To remove bearings and bushings on a bench | |

D. Auxiliary Items

Not Applicable

E. Consumable Materials

| *SPECIFICATION (BRAND)* | *DESCRIPTION* | *QTY* |
|---|---|---|
| ASTM-D-740 | Methyl Ethyl Ketone (MEK) | AR |
| MIL-PRF-81733 Type IV Class 1 | Corrosion-inhibiting sealant P/S 870 C12 | AR |
| MIL-G-23827 | Aeroshell Grease-7 | AR |
| MEP 09-075 | Corrosion-Inhibiting Compound (COR-BAN 27L) | AR |

F. Expandable Parts

Not Applicable

G. Persons Recommended

| *QTY* | *FUNCTION* | *PLACE* |
|---|---|---|
| 1 | Does the task | For on-wing work |
| 1 | Does the task | For on-bench work |

H. Installation (Figure 401)

*SUBTASK 420-002-A*

**WARNING: DO NOT BREATHE THE FUMES OF MEK. DO WORK IN A WELL-VENTILATED AREA. DO NOT GET MEK IN EYES OR SKIN. USE APPROVED PROTECTION. KEEP MEK AWAY FROM SPARKS, FLAMES, AND HEAT.**

(1) Use a clean lint-free cloth soaked in MEK to clean the hole in the fitting and the surfaces of the bearing and bushing housing.

(2) Apply a thin coat of corrosion-inhibiting compound (COR-BAN 27L) to the hole in the fitting and to the surfaces of the bearing and bushing.

(3) Use a hand-operated press to install the bearings and bushings into their fittings.

NOTE:
- The bearings installed in areas lubricated with system fluids, such as hydraulic fluids and lubricants, must have their surfaces and interfaces protected with the same system fluid.
- Do not apply corrosion-inhibiting compound to the above bearings.
- You must apply force slowly and parallel to the wall of the bearing housing. This will prevent damage to the bearing housing.
- Some fittings with bearings and bushings must be put on a workbench for complete assembly. You can then use a hammer and a punch with the same diameter as that of the bearings and/or bushings.

(4) Lock the bearings in their housings with the retaining rings, if necessary.

CAUTION: DO NOT REMOVE MORE MATERIAL THAN THE EXTERNAL LIP OF THE BEARING. DAMAGE TO THE FITTING CAN OCCUR.

(5) After installation and when necessary, swage the bearings and bushings. Obey the correct swaging process (Table 401, Figure 402, and Figure 403).

Table 401 - SWAGING PROCESSES

| PROCESS | DESCRIPTION |
|---|---|
| Type I | Split sleeve with one swaging face. |
| Type II | One-piece sleeve with two swage faces. |

Table 402 - STANDARD -300-SERIES TOOLS FOR ROLL BEARING SWAGING

| Dash Number | ØA | ØB | ØC | ØD | F | G/r |
|---|---|---|---|---|---|---|
| -300 | 18.415 | 4.813 | 14 | 24 | 53 | 6 |
| -301 | 25.44 | 6.337 | 16 | 30 | 58 | 6 |
| -302 | 34.29 | 7.925 | 18 | 40 | 56 | 10 |
| -303 | 39.05 | 9.512 | 20 | 45 | 64 | 10 |
| -304 | 45.40 | 12.687 | 25 | 50 | 66 | 10 |
| -305 | 22.285 | 4.813 | 14 | 30 | 48 | 6 |

Table 402 - STANDARD -300-SERIES TOOLS FOR ROLL BEARING SWAGING (Continued)

| Dash Number | ØA | ØB | ØC | ØD | F | G/r |
|---|---|---|---|---|---|---|
| -306 | 21.59 | 6.337 | 14 | 28 | 52 | 6 |
| -307 | 23.18 | 7.925 | 16 | 29 | 53 | 6 |
| -308 | 66.04 | 39.675 | 49 | 72 | 55 | 16 |
| -309 | 72.39 | 46.025 | 55 | 75 | 52 | 18 |
| -310 | 78.74 | 52.375 | 62 | 85 | 52 | 20 |
| -311 | 21.59 | 6.337 | 14 | 25 | 48 | 6 |
| -312 | 23.18 | 7.925 | 16 | 30 | 48 | 6 |
| -313 | 24.77 | 9.512 | 18 | 30 | 48 | 6 |
| -314 | 34.29 | 7.925 | 20 | 40 | 55 | 10 |
| -315 | 24.77 | 7.925 | 18 | 30 | 56 | 6 |
| -328 | 32.703 | 19.032 | 28 | 39 | 52 | 8 |
| -329 | 26.54 | 7.993 | 18 | 33 | 65 | 6 |
| -330 | 28.54 | 9.990 | 19 | 35 | 55 | 8 |
| -331 | 21.54 | 5.990 | 15 | 28 | 53 | 6 |
| -333 | 37.54 | 9.990 | 22 | 45 | 66 | 10 |
| -335 | 27.54 | 11.989 | 21 | 34 | 58 | 6 |
| -337 | 35.87 | 22.20 | 27 | 40 | 65 | 10 |
| -341 | 34.54 | 14.980 | 24 | 40 | 55 | 8 |
| -342 | 44.54 | 19.980 | 30 | 50 | 60 | 10 |
| -344 | 16.54 | 5.880 | 11 | 20 | 60 | 4 |
| -345 | 20.54 | 7.990 | 14 | 25 | 55 | 8 |
| -348 | 18.42 | 6.35 | 13 | 24 | 60 | 4 |
| -351 | 18.40 | 4.81 | 12 | 25 | 50 | 4 |
| -353 | 29.53 | 15.87 | 18 | 35 | 60 | 6 |

