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SERVICE INSTRUCTION

DATE: November 10, 2011

Service Instruction No. 1143C
(Supersedes Service Instruction No. 1143B, Supplement No. 2, 3 and 4 to Service Instruction No. 1143B and Service Letter No. L217)
Engineering Aspects are FAA Approved

SUBJECT: Counterweight Bushing Inspection, Replacement, and Special Tooling Upgrades

MODELS AFFECTED: All Lycoming piston aircraft engines with dynamic counterweights

TIME OF COMPLIANCE: During engine overhaul.

NOTE

Incomplete review of all the information in this document can cause errors. Read the entire Service Instruction to make sure you have a complete understanding of the requirements.

This Service Instruction includes all of the necessary information to examine, remove, prepare, and install counterweight bushings. Because of counterweight manufacturing changes, some modifications to existing tools used to replace counterweight bushings could be necessary. Instructions for tooling modifications also are included in Appendix A of this Service Instruction

NOTE

Previous supplements are included in this revision of the Service Instruction.

Overview

NOTE

Counterweight bushings must always be replaced with new counterweight bushings during engine overhaul or whenever counterweight bushings are removed. All counterweight bushings must be replaced at the same time.

Replacement of counterweight bushings is to be done in the following sequence of tasks:

	Task:	Section to refer to in this Service Instruction
1.	Remove the bushing	Counterweight Bushing Removal
2.	Identify the correct spacers that are necessary to install the counterweight bushings	Counterweight Spacer Identification
3.	It could be necessary to make special tools to do the bushing replacement	Appendix A – Special Tools Used for Counterweight Bushing Replacement

	Task:	Section to refer to in this Service Instruction
4.	Examine the bushing bore on the counterweight	Counterweight Bushing Bore Inspection
5.	Install the bushing pair on the counterweight	Counterweight Bushing Installation
6.	Do grinding on the bushing bore	Inner Diameter Bushing Bore Grinding Procedure
7.	Examine finished bushings	Inspection of Finished Counterweight Bushings
8.	Examine installed counterweight bushing	Counterweight Bushing Installation Inspection
9.	Do the balancing procedure	Counterweight Balancing Procedure

Counterweight Bushing Removal

Tools to be used include:

- Arbor press spindle
- Counterweight bushing driver ST-92 (Appendix A)
- Counterweight fixture assembly ST-93 (Appendix A)
- Depth control spacer ST-93-3 (Appendix A)
- Depth control spacer ST-93-5 (Appendix A)

1. Put the counterweight flat on the table, square and level against the arbor press spindle.
2. Install the applicable depth control spacer ST-93-3 or ST-93-5 in the counterweight bushing bore.
3. Use the arbor press spindle and counterweight bushing driver ST-92 to press both bushings out from one side of the counterweight. Refer to Figure 1.
4. Turn the counterweight over.
5. Use the arbor press spindle and counterweight bushing driver ST-92 to press out the remaining bushings.

Refer to the "Counterweight Bushing Bore Inspection" procedure in this Service Instruction.

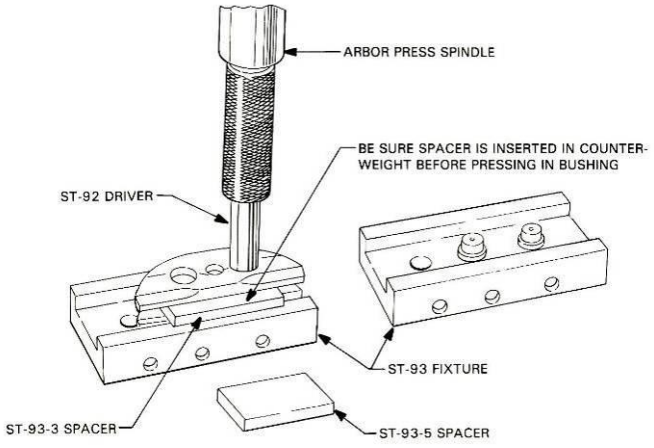


Figure 1
Counterweight Bushing Removal/Installation
Using the Counterweight Fixture Assembly ST-93 (Appendix A)
and the Counterweight Bushing Driver ST-92 (Appendix A)

Counterweight Spacer Identification

The counterweights with the new dimensions all have new part numbers. To identify new counterweights that have replaced superseded counterweights, refer to the latest revision of Service Instruction No. 1012.

Some new counterweights have a new suffix on the end of the part number that identifies counterweights that can only be installed on direct drive Lycoming engines.

Dimension A in Figure 2 is the distance from the center line of the counterweight bushing bore to the flat edge of the counterweight. This dimension is used to identify the thickness of the spacer, Dimension B. Refer to Figure 2 and Figure A-1.

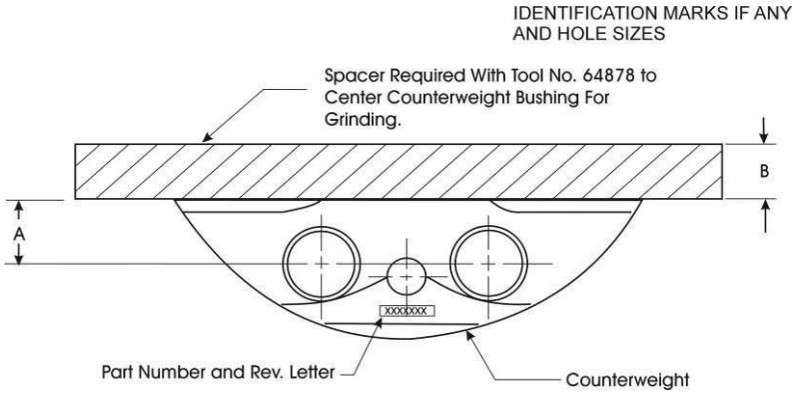


Figure 2
Dimension "A" and "B" on the Counterweight

Table 1 shows Dimensions A and B values in Figure 2 for the counterweight part numbers in addition to the corresponding spacers. Spacers are used to align the bushing bore of the counterweight with the fixture tool P/N 64878.

NOTE

In Table 1, some of the counterweights that have been made to the new specifications do not have the same Dimension A as superseded counterweights.

