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Send correction to carl750@sandprairie.net

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Revision History

2017-01-20	Original publication
5017-01-31	• **CORRECTED THE WIRING DIAGRAM in section 3.1** (colors were reversed!) • Added comment & picture on early Berlina toggle switch variation. • A few more Lucas motor specifications • Instruction on testing the old style auto-park contacts • Commentary about adding shim washer under 75213F style auto-park contact • Diagram showing correct orientation of new armature brushes. • Commentary about adding shims to Bundy tube to gear box connector. • Recommendation on tightening wheel box screws. • Revised instructions for installing in vehicle. • Diagrams depicting corrected wiper arm orientation for Sprint. • Added a Lucas part vendor.

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Wiper Motor Assembly

1 Wiper System

Complete details on all the various brands (AVOG, Lucas, Marelli, and S.W.F) used on 750-101 cars have been fully investigated. This document primarily covers Lucas.

2 Wiper Motor

2.1 Application by Alfa & Vendor Numbers

The following is from 750-101 parts manual and 101-1600 parts manual.

Vehicle Serial# Range	Wiper Motor		
	Alfa Part#	Vendor / Model #	Vendor Part#
Berlina & t,i.			
Not listed	Not listed	Marelli / TGE 41	T.G.E 514D
Not listed	1488.80.016	AVOG / not listed	M.8-04
Not listed	1488.80.020	S.W.F. / not listed	SWA 33050b
Not listed	1413.80.010	Marelli / TGE 63 B	70029304
Sprint & Sprint Veloce			
Three systems for different serial groups listed	1493.80.015	S.W.F. / not listed	B.S.W. 3305/a/1 (Note 1)
Not listed	1493.80.724 (Note 4)	Lucas / DR2 (Note 2)	75213 (Note 3)
101-1600 Sprint	101.12.65.052.00	Lucas / DR3A	Not listed
101-1600 Sprint	101.12.65.052.01	Lucas / DR3	Not listed
Spider & Spider Veloce			
Spider up to 1495.01088	1495.80.701 (Note 5)	Lucas / ?	?
• Spider after above • Spider Veloce from 1st car	1495.80.706 (Note 4 & 5)	Lucas / DR2 (Note 2)	75213 (Note 3)
101-1600 Spider	101.23.65.052.00	Lucas / DR3A	Not listed
SS & SZ			
• SS up to 101.20.00600 • SZ up to 101.2600100	101.20.65.052.00	Marelli / not listed	Not listed
SS after above	101.20.65.052.01	Marelli / not listed	Not listed
SZ after above	101.26.65.052.00	Marelli / not listed	Not listed

- Note 1: For Sprints the parts manual lists three S.W.F. systems, but all with the same S.W.F. motor number.
- Note 2: While DR2 is not listed in the 750&101 parts manuals, it is listed in Alfa's **Enclosure to Shop Manual Publication 854 11/1962**
- Note 3: While the Lucas part number is not listed in the 750&101 parts manuals, it is listed in **Lucas Spare Parts 1942 – 1962 Catalog**
- Note 4: The difference between 706 (Spider) and 724 (Sprint) motors have not been determined.
- Note 5: The change in the Spider serial number grouping is the section of the Bundy tube that attaches to the gearbox.

While not researched, it is interested to note that the early Berlina and t.i. are listed as using a 4-screw Bakelite toggle switch instead of the more common 2-screw Bakelite switch.