Table 403 - STANDARD -300-SERIES TOOLS FOR GROOVED BEARING SWAGING

| Dash Number | ØA | ØB | ØD | E | F | G/r |
|---|---|---|---|---|---|---|
| -317 | 14.93 | 6.337 | 22.1 | 3.5 | 60 | 0.1 |
| -318 | 16.61 | 7.925 | 25.4 | 3.5 | 60 | 0.1 |
| -319 | 17.73 | 9.512 | 26.2 | 3.5 | 62 | 0.2 |
| -320 | 20.12 | 11.100 | 28.4 | 3.5 | 62 | 0.1 |
| -321 | 21.90 | 12.687 | 31.8 | 3.5 | 62 | 0.2 |
| -322 | 24.28 | 14.725 | 33.3 | 3.5 | 65 | 0.2 |
| -323 | 26.65 | 15.862 | 34.8 | 4.0 | 66 | 0.2 |
| -324 | 33.00 | 19.037 | 41.1 | 4.0 | 70 | 0.2 |
| -325 | 36.17 | 22.212 | 44.4 | 4.8 | 70 | 0.2 |

Table 403 - STANDARD -300-SERIES TOOLS FOR GROOVED BEARING SWAGING (Continued)

| Dash Number | ØA | ØB | ØD | E | F | G/r |
|---|---|---|---|---|---|---|
| -326 | 40.95 | 25.387 | 50.8 | 4.8 | 75 | 0.2 |
| -327 | 49.74 | 31.737 | 60.2 | 7.4 | 75 | 0.2 |
| -334 | 18.00 | 9.990 | 26.4 | 4.5 | 55 | 0.2 |
| -336 | 16.92 | 7.900 | 25.4 | 4.0 | 65 | 0.2 |
| -338 | 16.00 | 7.990 | 25.4 | 4.0 | 65 | 0.1 |
| -346 | 14.15 | 6.35 | 20 | 4.0 | 65 | 0.1 |
| -349 | 14.53 | 6.35 | 20 | 4.0 | 50 | 0.2 |
| -350 | 23.00 | 12.00 | 35 | 4.0 | 60 | 0.2 |
| -352 | 29.53 | 15.87 | 35 | 4.0 | 60 | 6 |

Table 404 - SPECIAL -300-SERIES TOOL FOR GROOVED BEARING SWAGING

| Dash Number | ØA | ØB | H | ØD | E | F | G/r |
|---|---|---|---|---|---|---|---|
| -316E | 12.55 | 4.813 | 7 | 20.6 | 3.5 | 18 | 0.1 |

NOTE: Find the dimensions (outside diameter and width) of the housing and bushing for each bearing used.

(6) After the swaging is completed, make sure that the dimensions obey the limits (Figure 407).

(7) Clean excess corrosion-inhibiting compound.

(8) Use a needle file to remove excess material and residues from the bushings.

NOTE: If necessary, remove burrs and break sharp edges.

(9) After you complete the type-I our Type-II swaging process (Table 402), you must roll-swage the bearings to axially retain them in their housings. Refer to Table 405 , Figure 407, Figure 408, and Figure 409.

NOTE:
- The installation tool rotor must be coupled to a column and/or radial drilling machine. The peripheral speed for the balls of the swaging tool must be approximately 15 m/min up to 16 m/min.
- You can find the drilling machine rate if you divide 5080 (constant) by the bearing outside diameter (dimension given in millimeters).

(10) Apply the roll-swaging force slowly, with the installation tool, while the rotor rotates on the bushings, until the swaged material fully fills the chamfers of the bearing housing.

CAUTION: CONTINUOUSLY APPLY COMPRESSED AIR BLASTS AND LUBRICATE THE INSTALLATION TOOL BALLS WITH AEROSHELL 7 GREASE TO PREVENT OVERHEATING OF THE SWAGED AREA.

(11) For the roll-swaging of the bearings and bushings, do as follows:

**WARNING: DO NOT BREATHE THE FUMES OF MEK. DO WORK IN A WELL-VENTILATED AREA. DO NOT GET MEK IN EYES OR SKIN. USE APPROVED PROTECTION. KEEP MEK AWAY FROM SPARKS, FLAMES, AND HEAT.**

(a) Use a clean lint-free cloth soaked in MEK to clean the hole in the fitting and the faying surfaces of the bearing and bushing housing.

(b) Apply a thin coat of corrosion-inhibiting sealant P/S 870 C12, Spec. MIL-PRF-81733 Type IV Class 1, to the hole in the fitting and to the faying surfaces of the bearing and bushing.

CAUTION: APPLY THE INSTALLATION FORCE SLOWLY AND PARALLEL TO THE WALL OF THE BEARING HOUSING TO PREVENT DAMAGE TO THE HOUSING.

(c) With the sealant still wet, install the bearings and the bushings in the fittings with the correct -400-series installation tool and the hand-operated press.