TABLE 1
COUNTERWEIGHT SPACER DIMENSIONS

Counterweight Part No.	Spacer Detail Part No. *	Dimension A ± 0.010 in. (0.254 mm) Figure 2		Dimension B ±0.0005 in. (0.0127 mm) Figure 2		Weight Minimum	
		(in.)	(mm)	(in.)	(mm)	(Lbs.)	(Kg)
71904	12	0.825	21.0	0.425	10.8	1.796	0.81
LW-19225D	27	0.855	21.7	0.395	10.0	1.796	0.81
LW-19225E	17	0.875	22.2	0.375	9.5	1.796	0.81
14U22538	27	0.855	22.2	0.395	10.0	1.796	0.81
71905	12	0.825	21.0	0.425	10.8	1.752	0.79
LW-19226D	27	0.855	21.7	0.395	10.0	1.756	0.80
LW-19226E	17	0.875	22.2	0.375	9.5	1.756	0.80
14U22539	32	0.835	21.2	0.415	10.5	1.756	0.80
72801	10	0.715	18.2	0.535	13.6	1.846	0.84
LW-19227D**	28	0.740	18.8	0.510	13.0	1.846	0.84
LW-19227E	30	0.761	19.3	0.489	12.4	1.846	0.84

TABLE 1
COUNTERWEIGHT SPACER DIMENSIONS

Counterweight Part No.	Spacer Detail Part No. *	Dimension A ± 0.010 in. (0.254 mm) Figure 2		Dimension B ±0.0005 in. (0.0127 mm) Figure 2		Weight Minimum	
		(in.)	(mm)	(in.)	(mm)	(Lbs.)	(Kg)
72534	13	0.950	24.1	0.300	7.6	2.246	1.02
LW-19213	29	0.965	24.5	0.285	7.2	2.246	1.02
73643	15	0.805	20.4	0.445	11.3	2.212	1.00
LW-19211	12	0.825	21.0	0.425	10.8	2.212	1.00
73644	11	0.741	18.8	0.509	12.9	2.166	.098
LW-19210	30	0.761	19.3	0.489	12.4	2.166	.098
73812	16	0.908	23.1	0.342	8.7	2.266	1.03
LW-19212	31	0.923	23.4	0.327	8.4	2.266	1.03
74901	20	0.720	18.3	0.530	13.5	1.470	0.67
75636	20	0.720	18.3	0.530	13.5	1.600	0.73
75637	17	0.875	22.2	0.395	9.5	1.678	0.76
76044	18	0.730	18.5	0.520	13.2	1.810	0.82
78988	18	0.730	18.5	0.520	13.2	1.600	0.73
14U22539	32	0.835	21.2	0.415	10.5	1.756	0.80

* Spacers are used to align the bushing bore of the counterweight with the grinding fixture P/N 64878.

** Use spacer No. 30 and 0.001 in. (0.025 mm) thick shim stock to make 0.490 in. (12.45 mm) spacer thickness when grinding the bushings in an LW-19227 counterweight.

Counterweight Bushing Bore Inspection

1. Visually examine the bushing bore. The bore must be smooth and without scratches, tool marks, galling or other surface damage. If any evidence of surface damage is found, replace the counterweight.
2. Measure the bushing bore diameter on the counterweight.
   a. If the counterweight has a letter B marking, the bushing bore diameter must be between 0.9384 and 0.9392 in. (23.835 and 23.856 mm).
   b. If the counterweight does NOT have a letter B marking, the bushing bore on the counterweight is smaller and must be between 0.9369 and 0.9377 in. (23.797 and 23.818 mm).

⚠ CAUTION

DO NOT INCREASE THE DIAMETER OF THE BUSHING BORE ON A COUNTERWEIGHT. THIS ENLARGEMENT CAN CAUSE ENGINE DAMAGE BECAUSE IT WILL DECREASE THE SNAP RING GROOVE DEPTH IN THE BUSHING BORE ON THE COUNTERWEIGHT.

3. If the bushing bore on the counterweight is not within the tolerances shown above, replace the counterweight. Some counterweights must be replaced as a matched set. Refer to the latest revision of Service Instruction No. 1012 to identify the correct replacement counterweights and whether they must be replaced as a matched set.

NOTE

The magnetic particle inspection must be done by a qualified and certified technician as per the latest revision of Service Instruction No. 1285.

4. Examine the counterweight for cracks; use the magnetic particle inspection method. If cracks are found, replace the counterweight.

Counterweight Bushing Installation

Tools and parts to be used for this procedure include:

- Counterweight bushing driver ST-92 (Appendix A)
- Counterweight fixture assembly ST-93 (Appendix A)
- Two locating pins ST-93-2 (Appendix A)
- Depth control spacer ST-93-3 (Appendix A)
- Depth control spacer ST-93-5 (Appendix A)
- Four new dynamic counterweight bushings shown in Table 2

NOTE

Part numbers for dynamic counterweight bushings are identified with a suffix letter at the end of the part number.

TABLE 2
COUNTERWEIGHT BUSHING PART NUMBERS

Bushing Part Number	Outer Diameter (OD) Dimensions	
	Inches	Millimeters
71903-A	0.9390 to 0.9395	23.85 to 23.86
71903-B	0.9405 to 0.9410	23.89 to 23.90

⚠ CAUTION

SPACERS SUPPLIED WITH THE COUNTERWEIGHT FIXTURE ASSEMBLY ST-93 ARE USED TO CONTROL THE DEPTH THAT THE BUSHINGS ARE DRIVEN INTO THE COUNTERWEIGHT. THE BUSHING MUST BE FLUSH TO 0.002 IN. (0.051 MM) FROM PROTRUSION INTO THE SLOT OF THE COUNTERWEIGHT.

1. Use four new correct sized counterweight bushings to be installed; refer to Table 2 to identify the correct counterweight bushings.
2. Measure the center-to-center distance of the bushing bore in the counterweight.
3. Make a selection of two holes in the counterweight fixture assembly ST-93 that agree with the measured center-to-center distance.
4. Install two locating pins ST-93-2 in the two holes of the counterweight fixture assembly ST-93.
5. Install the correct spacer ST-93-3 (0.370 in. or 94 mm) thick or ST-93-5 (0.440 in. or 11.2 mm) on the counterweight. Refer to Figure 1.
6. Put the counterweight with the two locating pins ST-93-2 in the bushing bores on the counterweight fixture assembly ST-93.

7. Use an arbor press and counterweight bushing driver ST-92 to press the two new counterweight bushings into place.
8. Remove the spacer (ST-93-3 or 93-5).
9. Turn the counterweight over.
10. Install the correct spacer ST-93-3 or ST-93-5 on the counterweight. Refer to Figure 1.
11. Use an arbor press and counterweight bushing driver ST-92 to press the two new counterweight bushings into place.
12. Refer to the "Inner Diameter Bushing Bore Grinding Procedure" in this Service Instruction.