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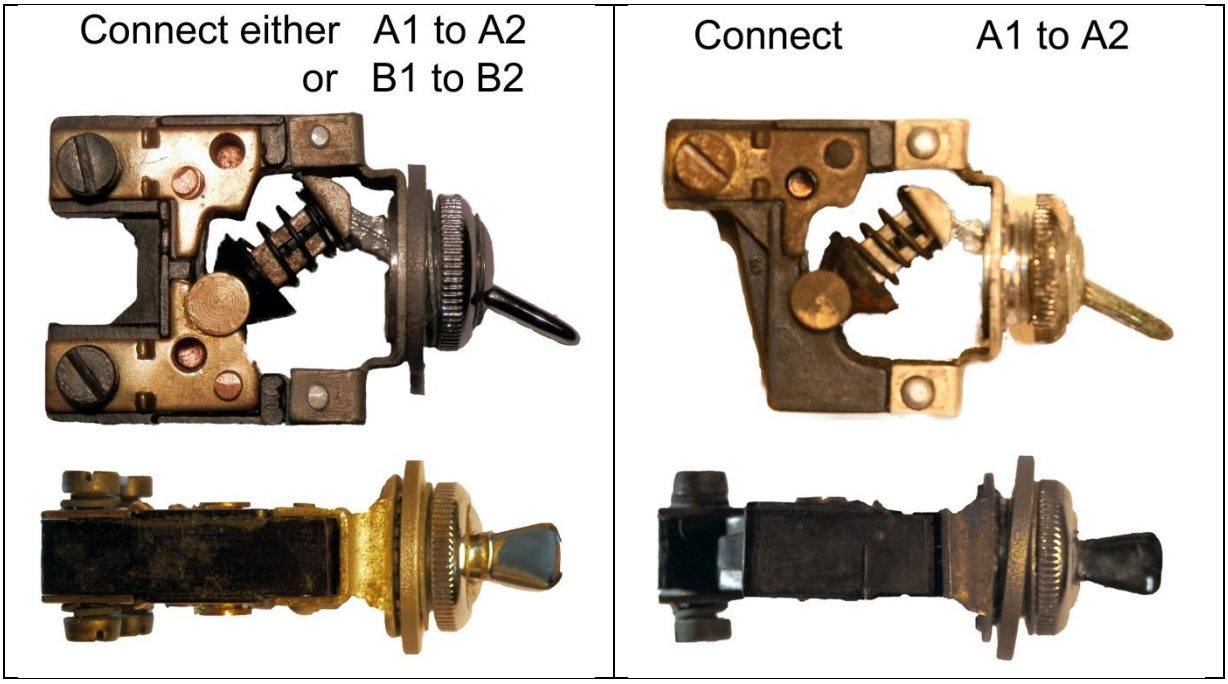
Wiper Motor Assembly



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3 Lucas Specific

Observed Lucas Examples
12 v @ 75313E DR2 258 BZ3  The order of elements that make up the full part number shown above does not reflect the order found on every example that has been examined.

Model #	Gearbox Cover #	Gearbox Housing #	From
DR2	75213**E** DR2 258 BZ3	None No "PATENT" wording	1958/August, 750E Transition Sprint Veloce 1493.06920
DR2	75213**F** DR2 659 BZ4	BS1004A FR2 PATENTED	1959/mid-year, 101 Sprint Normale 1493.20716
DR2	25123**F** DR2 1260 BZ3	BS1004A FR.2 A PATENTED	1959/November, 101 Sprint Normale 1493.21091
DR3A	DR3A 4 65 75504A	Unknown	1965 Spider Veloce, as reported by AlfaBB member

3.1 Date Code

The following has been stated by others, but it has not been verified.