Table 405 - DIMENSIONS FOR -400-SERIES ROLL-SWAGING TOOLS

| Dash Number | SWAGER | | | | | |
|---|---|---|---|---|---|---|
| | ØV | Y | ØA | ØR | ØW | S |
| -400 | - | - | 36.450<br>36.475 | 60.725<br>60.850 | 86 | 5.6 |
| -401 | - | - | 45.975<br>46.000 | 70.250<br>70.375 | 95 | 7.5 |
| -403 | 12.7 | 1.5 | 6.315<br>6.327 | 19.287<br>19.677 | 35 | 1.5 |
| -404 | 15.0 | 3.5 | 6.315<br>6.327 | 23.133<br>23.523 | 34 | 1.5 |
| -408 | 15.0 | 5.0 | 9.396<br>9.525 | 36.988<br>37.088 | 60 | 1.5 |
| -409 | 8.5 | 0.5 | 4.810<br>4.790 | 21.308<br>21.248 | 40 | 1.5 |

Table 406

| Dash Num-ber | BASE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ØK | ØE | ØB | ØP | Q | ØF | G | TYPE | L/M |
| -400 | 88 | 78 | 36.500<br>36.525 | 67.7 | 1.5 | 78 | - | I | - |
| -401 | 98 | 88 | 46.025<br>46.050 | 77.2 | 1.5 | 88 | - | I | - |
| -403 | 39 | 18.90<br>18.95 | 6.337<br>6.350 | 12.7 | 1.5 | 29 | 0.50<br>0.45 | I | 12/4 |
| -404 | 43 | 22.75<br>22.80 | 6.337<br>6.350 | 15 | 3.5 | 29 | 0.50<br>0.45 | I | 15/4 |
| -408 | 63 | 36 | 9.550<br>9.575 | 29 | 7.0 | 53 | 1.0 | I | 15/4 |

Table 406 (Continued)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| -409 | 43 | 19.73<br>19.68 | 4.830<br>4.850 | 8 | 0.5 | 30 | 0.5 | I | 8/4 |

NOTE: These dimensions are given in Figure 408.

(d) Roll-swage the two sides of the bushing and bearing with the swaging tool coupled to a radial drilling machine.

(e) Apply a gradual and constant force during the roll-swaging process.

NOTE: Make sure that the roll-swage rate is correct for the size of the bushing and bearing. Refer to paragraph 7. C.

(f) After the swaging is completed, make sure that the dimensions obey the limits (Figure 407).

(g) Use a needle file to remove excess material and residues from the bushings.

NOTE: If necessary, remove burrs and break sharp edges.

**WARNING: DO NOT BREATHE THE FUMES OF MEK. DO WORK IN A WELL-VENTILATED AREA. DO NOT GET MEK IN EYES OR SKIN. USE APPROVED PROTECTION. KEEP MEK AWAY FROM SPARKS, FLAMES, AND HEAT.**

(h) Clean all roll-swaged areas with MEK and examine them with a 10X (maximum) magnifying glass for the presence of cracks, rough edges, and burrs.

(i) Apply a thin and continuous coat of corrosion-inhibiting sealant P/S 870 C12, Spec. MIL-PRF-81733 Type IV Class 1, to the edges of the roll-swaged surfaces and to the bushing interfaces.

NOTE: Do a check to make sure that the bearings move freely.

