

1 **Supplemental Information & Instructions for**
2 **128-225 or 3H2865 Bearing Assembly, 20 Needle Roller**
3 **and/or**
4 **461-868 or 3H2865K Layshaft Bearing Kit w/ Spacer Tube**
5 **MGA (all), MGB w/standard gearbox to engine number GB74719 (62 ~67)**

6 The 461-868 or 3H2865K Layshaft Bearing Kit



- 1a Each bearing assembly comes in the original box.
1b Each bearing assembly is wrapped in protective paper
1c Once unwrapped the assembly inside the outer shell is visible.
1d The special retaining washers with the "lip" or "flange" on the inner edge.
1e *Some, but not all* bearing assemblies come with one snap ring
1f The 20 needle bearings. Note the pins on each end – these are trapped under the lip or flange of the retaining washers (1d)
1g We include 4 snap rings with each kit; any that you get with a bearing assembly will be "extra".
1h The spacer tube, which we make on the Moss Machine Shop

31 ***We suggest you leave the bearing assembly (1c) alone until you have read the rest of***
32 ***this... the bearing assembly is a lot easier to deal with as a unit than as 20+ separate bits.***
33

34 ***About this Kit.....***

35 *The 461-868 or 3H2865K Layshaft Bearing Kit represents a return to the original design specification for*
36 *the layshaft bearings for the three-synchro gearbox fitted to the MGA and early MGB. By reintroducing the*
37 *original bearings and dropping the caged bearings sold for this application, Moss Motors has eliminated*
38 *what many have blamed for the excessive wear of the layshaft- the caged roller bearings that cut the*
39 *number of load bearing rollers in half. This kit is intended for stock engines in a street application where*
40 *your laygear does not need replacing. If you need a laygear, or if you have a modified engine and/or a*
41 *more spirited driving style, we suggest our Uprated Laygear Kit (461-571 or 22H54K). Developed by Moss*
42 *Europe, this is another Moss exclusive. Built around the stock layshaft, it comes with a new laygear fitted*
43 *with uncaged needle roller bearings that are longer than stock, effectively doubling the load bearing area*
44 *over the original MG design. It is the most durable package we offer for the early layshaft/laygear. Please*
45 *see our website www.mossmotors.com for more information on these options. For pretty much everything*
46 *but the fire-breathing race car, Moss has a solution.*
47

48 ***And everyone wants to know where we found them...***

49 *Suffice it to say we discovered a substantial quantity in a warehouse in England, and we bought them all.*
50 *The bearings are from two manufacturers. The yellow boxed bearings (shown above) are from RHP and*
51 *the blue boxed bearings (not shown) are from R&M. These bearings have not been manufactured for*
52 *many years. For us, this is the ultimate "barn find".*
53

54 **A Little History.....**

55 The MGA and early MGB three synchro gearbox share a layshaft that is 0.645”
56 in diameter, which is smaller than the later shafts. Initially, three 3H2865 layshaft
57 bearings were used, each being made up of 20 loose needle roller bearings (2b)
58 that had pins on each end. These pins were “trapped” under the lip of the
59 special washers (2a) supplied as part of the bearing assembly. Two of the three
60 bearing sets were fitted on the 4th gear end of the layshaft (toward the front),
61 leaving a single bearing set for the 1st gear end toward the rear.

62
63 As supplies of the 3H2865 loose needle bearing assembly dried up, it was
64 replaced by AAU3052, a caged needle roller bearing assembly (3a). While the
65 caged assembly greatly simplified the assembly procedure, each one only has
66 11 or 12 needles (depending on the manufacturer) compared to the 20 in the
67 original bearings. In time the caged bearings became associated with premature
68 layshaft wear. The wear is always most severe at the first gear end (toward the
69 rear) of the layshaft because it is more heavily loaded than the 4th gear end
70 (toward the front). It certainly does not help that the first gear end is supported
71 by a single bearing assembly while the 4th gear end has two.

72
73 The three layshafts in Figure 4 show a progression from almost no wear (4a) to
74 very severe wear (4c). There is a great deal of discussion on the web about this
75 problem, and there are several causes mentioned, one being the reduced load
76 bearing surface available due to the reduced number of needles in the caged
77 bearing assembly.