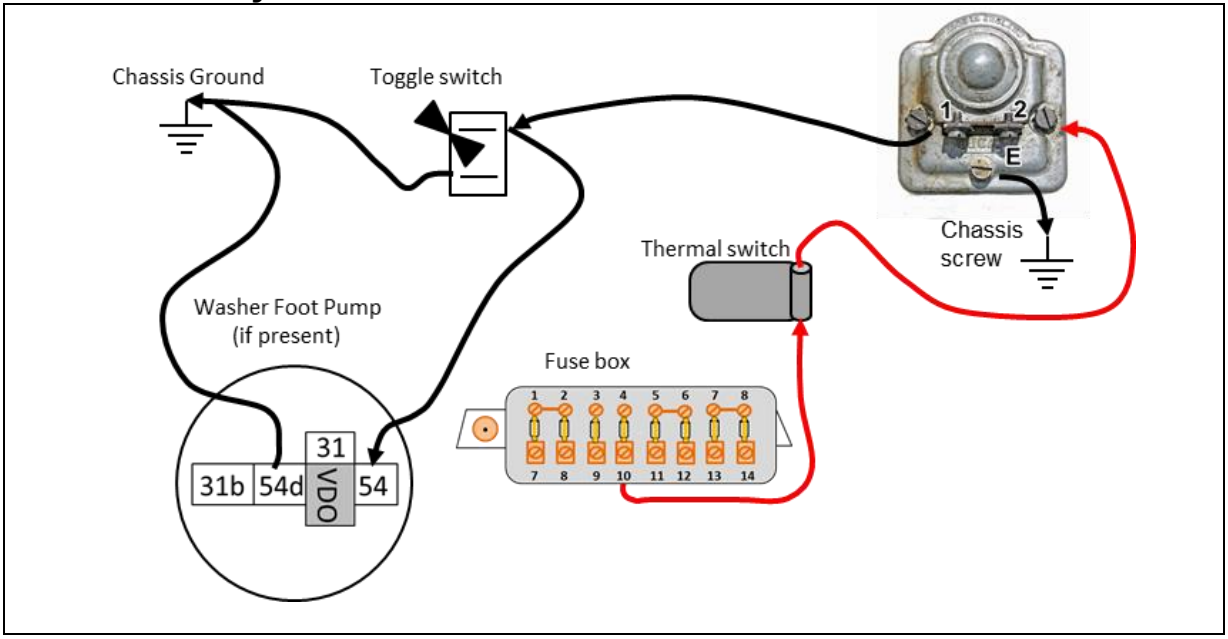
- For a gearbox stamp like "75213E DR2 258 BZ3", the "258" means it was manufactured the 2nd week of 1958.

3.2 Housing Color

The following is based on observation of a few samples.

	Example			
Lucas Model #	Embossed on Gearbox	From	Color	Finish
DR2	75213**E** DR2 258 BZ3	1958/August, Transition Sprint Veloce 1493.06920	Dark gray	Hammered
DR2	75213**F** DR2 659 BZ4	1959/mid-year, 101 Sprint Normale 1493.20716	Dark gray	Hammered
DR2	25123**F** DR2 1260 BZ3	1961, 101 Spider Normale 1493.21091	Dark gray	Hammered

3.3 How the DR2 System Works



- Pin "E" always has "ground" available, but it is only used for the auto-park feature.
- Pin "2" always has +12 volts available
  - Pin "2" can lose the +12 volts if the inline thermal switch is trigger by an overload, such as when the wipers are used on a dry windshield.
- Pin "1" :
  - It provides "ground" when the toggle switch is turned "ON", which completes the circuit causing the motor to run continuously.
  - It loses "ground" when the toggle switch is turned "OFF", but there is a second temporary "ground" provided though the "auto-park switch" connection to Pin "E". How long the motor continues to run is determined by the time it takes for the auto-park mechanism to complete a cycle (more details on next page).

(Sprint only) If the foot pump/switch is stepped on:

- Pin "54d" provides "ground" to Pin 54, which in effect bypasses the Toggle Switch and provides "ground" to Pin "1" causing the motor to run as long as the foot pump is held down.