I. Follow-on

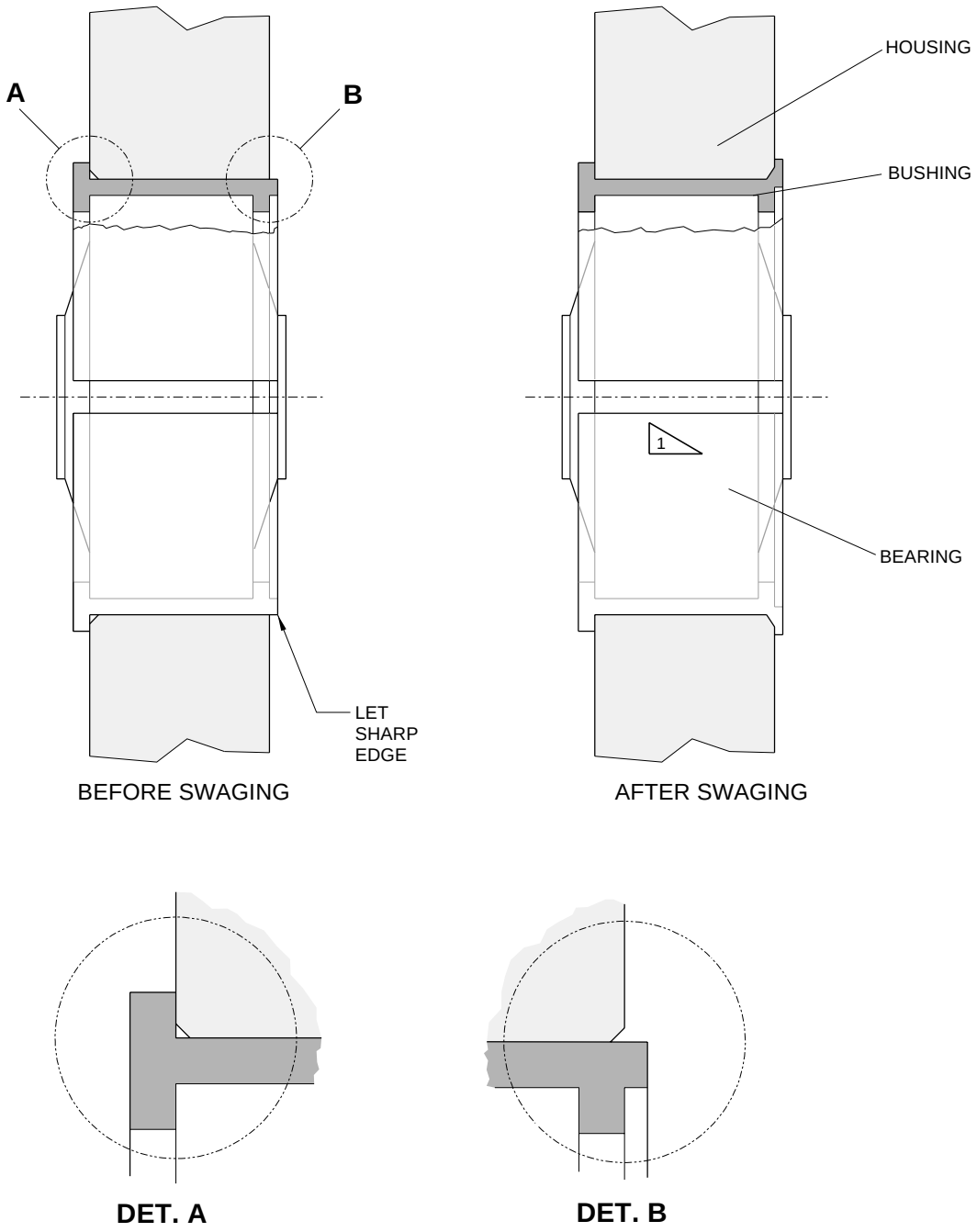
*SUBTASK 842-002-A*

(1) Put the aircraft back to the original condition.

(2) Do the applicable operational system test.

*EFFECTIVITY:: ALL*

Type-I Swaging of Bearings and Bushings with -300 Series Tool
Figure 402




1 SPLIT BUSHING WITH MAXIMUM GAP OF 1.3 mm AFTER SWAGING.

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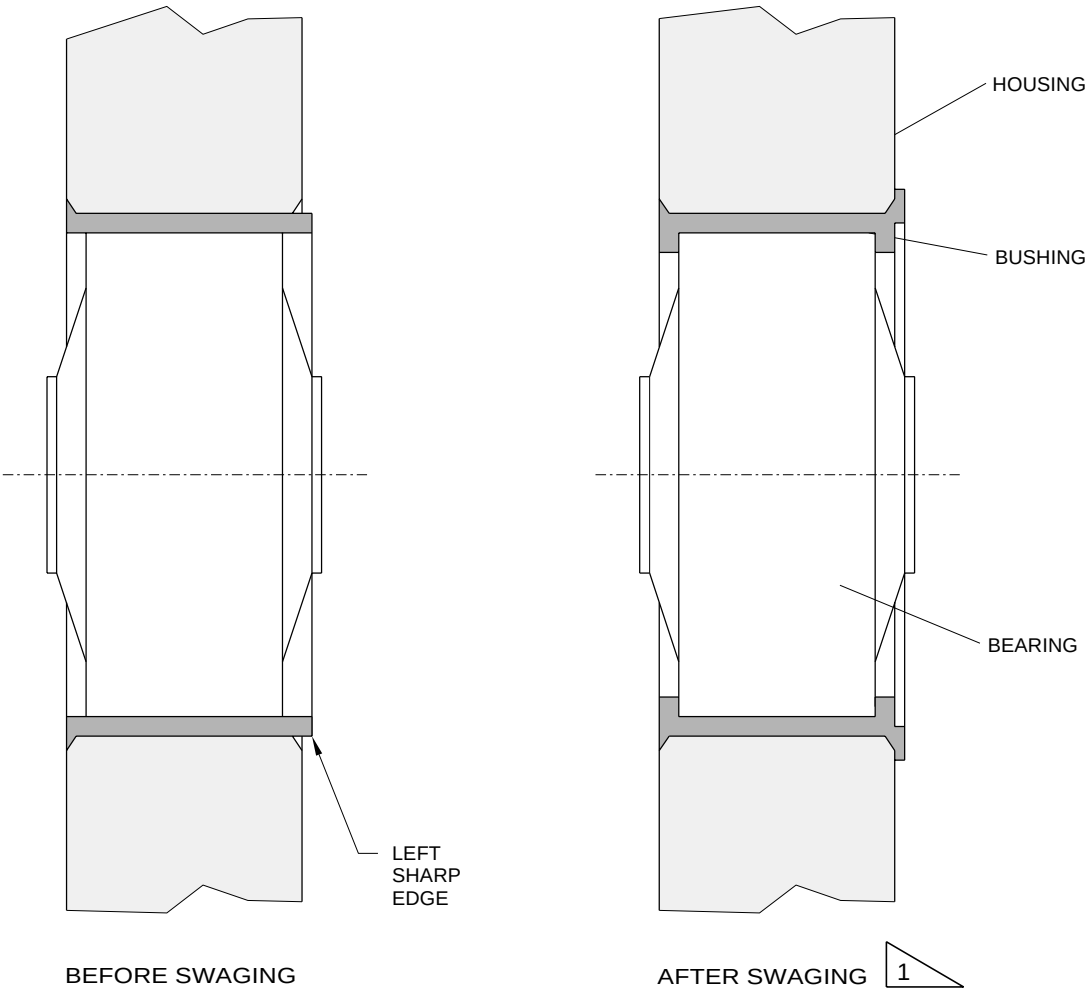
*EFFECTIVITY:: ALL*