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79 **How can I tell if my layshaft is “going”?**

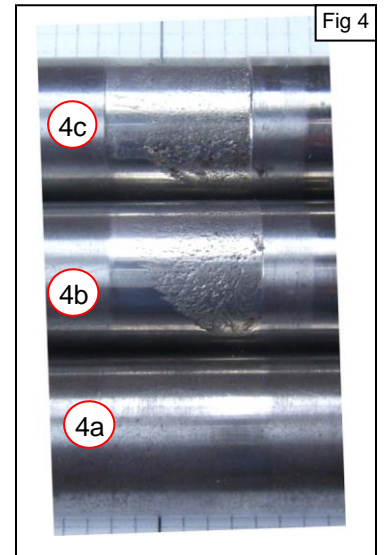
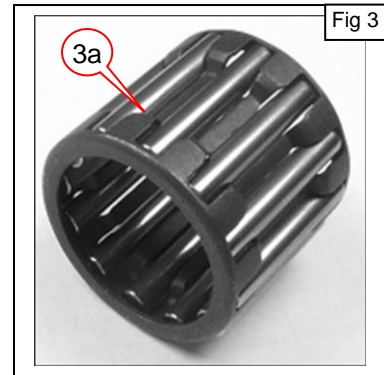
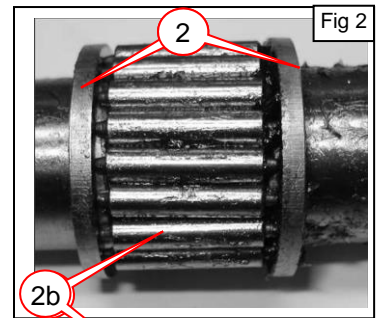
80 Anyone can tell if you need a new layshaft with the old one in hand. John
81 Esposito (Quantum Mechanics, British Gearbox specialist) explains how you can
82 get a pretty good idea about the condition of the layshaft and layshaft bearings
83 just by **listening** to the 3-synchro gearbox.

84
85 4th gear is your bench mark. It is direct drive; the laygear is not loaded or
86 involved, so 4th is very quiet.
87 In 3rd gear the laygear is engaged. If the layshaft and layshaft bearings are fine, it
88 should not be any noisier than 4th gear. If there is any increase in noise when
89 moving from 4th to 3rd, the layshaft is suspect.
90 Same thing applies to 2nd gear – the laygear is engaged. If there is any increase
91 in noise when moving from 3rd to 2nd, the layshaft/layshaft bearing problems are
92 confirmed.
93 1st gear is going to be ignored because it uses straight cut gears which are
94 inherently noisy. That noise will mask any layshaft related noise that might be
95 there.

96
97 The layshaft/layshaft bearing related noise you can hear when down shifting can also be heard when up
98 shifting. If 2nd gear is noisy, and the noise *decreases* going to 3rd, and it goes away after shifting to 4th, the
99 layshaft/layshaft bearings are the probable cause. And another good rule of thumb – when it is time to
100 change out the clutch, it is time to check the layshaft and the inside of the laygear for wear.

101
102 If you detect layshaft/layshaft bearing noise, plan on dealing with it soon. It will not be long before more
103 serious problems (like broken gear teeth) develop. You can avoid all that by taking action quickly. It is
104 much easier (and much less expensive) to replace the layshaft and bearings by themselves without
105 adding a gear or two to the bill.

106



107 **Before you install anything...**
108 *Make sure you have a transmission with the 0.645" diameter layshaft and that it can be rebuilt. Nobody*
109 *should go to the trouble of pulling a gearbox apart without a complete inspection. Plan on replacing **all***
110 *worn components – usually synchros, bearings, gaskets and seals. The factory workshop manual is*
111 *essential and Barney Gaylord's website (mgaguru.com) has a good section on disassembly and*
112 *inspection of the gearbox. Both will tell you to carefully check the gears, and we'll say pay particular*
113 *attention to the inside of the laygear where the needle roller bearings ride. If the surface inside the*
114 *laygear is worn, renewing the bearings will be a bad investment- you need a new laygear.*
115

116 **Why Not Just Tell People to Follow the Factory Workshop Manual?**

117 Section F.5 (June 1956 revision, at right) from the
118 MGA Service Manual has been inserted here for
119 your review.

120
121 It's not entirely helpful. First and foremost, neither
122 the MGA or MGB workshop manuals address the
123 pre-assembled bearing. Most likely, they were not
124 available until well after the manuals were written.