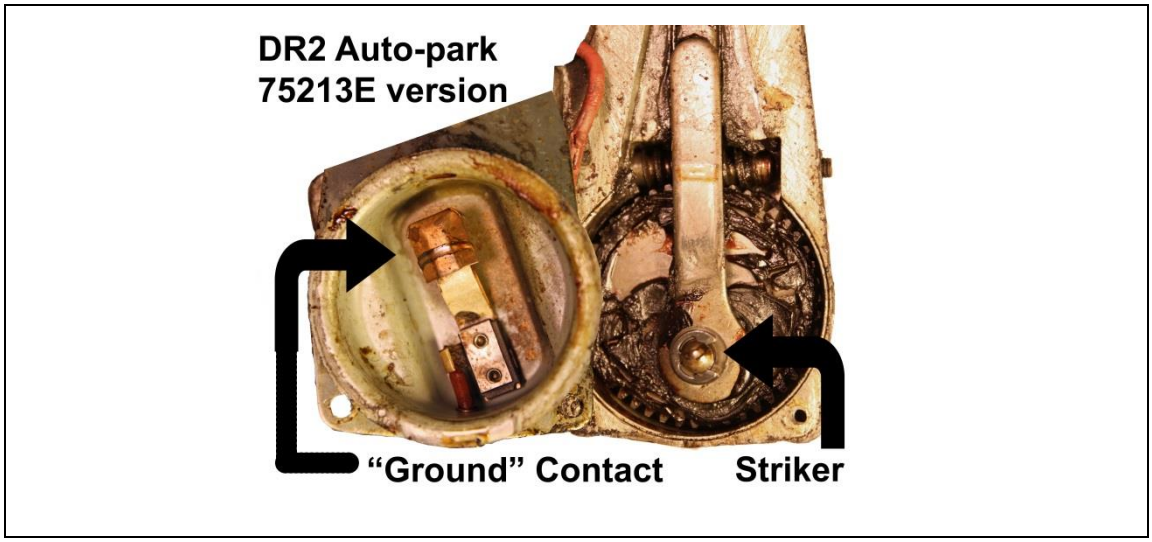
3.4 DR2 Model Variations

There were running changes in the DR2 motors. For example the "auto-park adjustment mechanism" changed.