Inner Diameter Bushing Bore Grinding Procedure

Tools and parts to be used for this procedure include:

- Fixture P/N 64878 with a 3/4 x 1 x 1/4 in. (19.05 x 25.4 x 6.35 mm) grinding wheel
- Three 1/4-20 socket head screws
- One knurled head screw
- One small locating pin P/N 64878-2
- One larger locating pin P/N 64878-6
- Locating clamp P/N 64878-23
- Metal block P/N 64878-21

NOTE

The fixture P/N 64878 does not have any mounts or pre-drilled holes in its base to enable flexible installation on any grinding machine without interference from pre-drilled holes or mounts.

This procedure is used to make the inner diameter of the new bushings of the correct size and surface finish for correct counterweight bushing installation and operation.

NOTE

You must follow the steps of this procedure in sequence. Do not use any other procedure or method for grinding the bushings.

1. Refer to Table 1 to identify the correct spacer to be used for the corresponding counterweight.
2. Install the fixture P/N 64878 on the faceplate of an internal grinding machine.
3. Make sure that the 1/8 in. (3.18 mm) diameter hole in the center of the fixture is concentric with the center of the face plate on the internal grinding machine. Concentricity must be held to within ± 0.0005 in. (± 0.0127 mm). Refer to Figure 3.

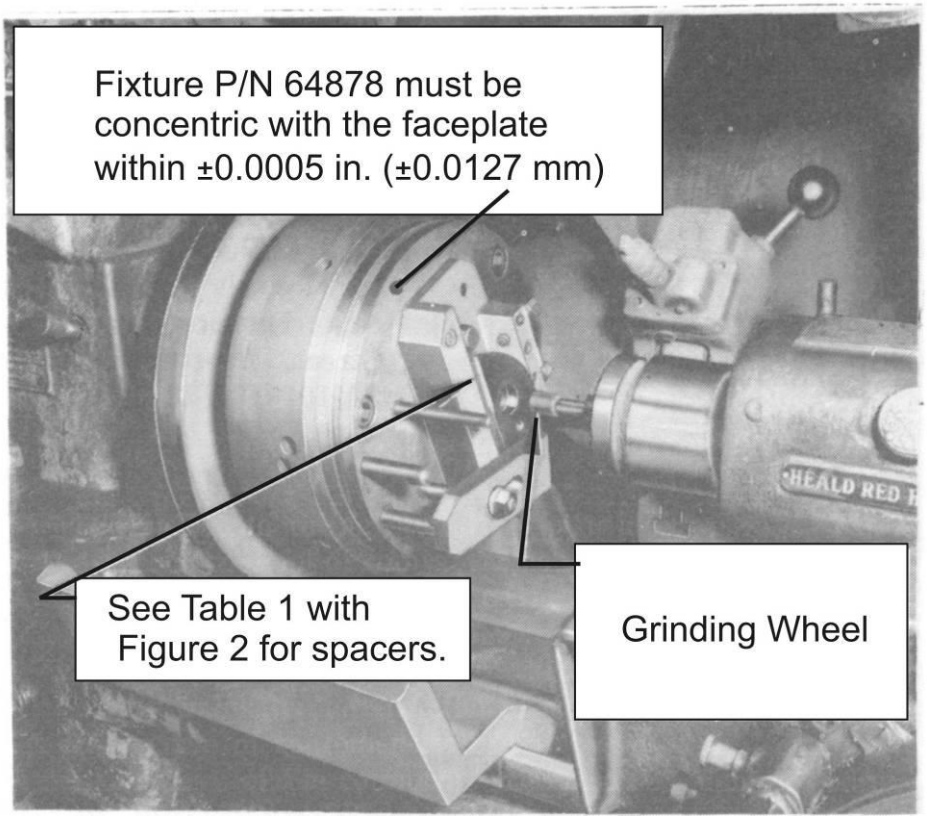


Figure 3
Counterweight and 64878 Fixture
Assembled on an Internal Grinding Machine

4. Install the correct spacer (identified in Table 1 of this Service Instruction) on the fixture P/N 64878.
5. Attach the spacer securely to the alignment bar of the fixture with three, 1/4-20 socket head screws.

NOTE

The small locating pin P/N 64878-2 is used to align the counterweight with an unground counterweight bushing. The larger locating pin P/N 64878-6 is used to align the fixture P/N 64878 with ground-to-size counterweight bushing bore distances on the counterweights.

6. Install and rotate the smaller locating pin P/N 64878-2 in a position to install one set of counterweight bushings on the centerline of the fixture.
7. Lock the locating pin in this position by tightening the 10-32 socket head screw that attaches the locating clamp P/N 64878-23.
8. Make sure the mating surfaces of the counterweight and fixture P/N 64878 are clean.
9. Install the counterweight on the fixture P/N 64878 as shown in Figure 3.

NOTE

In the next step, when tightening the knurled head screw, do not tighten past the point where the screw can enter the slot in the counterweight. If the threaded-end of the knurled head screw starts to enter the slot, install the metal block P/N 64878-21 on the end of the knurled head screw.

10. Tighten the knurled head screw to attach the counterweight securely against the spacer.

11. Adjust the fiber block of the hold down clamp over the center of the counterweight.
12. Tighten the socket head screw to securely attach the counterweight to the fixture.
13. Grind the inside diameter of both counterweight bushings to between 0.7485 to 0.7505 in. (19.011 to 19.063 mm) in diameter. The surface of the ground bushing must be 15 micro-inches (0.000381 mm).
14. Remove the counterweight from the fixture.
15. Remove the small locating pin P/N 64878-2 from the fixture.
16. Install the larger locating pin P/N 64878-6 in the hole opposite from where the smaller locating pin P/N 64878-2 had been installed.
17. Rotate the larger locating pin P/N 64878-6 to align the unground bushings with the centerline of the fixture.
18. Do steps 7 through 17 again.
19. Remove the larger locating pin from the fixture.
20. Examine the finished counterweight bushings. Refer to the section "Inspection of Finished Counterweight Bushings" in this Service Instruction.

Inspection of Finished Counterweight Bushings

Tools and parts to be used for this procedure include:

- Counterweight bushing location gage ST-94 (Appendix A)
- Relieved locating pin ST-94-2 (Appendix A)
- Solid locating pin ST-94-3(Appendix A)
- Counterweight squareness gage ST-91(Appendix A)
- Spacers: ST-91-7, ST-91-8, ST-91-9, ST-91-10, ST-91-11, ST-91-12, ST-91-13, ST-91-14 (Appendix A)
- Gauging arbors ST-91-3 (Appendix A)
- Depth gage

NOTE

The magnetic particle inspection must be done by a qualified and certified technician as per the latest revision of Service Instruction No. 1285.