125
126 The workshop manual leaves too much to be
127 discovered the hard way. For example, it does not
128 explain how to fit the internal snap ring, It simply
129 says "...fit a circlip to the innermost groove in the
130 gear, pushing it in from the front..." That simply will
131 not work. That circlip (snap ring) will pop into the first
132 groove it crosses and getting it out is not a trivial
133 task. Given the frustration and aggravation inherent
134 in a "trial & error" process and the potential for an
135 expensive mistake or two, providing instructions
136 seemed to be an essential part of this kit.

137
138 We hope to develop these instructions further using
139 your tips and suggestions. So please – if you have
140 come up with a better way let us know so we can
141 share.

142
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144
145 Before we start, take a closer look at the bearing assembly.

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147 **6a** The thin outer shell used to hold the assembly together until it is
148 installed.

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150 **6b** One of three folded-over edges holding the bearing in.

151
152 **6c** The rolled over lip at the front securing the bearing.

153
154 **6d** One of 2 special retaining washers holding the needles in place.

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156 **6e** The thin snap ring supplied in some bearing assemblies

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158 **6f** The needle bearings.

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Section F.5

THE LAYSHAFT GEAR

The assembly sequence of the layshaft bearings is as follows: a circlip at the rear, a needle race, a single long distance tube, a circlip, a needle race, a circlip, a needle race, a circlip; two races being fitted at the front end and one at the rear.

When assembling, fit a circlip to the innermost groove in the gear, pushing it in from the front, or large gear, end.

Hold the layshaft vertically in the vice, stepped end downwards.

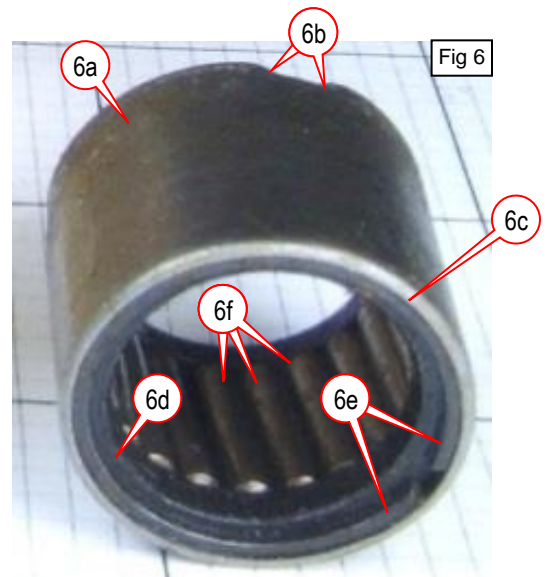
Smear the shaft with grease and assemble a roller bearing on the shaft against the vice jaws and then slide the gear cluster over the shaft and the bearing with the large gear downwards.

Remove the shaft from the vice and push the bearing into the gear against the circlip. Fit a retaining circlip and follow with the end roller bearing assembly and retaining circlip.

Slide the distance tube into the other end of the gear, followed by the other end bearing and circlip. Withdraw the shaft from the gear.