Type-II Swaging of Bearings and Bushings with -300 Series Tool
Figure 403




1 UNLESS OTHERWISE SPECIFIED, BURRS SHOULD BE REMOVED, AND SHARP EDGES BROKEN.

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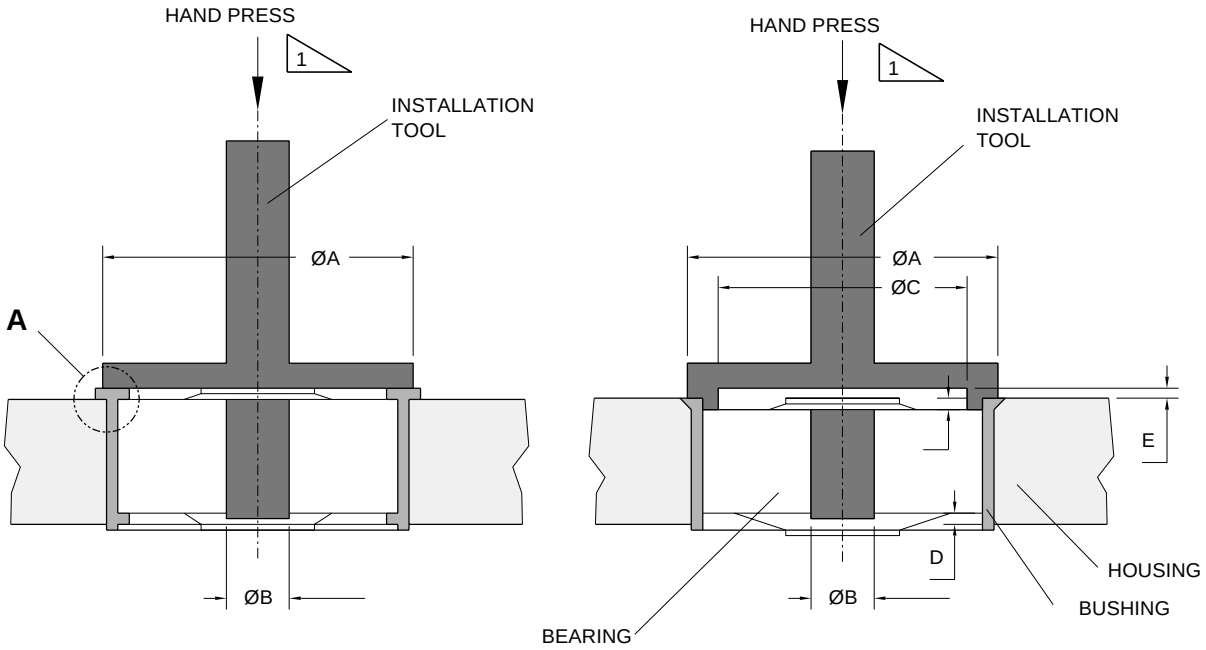
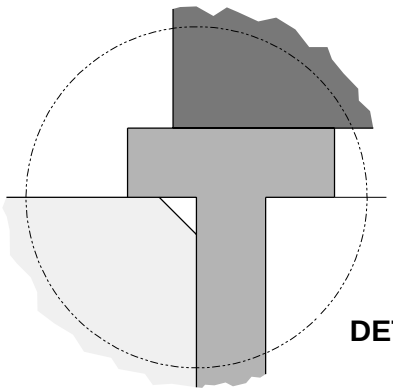
*EFFECTIVITY:: ALL*

Swaging of Bearings and Bushings with -300 Series Tool
Figure 404




TYPE I SWAGE

TYPE II SWAGE



**DET. A**

ØA : DIAMETER EQUAL TO OUTSIDE DIAMETER OF BUSHING.

ØB: GUIDE DIAMETER, TO ROUTE TOOL INTO BEARING HOLE.

ØC: DIAMETER EQUAL TO SMALLER DIAMETER OF BUSHING EXTERNAL LIP.

ØD: DIMENSION THAT POSITIONS BEARING IN THE CENTER OF ITS HOUSING.

ØE: HEIGHT THAT PREVENTS TOOL FROM BEING SUPPORTED ON BUSHING INTERNAL LIP.

1 FOR TYPE I SWAGING, THE AXIAL FORCE DEVELOPED BY THE TOOL MUST BE APPLIED ONLY TO THE BUSHING WALL.
FOR TYPE II SWAGING, THE AXIAL FORCE DEVELOPED BY THE TOOL MUST BE APPLIED BOTH TO THE BUSHING WALL AND TO THE EXTERNAL LIP OF THE BEARING.

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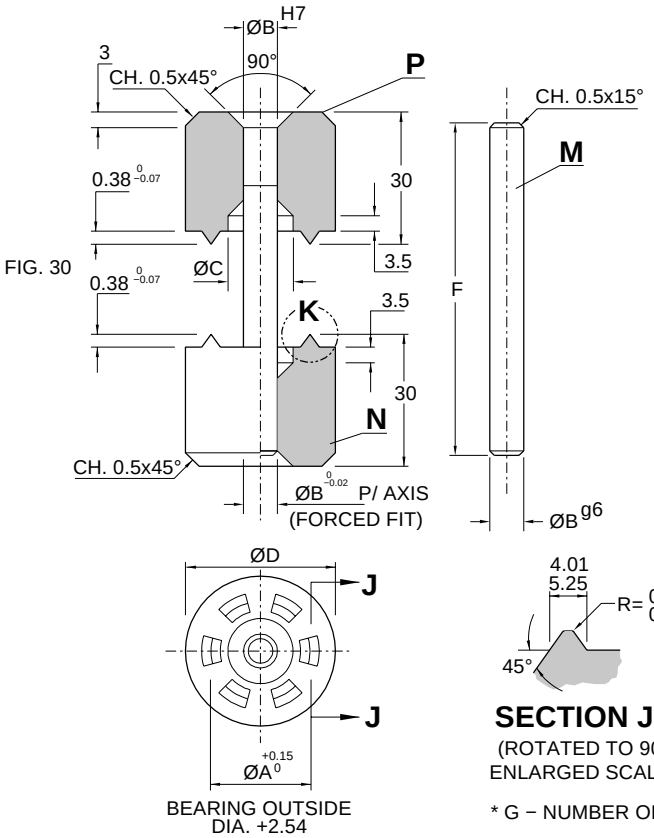
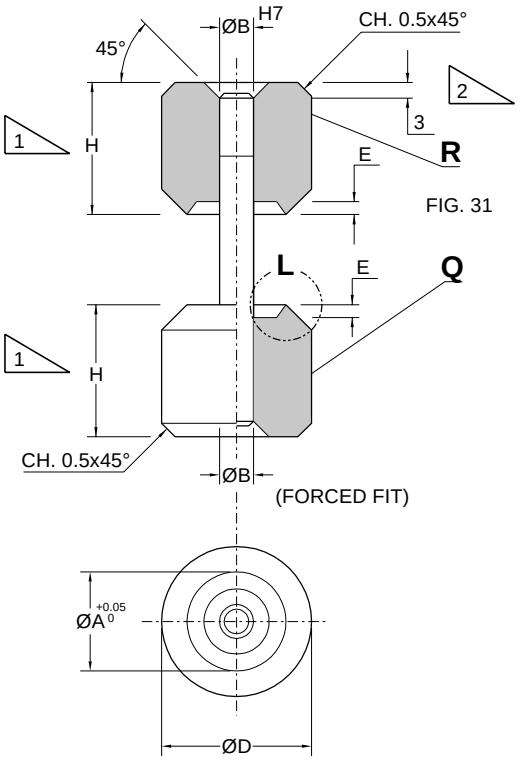
*EFFECTIVITY:: ALL*