DR2 - Early	DR2 - Late
75213E DR2 	75213F DR2 

Wiper Motor Assembly

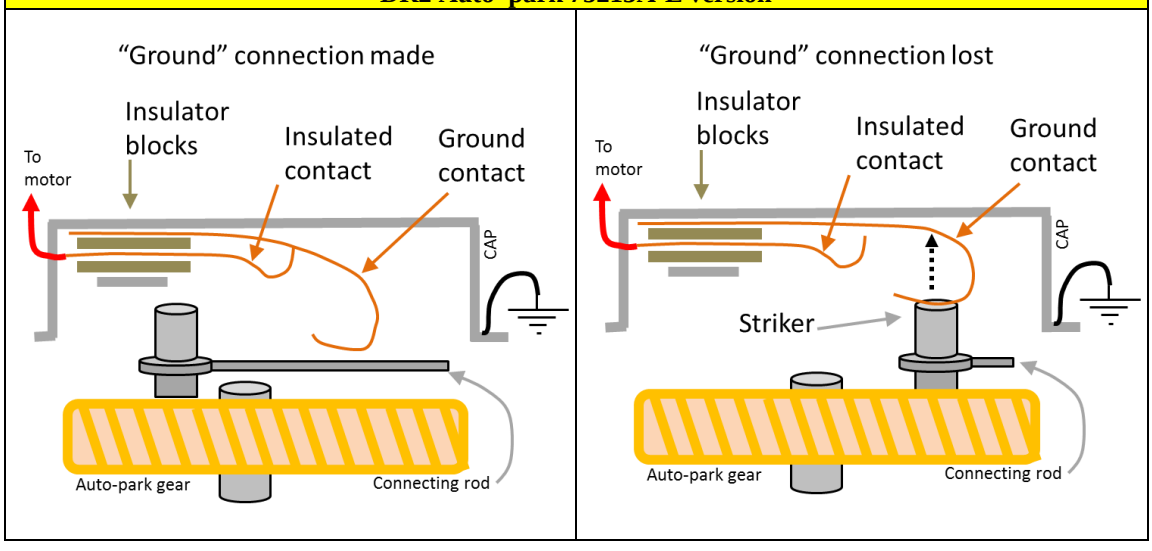
3.4.1 DR2 – 75213A/E vs. 75213F



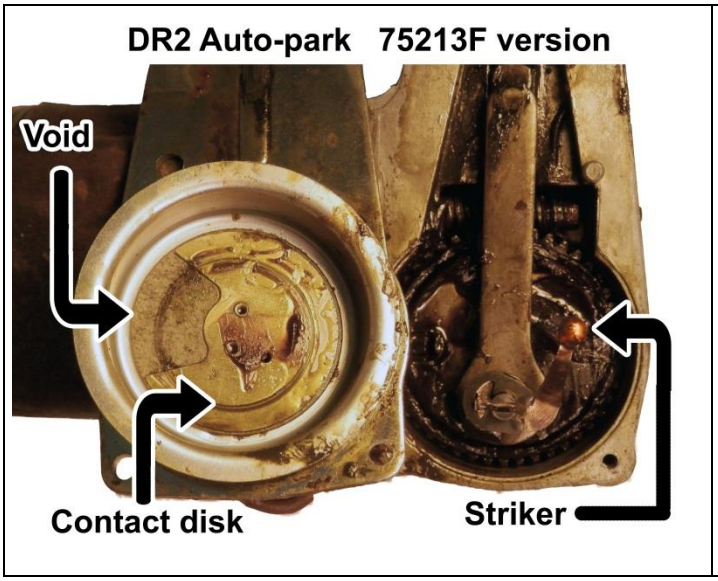
How it works:

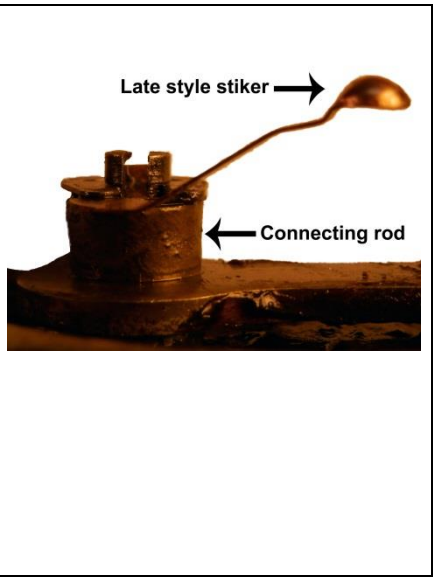
- Remember
  - The motor always has +12 volts
  - To complete the circuit it needs a "ground" which it receives from either the dash toggle switch when in the "ON" position, or from the auto-park switch for a brief period.
- After the dash toggle switch is turned "OFF" the motor loses that source of "ground", but as long as the auto-park's two contacts touch the motor continues to receive a "ground" through that switch.
- Using the following pictures as a guide, you can see that until the "striker" on the shaft of the gear lifts the upper contact away from the lower contact a "ground" is passed to the motor.
- But once the still rotating gear bringing the "striker" to where it can lift the upper contact away from the lower contact, that ground connection is broken and the motor stops.
- The position of the "ground contact" determines the "park position" of the wipers.
- When the dash toggle switch "ON", the striker opens and closes the contact switch with each revolution of the gear (sweep of the wipers) but this doesn't matter until the toggle switch is "OFF".