M.G. "MGA". Issue 2. 2436-6/56

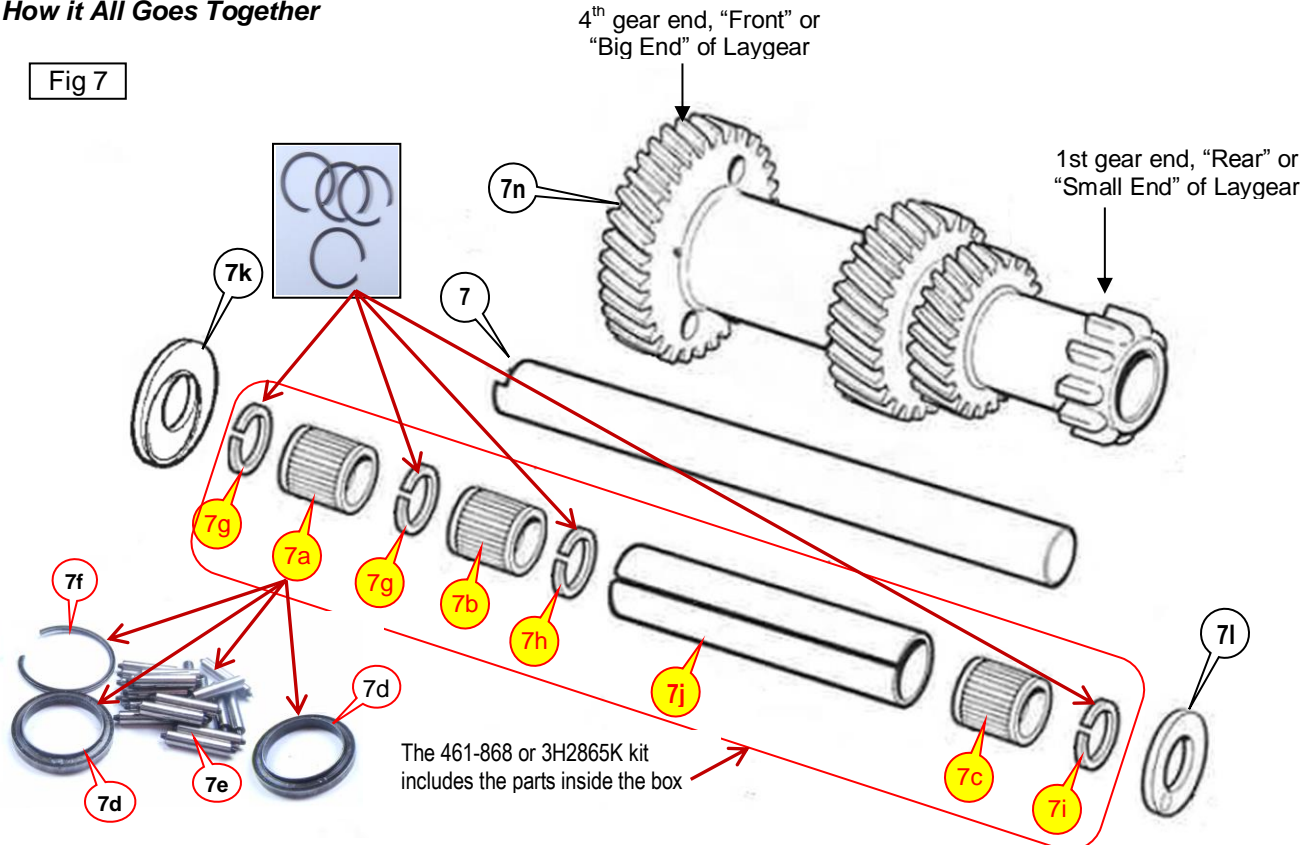
Fig 5



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How it All Goes Together

Fig 7



Ref	Moss US	Moss Europe	Description	Notes
7abc	128-225	3H2865	Bearing Assembly, as originally fitted	3 in kit
7d	NPN	NPN	Retaining washer, w/lip	2 per bearing assembly
7e	NPN	NPN	Needle Roller Bearings, loose (uncaged)	20 per bearing assembly
7f	NPN	NPN	Snap Ring (included with some bearings)	slightly smaller than 326-190
7ghi	326-190	11G3027	Circlip or Snap Ring	4 included in kit
7j	461-580	11G3026	Tube, layshaft bearing spacer	1 in kit
The following items are not included - they are illustrated & listed here for clarity.				
7k	461-590	1G3576	Thrust Washer, Front (0.154")	
7l	461-600	1G3577	Thrust washer rear, (0.155)	
	461-610	1G3578	Thrust washer rear, (0.157)	
	461-620	1G3579	Thrust washer rear, (0.158)	
	461-630	1G3580	Thrust washer rear, (0.163)	
7m	461-560	1H3305	Layshaft, 0.645" nominal diameter	
7n	461-570	22H54	Laygear, for 1H3305 layshaft (If you need a laygear, consider the 461-571 Laygear Kit)	

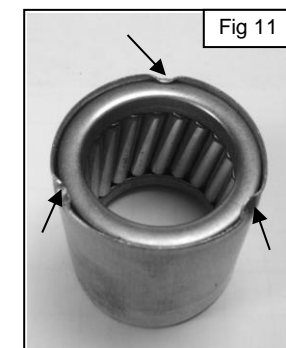
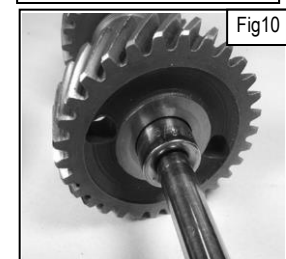
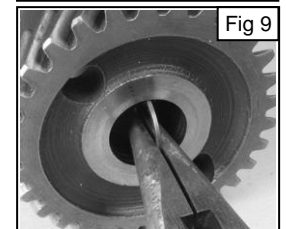
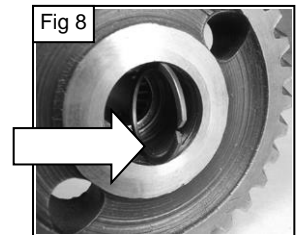
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Special Tools