1. Examine the newly ground counterweight bushings using the magnetic particle inspection method to identify any grinding cracks in the finished bushing. Replace any bushings with a crack.
2. To set up the counterweight bushing location gage ST-94:
   a. Install the relieved locating pin ST-94-2 in the center hole on the set-master with the locating diameters in the vertical position as shown in Figure 4.
   b. Install the solid locating pin ST-94-3 in the outside hole that has the same center to center distance as the counterweight bushing bores. The relieved locating pin ST-94-2 can stay permanently installed in the center hole with the solid locating pin ST-94-3 moved as necessary to adapt to the counterweight under inspection.
   c. If the locating pins do not install into the newly ground bushing, the bores are not in the correct location; the bushings must be replaced and reground again. If the locating pins install correctly, do the next step.

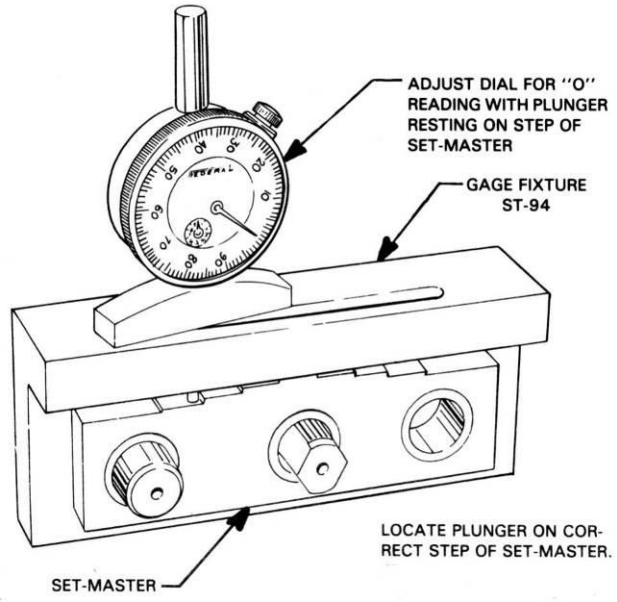


Figure 4
Depth Gage Adjusted with Set-Master Preparatory to
Checking Line Position of Counterweight Bushings

3. Use the counterweight bushing location gage ST-94 to measure the finished bushing bores on the counterweight for correct location.
4. Use the counterweight bushing location gage ST-94 to measure the distance from the center of the bushing bore to the flat edge of the counterweight.
5. Use either set-master ST-94-5 or the new set-master ST-94-10 as follows:
   a. Put the set-master over the locating pins of the counterweight bushing location gage ST-94 (Figure 4).
   b. Do a preload of the depth gage approximately 0.010 in. (0.25 mm).
   c. Set the dial gage to "0" with the plunger on the applicable step of the spacer set-master. As shown in Figure A-2, the steps are identified by Dimension A from Table 1.
   d. Remove the set-master.
   e. Install the counterweight over the locating pins.
   f. Set the depth gage through the counterweight bushing location gage ST-94 and onto the counterweight and take a measurement. Refer to Figure 5.
   g. There must not be more than a ± 0.004 in. (± 0.10 mm) difference between the depth gage measurement on the counterweight and the measurement taken with the set-master.

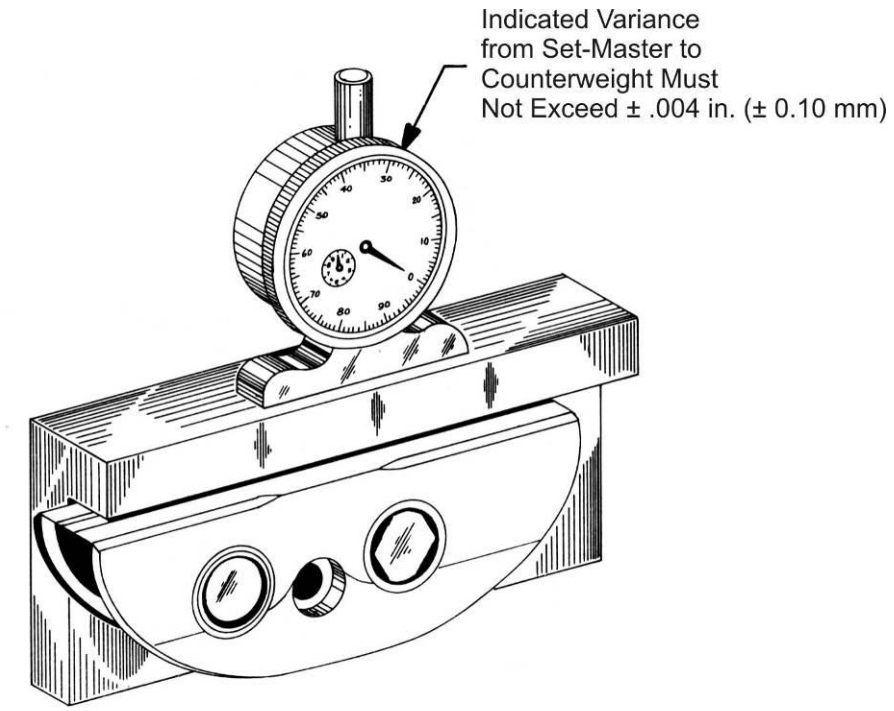


Figure 5
Checking Center Line Position of Counterweight
Using the Counterweight Bushing Location Gage ST-94

6. If erratic or excessively "out of tolerance" measurements are found:
   a. Remove the counterweight from the locating pins.
   b. Install the counterweight on the counterweight squareness gage ST-91 so that the opposite inner face of the counterweight is against the counterweight squareness gage ST-91.
   c. Only one of the inner faces of the counterweight is square with the bushing bores.
   d. Take the depth measurements again.
7. Install the correct spacer, (ST-91-7, ST-91-8, ST-91-9, ST-91-10, ST-91-11, ST-91-12, ST-91-13, ST-91-14) and the counterweight on the counterweight squareness gage ST-91. Refer to Figure A-3 and Table A-2 for spacer application.
8. Press the counterweight squarely against the spacer and tighten the knurled screw to attach the counterweight firmly against the locating surface of the counterweight squareness gage ST-91.
9. Install the gauging arbors P/N ST-91-3 through each of the finished bushings as shown in Figure 6.
10. Put the counterweight squareness gage ST-91 on a surface plate and measure both ends of each arbor as shown in Figure 6.
11. Turn the counterweight squareness gage ST-91 over on its adjacent side and again measure both ends of the gaging arbors (Figure 7).
12. The difference in measurements from one end of the gaging arbor to the other must not be more than 0.003 in. (0.076 mm) per inch (25.4 mm) in any instance.
13. Refer to the "Counterweight Balancing Procedure" in this Service Instruction.