DR2 Auto–park 75213A-E version



Wiper Motor Assembly

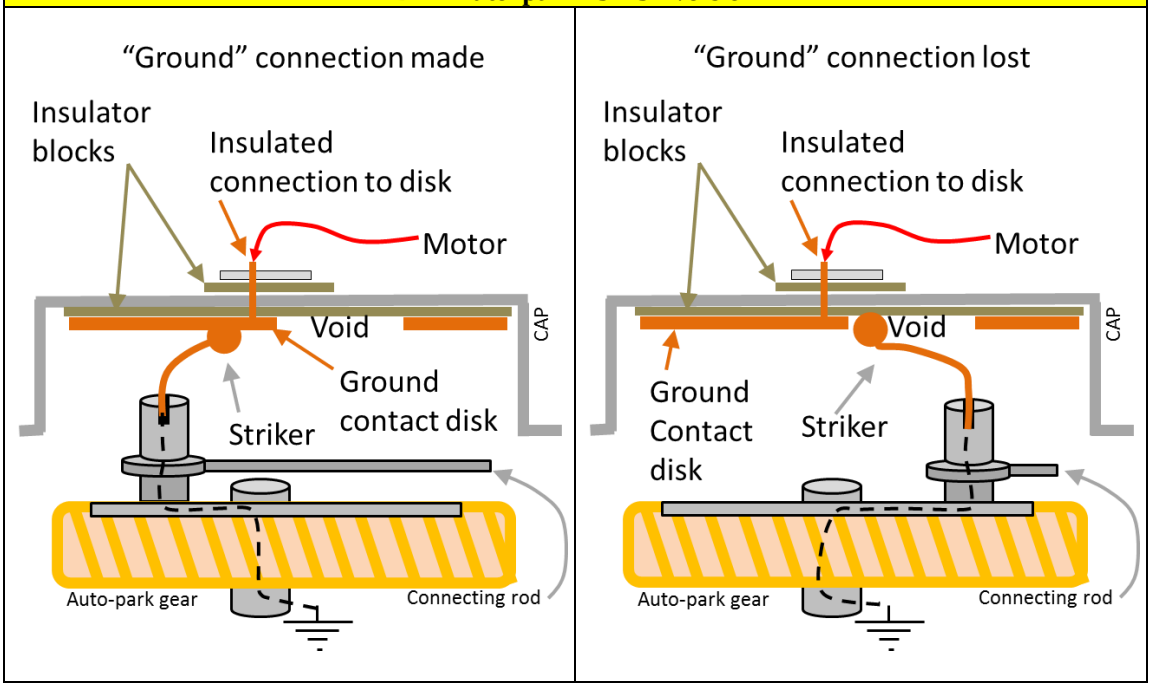




How it works:

- Remember
  - The motor always has +12 volts
  - To complete the circuit it needs a "ground" which it receives from either the dash toggle switch when in the "ON" position, or from the auto-park switch for a brief period.
- After the dash toggle switch is turned "OFF" the motor loses that source of "ground", but as long as the auto-park mechanism supplies a ground the motor continues run.
- Using the following pictures as a guide, you can see that as long as the "striker" on the shaft of the gear touches the "ground contact disk" a "ground" is passed to the motor.
- But once the still rotating gear bringing the "striker" into the "void" (in contact with insulation block), that ground connection is broken and the motor stops.
- The position of the "void" in the "ground contact disk" determines the "park position" of the wipers.
- When the dash toggle switch "ON", the striker passes over the void with each revolution of the gear (sweep of the wipers) but this doesn't matter until the toggle switch is "OFF".