Pushing the bearing assembly out of the shell and into the laygear will be facilitated by a tubular drift that will fit over the layshaft and inside the outer shell of the bearing. We suggest starting with a 6" piece of 0.875" thin wall aluminum tubing. This is a standard size and should be readily available. One end will need to be turned down to approximately 0.820" to fit inside the outer shell and make contact with the snap ring and the retainer washer at the end of the bearing assembly. The turned down section only needs to be about 1" in length (the shell is only 7/8" in length overall). We hope to supply this as part of the kit at some point in the future. All references to a "tubular drift" in the instructions are referring to this special tool.

Installation Tips (refer to Fig 7)

1. About Snap Rings. Four snap rings are needed. Some of the bearing assemblies come with a snap ring, but some don't so we include four snap rings in the kit. If you end up with an extra snap ring-great - they are handy in case one popped into the wrong groove; removing them usually damages them enough to make them unusable.
2. The first snap ring to install is (7h). Shine a light down inside the laygear from the 4th gear (big) end- you can see 3 snap ring grooves clearly. The groove for the (7h) snap ring is the 3rd groove, 1 ¼" deep inside the laygear and therefore hardest to fit.
3. Hold the snap ring (7h) it so that it is 90° to the long axis of the laygear (Fig 8) and insert it in the opening at the 4th gear end (aka the "big" or "front end") of the laygear using a pair of long needle nose pliers. Using the same pliers (Fig 9), push the snap ring straight in until it is past **both** of the outer snap ring grooves.
4. Once safely past the 2 outer grooves, rotate the snap ring (7h) back 90° so that it is in full contact with the bore of the laygear. Push the snap ring into the internal snap ring groove with the tubular drift (see **Special Tools** above), or a Craftsman 5/8" socket (0.862" OD) on a long extension (Fig 10). Note that the snap ring is not very wide - if the nose of the socket is rounded, it may not work very well. In that case, flip the socket around and use the "back" to push the snap ring. The "back of the socket is usually unaffected by wear and should make good contact with the snap ring. You can square the snap ring up in the bore by running a second socket in from the other end. When the sockets are pressed together, the snap ring will "square up" in the laygear bore. The next step will be to install the (7b) set of needle bearings in the laygear and press it against the (7h) snap ring you just fitted.
5. Pick one of the three bearing assemblies. Liberally apply grease to the bearing whilst still in its outer shell. This provides sticktion and will help keep the bearing together. Make sure all the rollers inside the outer shell are running parallel to the long axis of the assembly and not at an angle as they are in Fig 11.
6. Locate the three bent over sections of the lip shown in Fig 11. These hold the bearing assembly inside the shell.
7. Using a pair of long needle nose pliers, straighten out the bent sections completely. The outer shell material is quite thin and it is easily straightened. Make sure the lip of the outer shell will not interfere with the bearing assembly when it is pushed out of the shell. This is now **"the open end of the bearing assembly."**
8. Have laygear lying flat on the workbench - **not** on its end.
9. Insert the layshaft into the laygear from the 4th gear (big or front) end.
10. Using the layshaft as a guide, slide the **open end of the bearing assembly** (including the outer shell) onto the layshaft. Slide the bearing assembly up the shaft until the outer shell touches the laygear. The outer shell of the bearing assembly will not fit inside the laygear- it stays outside.
11. The next step is to push the bearing assembly out of the shell and into the laygear. Using the small end of the tubular drift, start pushing the bearing out of the shell and into the laygear. As soon as the snap ring (if included) in the bearing assembly clears the end of the outer shell, **stop**. The reason for stopping is that this 2nd snap ring (7g) must be pushed over the outer snap ring groove. If you simply push it in straight, it will pop into the outer groove and you will have fun trying to get it out.
12. Remove the tubular drift and extract the snap ring and set it aside.
13. Use the full-sized end of the tubular drift to push the bearing with the two retaining washers into the layshaft until the inner retaining washer comes up against the first snap ring (7h) you installed.
14. Remove the layshaft **carefully** from the laygear while you press on the tubular drift, holding the bearing assembly in position as you withdraw the layshaft. Now remove the drift. Once the bearing assembly is seated, the two special retaining washers overlap the pins on the ends of the needle bearings, making it impossible for the needles to "fall out" when the layshaft is removed. In reality, the grease on the bearings and on the layshaft would hold the needles in place without the special washers.