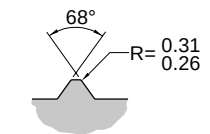
-300 Series Tools for Swaging Bearings and Bushings
Figure 405

## ROLL BEARINGS

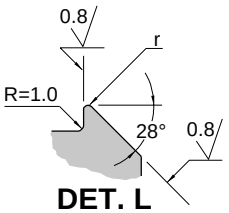



## GROOVED BEARINGS




**DET. K**
ENLARGED SCALE




**DET. L**
ENLARGED SCALE

r = BEARING MINIMUM RADIUS
ØA = CENTER CHANNEL MINUS 2r

MATERIAL:
DET. M = STEEL SAE 1045 (HARDENING AND TEMPERING RC 40–45).
DET. N, P, Q AND R = STEEL SAE 01 (HARDENING AND TEMPERING RC 58–60) OXIDE IN BLACK AS PER MIL–C–13924 (ALL DETAILS)

1 H=30, EXCEPT FOR SPECIAL SWAGERS.

2 FOR SPECIAL SWAGERS, CH. 0.5mm.

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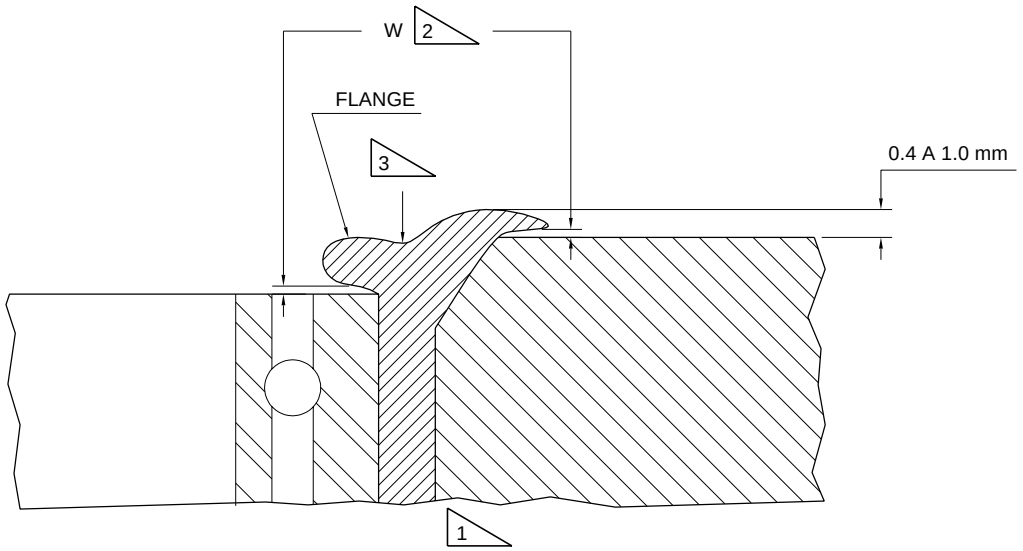
*EFFECTIVITY:: ALL*