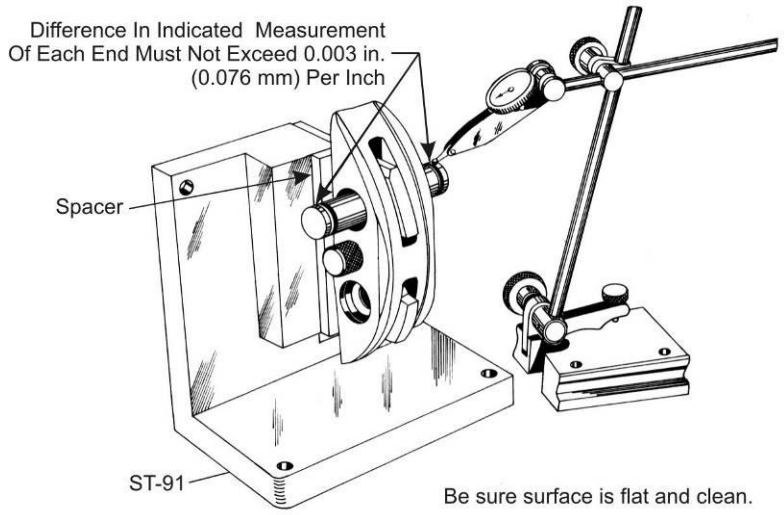


Figure 6
Checking Parallel and Squareness of Counterweight Bushings
with Counterweight Squareness Gage ST-91 – Vertical Position

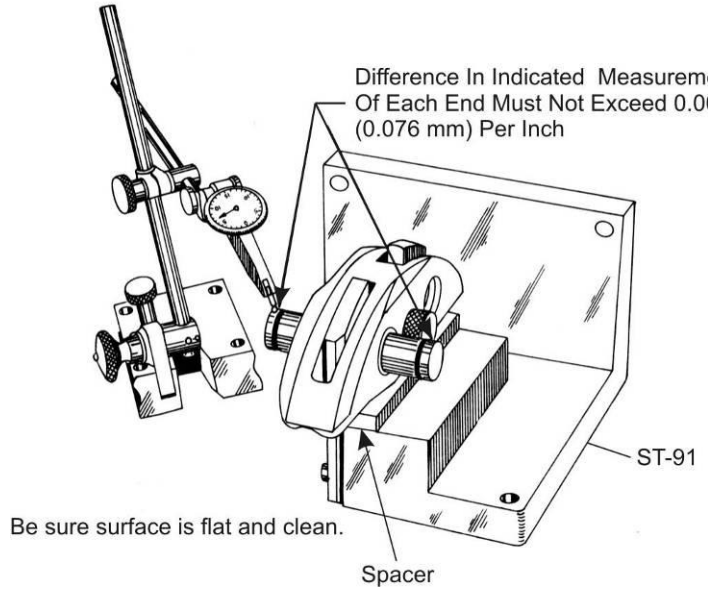


Figure 7
Checking Parallel and Squareness of Counterweight Bushings
with Counterweight Squareness Gage ST-91 - Horizontal Position

Counterweight Bushing Installation Inspection

Tools to be used include:

- Counterweight dial bore gage ST-73 (Appendix A)
- Micrometer or set ring

1. Calibrate the counterweight dial bore gage ST-73 with a micrometer or set ring.
2. Measure the diameter of each counterweight bushing using the counterweight dial bore gage ST-73. The diameter must be between 0.7485 and 0.7505 in. (19.01 and 19.06 mm).
3. The out-of-round must not be more than 0.0005 in. (0.0127 mm).

NOTE

Evidence of bushing wear includes out-of-roundness on the inside diameter.

4. If the diameter of the bushing is out-of-round, oversized, or out-of-tolerance, replace ALL of the bushings in the counterweight. Start with the "Counterweight Bushing Removal" procedure in this Service Instruction.

Counterweight Balancing Procedure

Tools and parts to be used for this procedure include:

- Counterweight balancing weight ST-95 (Appendix A)
- Counterweight balancing arbor ST-96 (Appendix A)
- Counterweight balancing arbor ST-96-1 – 3/8 in. (6.35 mm) size (Appendix A)
- Counterweight balancing arbor ST-96-2 – 1/4 in. (9.53 mm) size (Appendix A)

Installation of new counterweight bushings can inadvertently change the counterweight balance in relation to its center of gravity. The center of gravity of the counterweight is at the center of the 1/4 in. (6.35 mm) or 3/8 in. (9.53 mm) diameter drilled hole that is between the bushing bores.

You must do a check of the counterweight balance after bushings are installed on the counterweight for correct counterweight operation. To do this check:

A. Use one of two counterweight balancing arbors ST-96-1 for the 3/8 in. (6.35 mm) size or ST-96-2 for the 1/4 in. (9.53 mm) size.

B. Install the counterweight on the correct counterweight balancing arbor (ST-96-1 or ST-96-2).

C. Put the counterweight balancing arbor on a pair of balancing ways.

D. Make sure each blade of the balancing ways engages the arbor at a point not more than 1.5 in. (38.1 mm) from each end.

NOTE

The center of both of the balancing arbors (ST-96-1 and ST-96-2) has a taper as compensation for slight variations in the diameter of the hole. The first 1.5 in. (38.1 mm) of each end of the arbor is carefully ground for concentric diameters.

E. Record the position of the counterweight and refer to Table 3 to analyze the results:

TABLE 3
COUNTERWEIGHT BALANCING RESULTS

Results	Reference	Outcome
Counterweight stays in any position when it is placed on the counterweight balancing arbor	Figure 8	Counterweight is in perfect balance

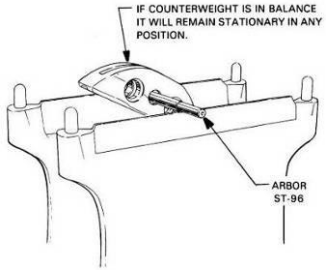


Figure 8
Counterweight Mounted on ST-96 Arbor for Balancing

TABLE 3
COUNTERWEIGHT BALANCING RESULTS

Results	Reference	Outcome
If the counterweight moves, put the center of a counterweight balancing weight ST-95 not more than 1 in. (25.4 mm) from the center of the arbor.	Figure 9	If the counterweight comes into balance with the addition of this weight, the counterweight balance is satisfactory.

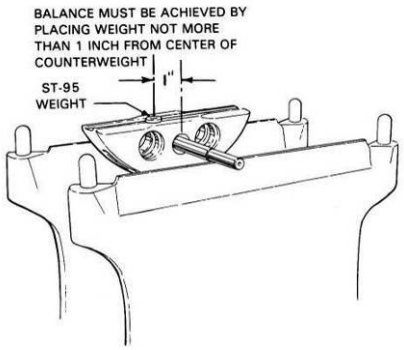


Figure 9
Counterweight Balanced by Balancing Weight ST-95
Placed Within One Inch from Center

F. If the counterweight does not become balanced with the addition of the counterweight balancing weight ST-95, carefully grind the heavy end at the locations shown in Figure 10. Do the Counterweight Balancing Procedure again.