- 250 15. Install the (7g) snap ring and push it over the outer snap ring groove following the procedure used
- 251 in steps 3-4 above. *Once the (7g) snap ring is in the proper groove, the inner bearing is secured and you can*
- 252 *proceed to install the outer or second bearing (7a).*
- 253 16. To install bearing (7a) on the 4th gear or front end, you will be repeating steps 5 –11.
- 254 17. As soon as the snap ring (if included) in the (7a) bearing assembly clears the end of the outer
- 255 shell, stop.
- 256 18. You may use the snap ring from the assembly or, if you wish, you can replace it with one of the four
- 257 326-190 (11G3027) snap rings supplied in the kit. Insert the snap ring in the outer snap ring groove.
- 258 *This completes the installation of the two bearings and the three snap rings in the 4th gear or front end of the laygear.*
- 259 19. *Moving to the 1st gear end of the laygear, we have only a spacer tube (7j), one bearing (7c) and the outer snap ring (7i) to*
- 260 *deal with, and they are fitted in that order.*
- 261 20. Insert the spacer tube (7j) into the 1st gear end of the laygear and press it home. *It will stop when it*
- 262 *comes up against the inner most of the three snap rings (7h) installed from the 4th gear end- the first snap ring installed.*
- 263 21. Install the 3rd bearing assembly (7c), using steps 5 -11 (above) as a guide.
- 264 22. You may use the snap ring from the assembly if there was one, or, if you wish, you can replace it
- 265 with one of the four 326-190 (11G3027) supplied in the kit. Insert the snap ring (7i) in the outer snap
- 266 ring groove. *This completes the installation of the spacer tube, bearing and the snap ring in the 1st gear or rear end of*
- 267 *the laygear.*
- 268

269 **Some Final Questions, and one last Tip...**

270 The most obvious question is this: How long can I expect this bearing set to last? The answer is going to

271 depend on the state of tune of the engine and how you drive, but remember that this is the original three-bearing

272 configuration the factory used in the MGA/early MGB gearbox, and it has much greater load bearing capacity

273 than the caged needle bearings fitted as replacements for many years. Properly maintained, you can expect 50

274 to 75,000 miles with a stock MGA engine driven normally on the street.

275

276 Almost forgot the most important tip of all – how do you remove the 2 old snap rings that are down inside the

277 laygear? The outer snap rings can be levered out fairly easily. The two snap rings that trap the inner bearing

278 must be bashed with a brass drift and a hammer until the snap ring is either bent out of shape or actually

279 broken. Honest – we asked a lot of folks that rebuild these for a living. Be careful not to damage the bearing

280 surface (which is why we specify a brass drift).

281

282 ***Special thanks to John Esposito of Quantum Mechanics (john@quantumechanics.com), Barney Gaylord***

283 ***(mgaguru.com) the R&D Team at Moss Europe, particularly Michael Pratt, and David Aidnik, Product***

284 ***Development Engineer at Moss Motors, Ltd.***

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286 **Notes**

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297 *Any suggestions that you may have that will improve the information (especially detailed installation notes) are welcome. Please use*

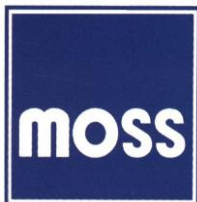
298 *the simple email form on the “**Contact Us**” page on the Moss website:<http://www.mossmotors.com/AboutMoss/ContactUs.aspx> If you*

prefer, you may call our Technical Services Department at 805-681-3411. So many people call us for help that we are often not able to

answer the calls as fast as we’d like, and you may be asked to leave a message. We respond to every call for help as quickly as we

can, which is normally within 2 business days, but when the volume of calls and emails is high, it may take longer. We apologize in

advance for the inconvenience.



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