Bearing and Bushing Dimensional Limits
Figure 406




1 DIMENSIONAL LIMITS OF BUSHINGS AFTER SWAGING.

2 WHEN BEARING IS INSTALLED WITH:
a) PRIMER OR FLUID, W < 0.08mm;
b) SEALANT, W < 0.15mm.

3 THE HEIGHT OF SURFACE DEFECTS (BOSS, RECESS, ETC.) THROUGHOUT THE SWAGE AREA MUST BE ≤ 0.8mm.

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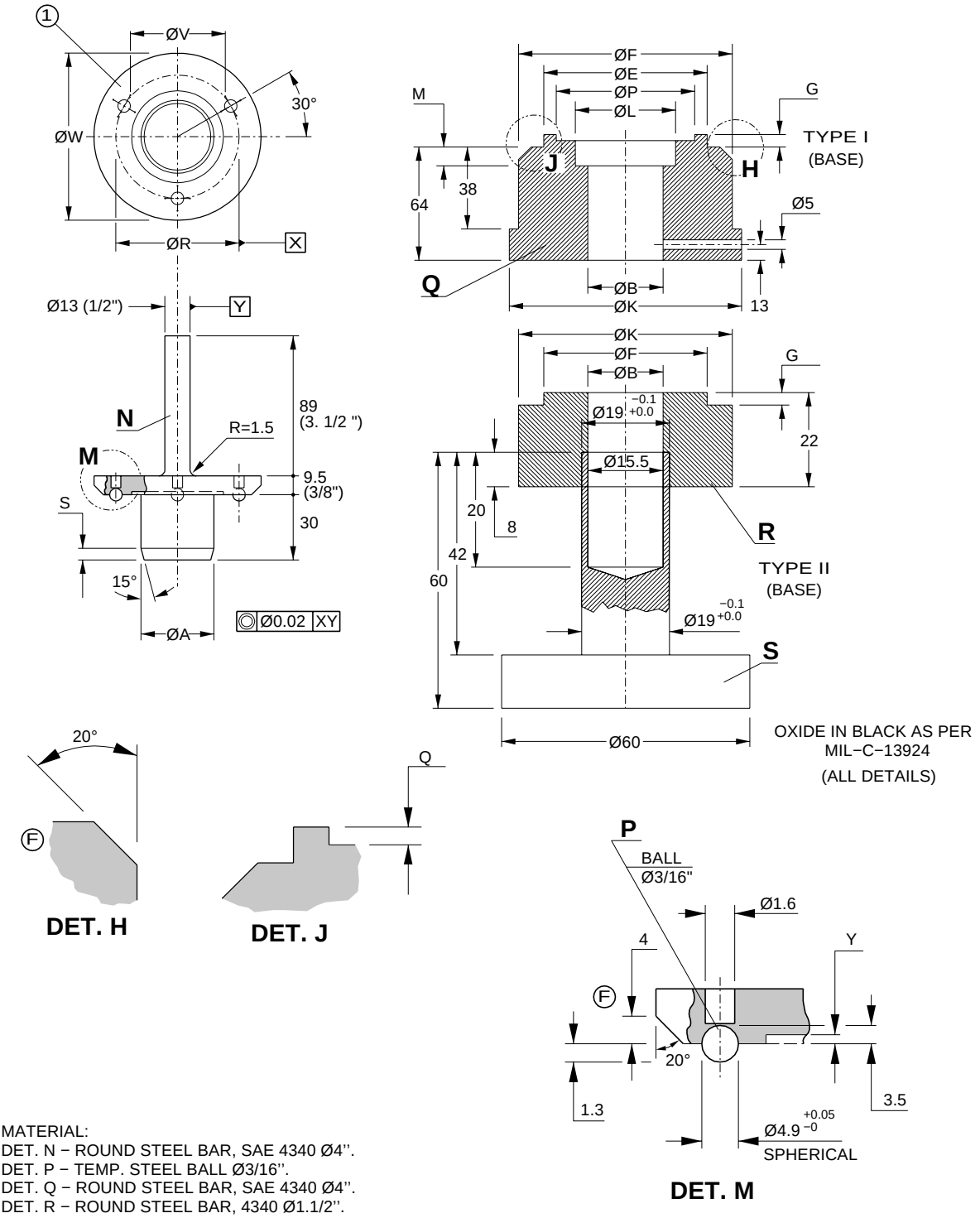
*EFFECTIVITY:: ALL*

-400 Series Tools for Roll-Swaging Bearings and Bushings

Figure 407




MATERIAL:
DET. N − ROUND STEEL BAR, SAE 4340 Ø4''.
DET. P − TEMP. STEEL BALL Ø3/16''.
DET. Q − ROUND STEEL BAR, SAE 4340 Ø4''.
DET. R − ROUND STEEL BAR, 4340 Ø1.1/2''.
DET. S − ROUND STEEL BAR, 1020 Ø2.1/2''.

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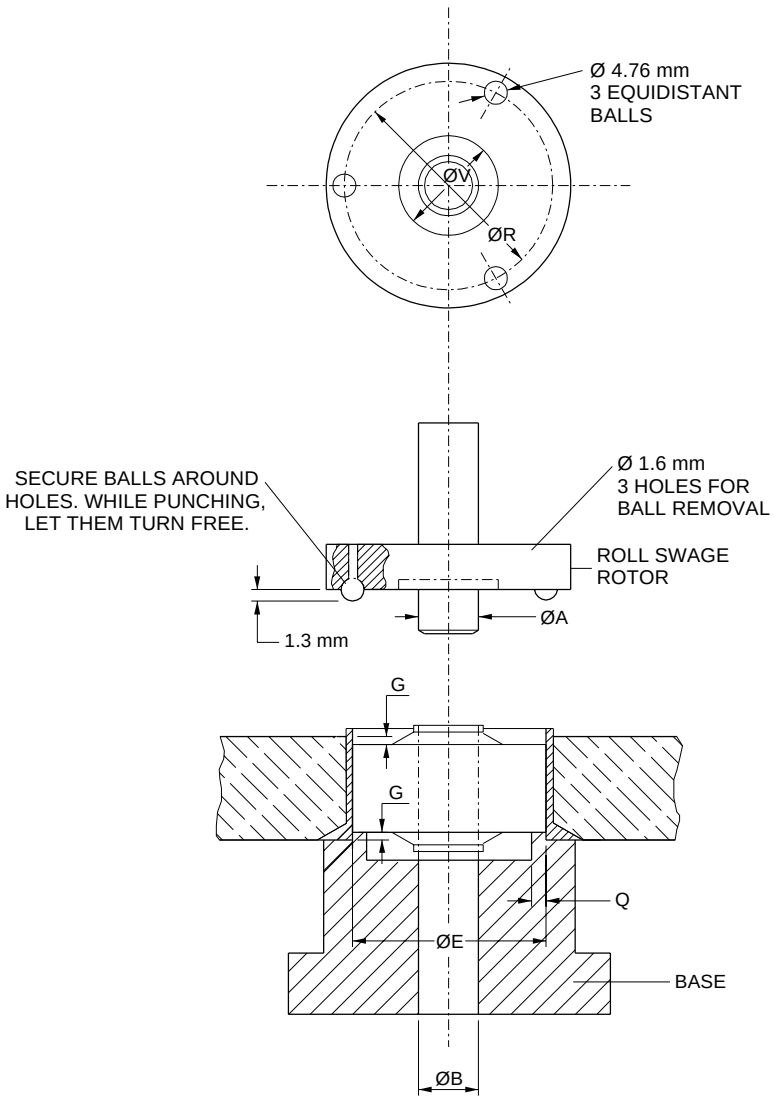
*EFFECTIVITY:: ALL*