NOTE

A weight check of the counterweight is not necessary unless the counterweight has been ground to correct an out-of balance condition. If the counterweight has been ground, it must be in compliance with the minimum weight requirements shown in Table 1. Do not install a counterweight that weighs less than the minimum weight shown in Table 1.

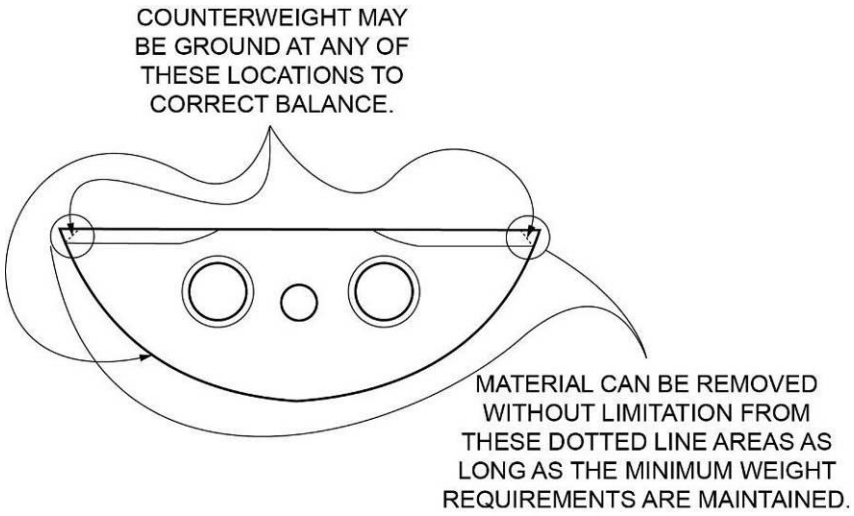


Figure 10
Location of Areas on Counterweight for Grinding

Record all procedures done to replace the counterweight bushings in the engine logbook.

APPENDIX A

Special Tools Used for Counterweight Bushing Replacement

Table A-1 shows a list of special tools used to replace counterweight bushings. Refer to the latest revision of SSP-384 for Lycoming Engines' complete special tool list.

NOTE

Tools are available for purchase or rental.

TABLE A-1
SPECIAL TOOLS FOR COUNTERWEIGHT BUSHING INSTALLATION

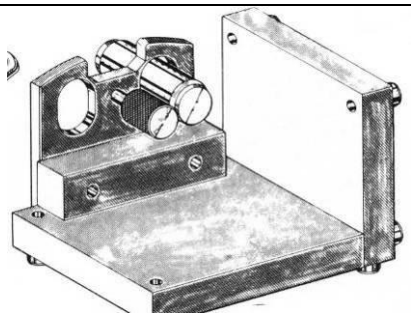
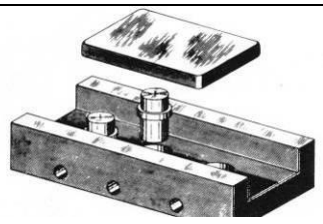
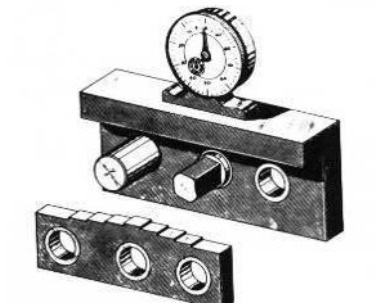
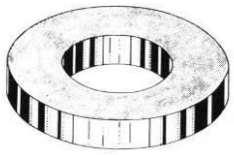
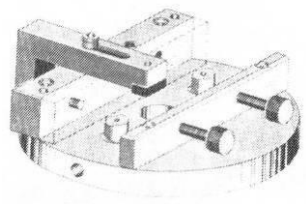
ST-73		Gage, Counterweight Dial Bore (.7485/.7505 ID of Bushings) Replace Bushings in Counterweights - All engines with counterweights that have bushings except counterweight P/N 77002
ST-91		Gage, Counterweight Squareness (Check Parallel and Squareness of Finished Inside Diameter of Bushing Hole) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-91-3		Gauging Arbors
ST-91-6		Knurled Screw
ST-91-7		Spacer
ST-91-8		Spacer
ST-91-9		Spacer
ST-91-10		Spacer
ST-91-11		Spacer
ST-91-12		Spacer
ST-91-13		Spacer
ST-91-14		Spacer
ST-92		Driver, Counterweight Bushing (Remove and Install Bushings) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-93		Fixture Assembly, Counterweight (Install Bushings in Counterweights) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-93-2		Locating Pin
ST-93-3		Spacer, Control Depth of Bushing - 0.370 in. (9.4 mm) thick (detail of ST-93)
ST-93-5		Spacer, Control Depth of Bushing - 0.440 in. (11.2 mm) thick (detail of ST-93)

TABLE A-1 SPECIAL TOOLS FOR COUNTERWEIGHT BUSHING INSTALLATION		
ST-94		Gage, Counterweight Bushing Location (Check Hole Location After Grinding) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-94-2		Pin, Relieved Locating
ST-94-3		Pin, Solid Locating
ST-94-5		Set-Master
ST-94-10		Set-Master
ST-95		Weight, Counterweight Balancing (.004 pound - Check Balance of Counterweight after Re-bushing) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-96		Arbor, Counterweight Balancing (Check Balance of Counterweights after Re-bushing) - All engines with counterweights that have bushings except Counterweight P/N 77002
ST-96-1		Arbor, Counterweight Balancing 3/8 in. (6.35 mm) size
ST-96-2		Arbor, Counterweight Balancing 1/4 in. (9.53 mm) size
64878		Fixture, Grind Bushings in Dynamic Counterweight - All engines with counterweight bushings
64878-2		Small Locating Pin
64878-6		Large Locating Pin
64878-21		Metal Block
64878-23		Locating Clamp
64878-50		Fixture Update Kit