DR2 Auto–park 75213F version



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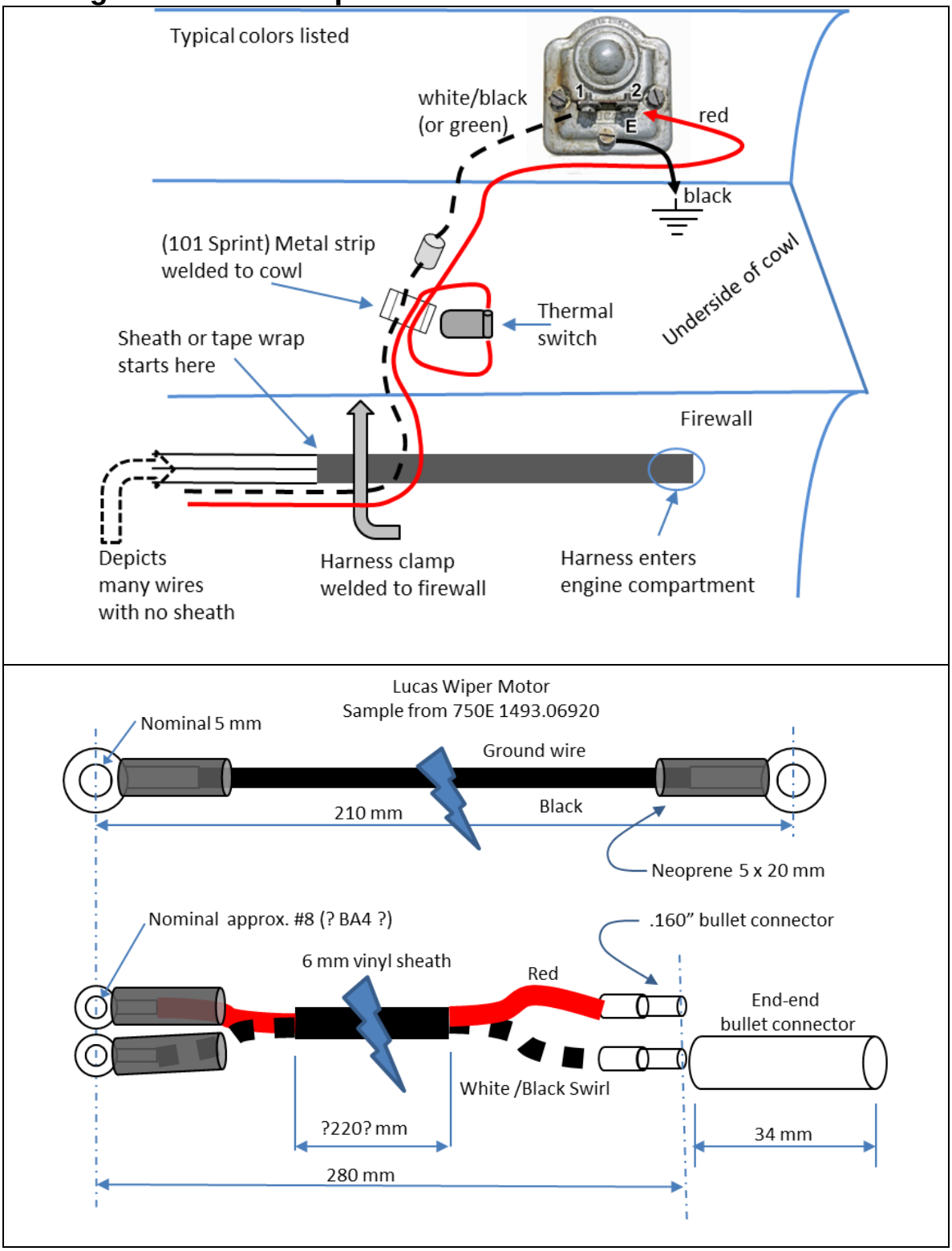
Wiper Motor Assembly

3.1 Wiring Harness Description & Colors



Where is the other end of the ground wire attached: Observations:

- 750 Transition Sprint –
- 101 Sprint – to screw in the same support where the wiper motor is bolted.
- 750 Spider – heater mounting stud.

Wiper Motor Assembly

3.2 Specifications

The following data is from a Lucas factory publication.

Lucas Technical Service / Section 8				
Model	**Light Running (wet windshield)**	**Running without Arms & Blades**	**Sweep Rate**	**Armature End Float**
	Amps			
DR2	2.5 – 3.0	2.3 – 2.9	12-17 inches in 10 seconds	.008-.012”
DR3	Not covered			
DR3A	Not covered			

The following data was found on the Internet in 2016, but ultimate source is not known.

Servicing Lucas Windshield Wipers							
Model	**Version**	**Light Running (method not listed)**	**Stall Current**	**Field Current**	**Field Resistance Each Coil**	**Armature Resistance Between Segments**	**Armature End Float**
		Amps			**Ohms at 60^0 F**		**Inches**
DR2	27 S.W.G. wire (.0182”)	2.7-3.4	Cold 13-15 Hot 7-9	0.9	12.8 - 14	.29-.35	.008-.012”
	After above			1.4	8-9.5		
DR3		Std. speed 2.7-3.4 High speed 2.0-2.6	As above	As above	As above	As above	As above
DR3A		Not covered					

Observed examples:

Observations							
Model	**Version**	**Light Running (installed, no arms)**	**Field Current**	**Field Resistance Each Coil**	**Armature Resistance Between Segments**	**Armature End Float**	**Sweep Rate**
		Amps		**Ohms at 60^0 F**		**Inches**	
DR2	E	3.0					

3.3 In Vehicle Testing

3.3.1 Voltage

To check condition of wiring harness measure voltage at the motor terminals, the voltage should be very close to the same as the battery voltage.