Roll-Swaging of Bearings and Bushings with -400 Series Tool
Figure 408




ØA: GUIDE DIAMETER TO ROUTE SWAGE ROTOR INTO BEARING HOUSING.

ØV: FREE DIAMETER TO HOUSE CENTER PART OF BEARING.

ØR: BUSHING INNER DIAMETER

ØB: DIAMETER EQUAL TO BEARING HOLE.

ØE: DIAMETER TO GUIDE TOOL BASE IN THE INNER DIAMETER OF BUSHING.

Q: THICKNESS EQUAL TO THE WALL OF THE HOUSING EXTERNAL LIP.

G: DIMENSION THAT POSITIONS BEARING IN THE MIDDLE OF ITS HOUSING.

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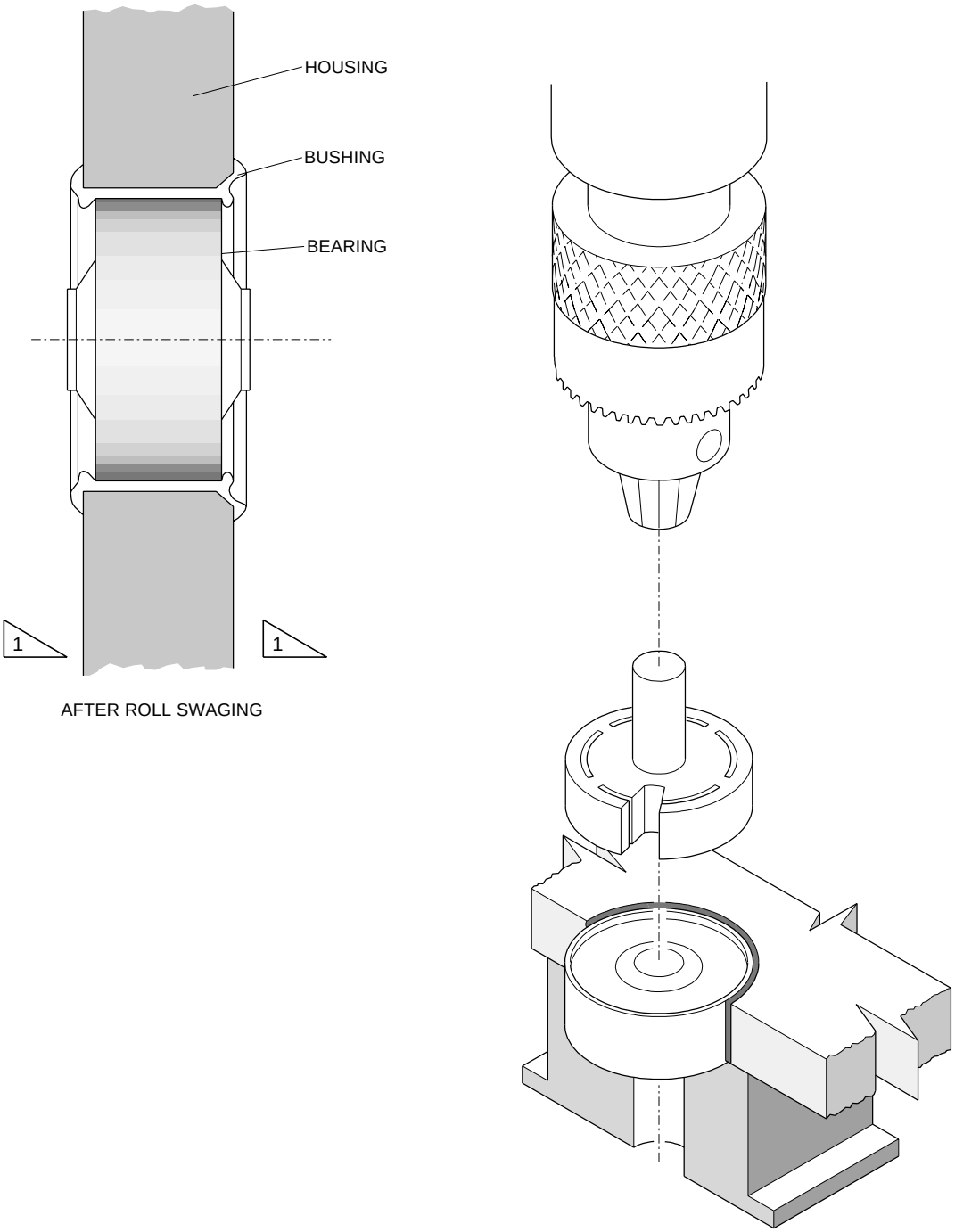
*EFFECTIVITY:: ALL*

Roll-Swaging of Bearings and Bushings with -400 Series Tool
Figure 409




1 CORROSION−INHIBITING SEALANT P/S 870 C12, SPEC. MIL−PRF−81733, TYPE IV, CLASS 1.

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