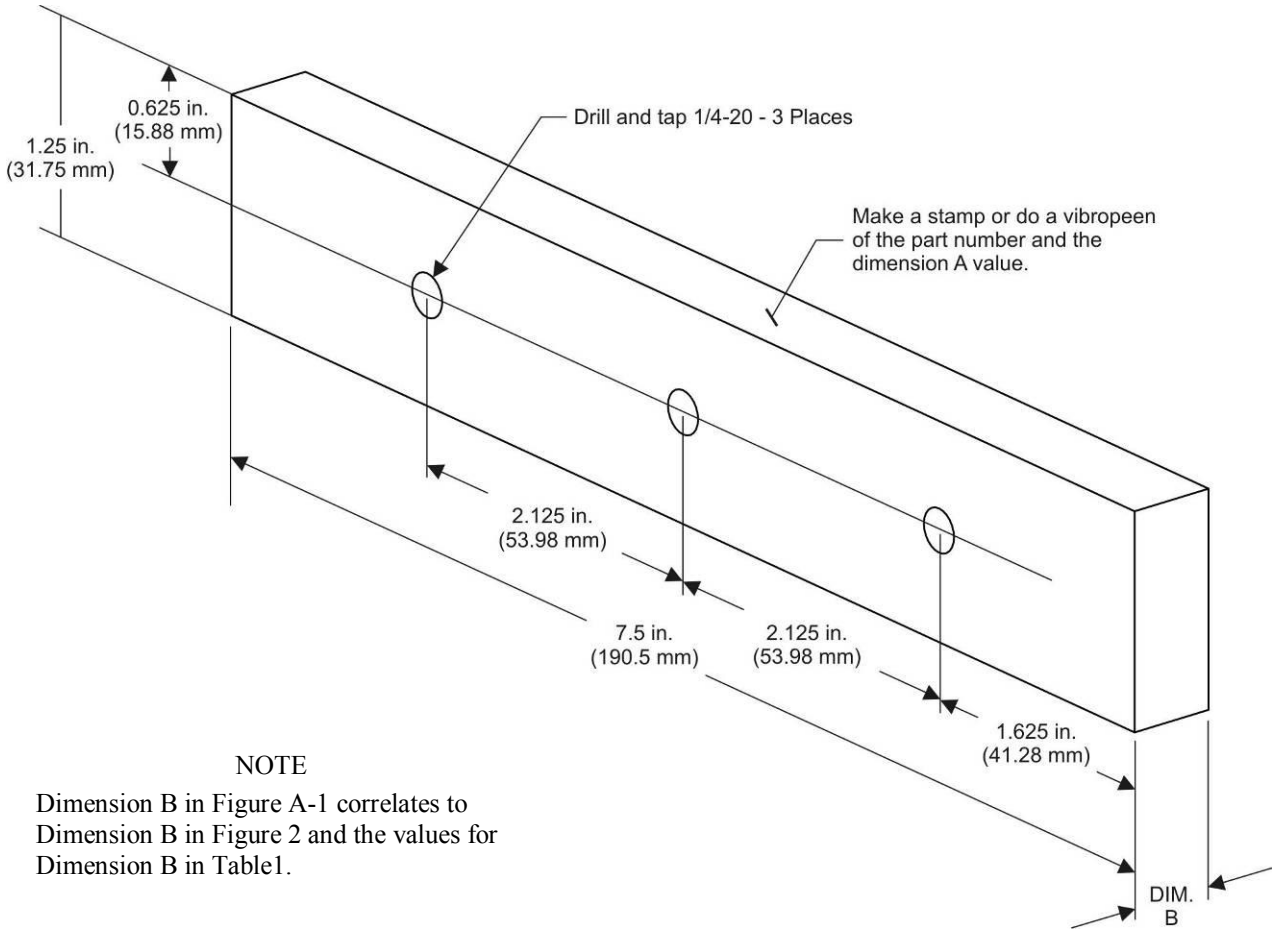
New Tool Updates and Modifications

A new fixture update kit P/N 64878-50 is available for purchase from Lycoming Engines. This kit includes special spacers for the new counterweights.

As an alternative, if you do not make a purchase of the new update kit, you can make the necessary spacers from hardened and ground steel using the dimensions shown in Figure A-1. You must make a stamp or do a vibra-peen etch of the correct part number on the surface of each spacer in such a way that will not prevent correct counterweight alignment.

NOTE

Service Letter No. L217, which had identified counterweight tooling update kits, is no longer active.



NOTE

Dimension B in Figure A-1 correlates to Dimension B in Figure 2 and the values for Dimension B in Table1.

Figure A-1
Dimensions of New Spacers for Fixture
P/N 64878

A new set-master ST-94-10 is necessary for the counterweight bushing location gage ST-94. Figure A-2 shows the finish grinding dimensions for the new set-master ST-94-10. You must make a stamp or do a vibra-peen etch of the step height dimension on each step, as shown in Figure A-2. This dimension is the distance from the centerline of the set-master to the surface of the step which can be compared to Dimension A in Table 1 of this Service Instruction. The counterweight bushing location gage ST-94 is made from oil hardened tool steel and ground to the finished dimensions.

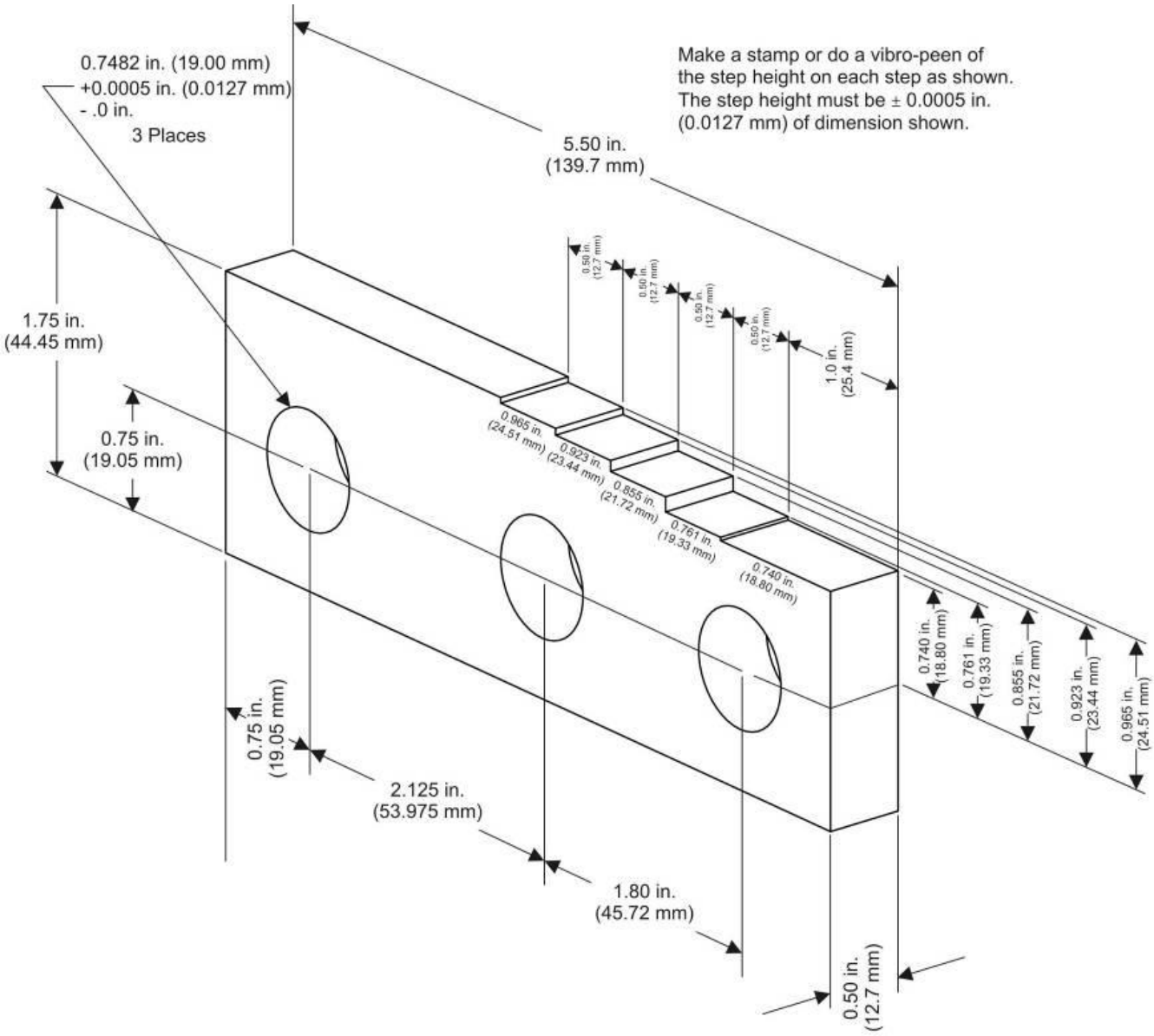


Figure A-2
Dimensions of New Set-Master P/N ST-94-10

To make sure the counterweight is correctly and squarely attached to the counterweight squareness gage ST-91, spacers have been added. These spacers are made from hardened steel and ground to finished dimensions. Refer to Figure A-3 and Table A-2 for special tool detail, part numbers, finished dimensions, and application of these spacers.

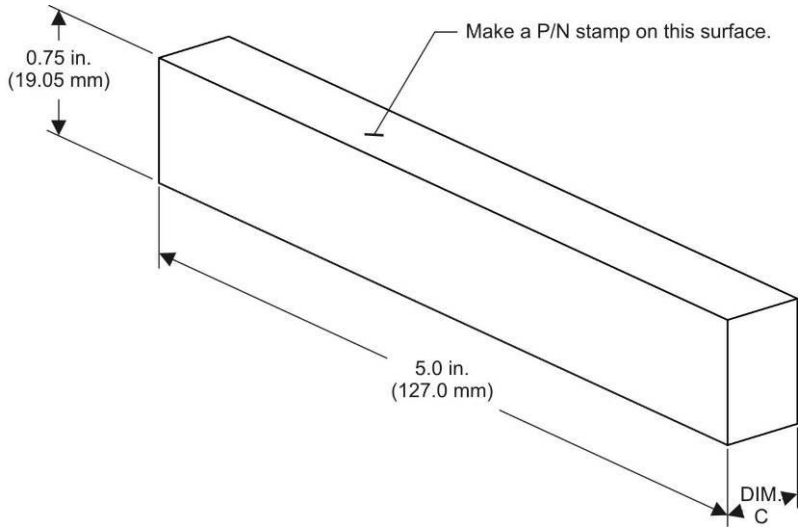


Figure A-3
Dimensions of New Spacers for
the Counterweight Squareness Gage ST-91

TABLE A-2
DIMENSIONS OF NEW SPACERS FOR ST-91 GAGE

SPACERS	DIMENSION "C" FROM FIGURE A-3		USE WITH COUNTERWEIGHT P/N
	IN.	MM	
ST-91-7	5/64	1.98	73643, 73644, 72534, 73812
ST-91-8	11/64	4.37	72801, LW-19225E, LW-19226E
ST-91-9	13/64	5.16	71904, 71905, LW-19210
ST-91-10	7/64	2.79	LW-19225D, LW-19226D, 75637, 14U22538
ST-91-11	7/32	5.56	LW-19227D
ST-91-12	9/64	3.57	LW-19211, LW-19227E, 14U22539
ST-91-13	1/32	0.79	LW-19212
ST-91-14	1/4	6.35	75636, 76044, 78988

Different tools and set-up procedures are necessary for counterweights identified with the letter "E" as a suffix to the part number.

These changes are:

1. Use spacers shown in Table 1 for Figure 2 of this Service Instruction.

   NOTE

   Use a 0.001 in. (0.025 mm) thick shim stock between the fixture P/N 64878 and the spacer P/N 64878-30 to align the counterweight P/N LW-19227E.

2. To do a check of the distance from the centerline of the bushing bore to the flat edge of the counterweight P/N LW-19227E with the fixture ST-94, use the 0.0761 in. (19.33 mm) step of the set-master ST-94-10. Refer to Figure A-2.

3. Set the preloaded dial indicator to ± 0.001 in. (0.025 mm) to compensate for the 0.001 in. (0.025 mm) difference between the counterweight measurement and the set-master.
4. Figure A-4 shows an undercut to the knurled screw ST-91-6. This undercut is necessary to allow the use of existing spacers with the revised counterweights.

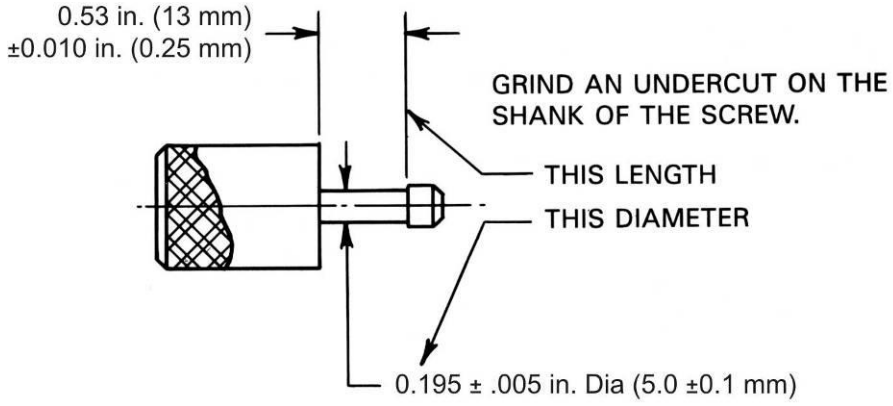


Figure A-4
Modifications to the Knurled Screw ST-91-6