3.3.2 Light Running Current

- Remove wiper arms and blades
- Insert an amp meter between the +12v motor lead wire and the motor.
- Compare to specification.
  The following is from **Lucas Technical Service / Section 8** with additions from **Austin-Healey 100-six Shop Manual**.
  - If higher amperage reading than specified, investigate in this order:
    - Binding of wheel box spindels or gears
    - Binding of rack cable inside Bundy tube
    - Binding of motor armature in bearings or armature screw-shaft against crankshaft gear

- Carbon short-circuiting adjacent segments of commutator
- If lower amperage reading than specified
  - The brushes are probably worn out
  - The brush tension spring is weak
  - The brush holder is lacking free rotational movement.

The following was provided by others has not been personally verified.

Excessive current load can be caused by

- bad wiper motor rubber mounts
- excessive wiper arm pressure onto the windshield

3.3.3 Stall Current

Suggest against trying this test.

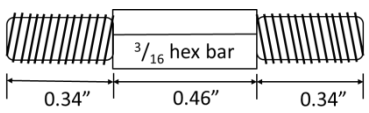
3.4 Remove Entire Assembly from Vehicle

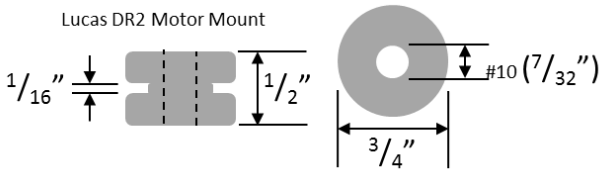
CAUTION: Don't bend the Bundy tubes!

HINTS:

- Remove wiper arms.
- Remove wiper arm spindle (wheel box) nuts and associated pieces.
- **KEY ITEM**: Release the nut holding the Bundy Tube to the motor unit and remove the screws from the wheel box nearest the motor.
- Remove mounting bolts from motor.
- This allows the whole assembly to be removed without bending the Bundy Tube (which bends easily!).

3.4.1 Hardware





Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Fix unit to chassis	Special	3	See above			CAD	
	Washer	6	#10	N/A	¾" OD	CAD	
	Nut	6	#10	32	N/A	CAD	11/32" wrench
Motor silent block	Grommet	3	See above diagram			Rubber	Approximately Durometer 60

3.4.2 Evaluation - Motor Mount

- Verify rubber mounts have not deteriorated.
  The motor is designed to move slightly on the three rubber mounting bushings.

3.5 Bearing Materials

- The Lucas gearbox's gear shaft bearing (bush) is bronze.
- Early DR2 have sintered bronze armature bearings, while late DR2 have white metal (Babbitt) bearings.
- The wheel box spindles are lined with either brass or white metal.

3.6 Bearing Clearance Recommendations

Lucas specifications have not been found, but there are many rules of thumb.

- Low speed motors can operate with more clearance than high speed motors.
- Longer bearings require more clearance.
  A Lucas gearbox's gear shaft bearing is 1.34", which would be considered long.
- Vertical sleeve bearings require less clearance (our wipers sit at an angle).
- 0.002" per inch of diameter (go back and read rule #1 & #2)
  A Lucas gearbox's gear shaft is 0.4056"; thus ~ 0.001" (but applying rule #1 & #2: maybe 0.002")

3.7 Lubricant Recommendations

During reassembly there are multiple items to lubricate:

- armature bearings
- gearbox gear's nylon teeth and steel shaft
- rack cable
- wheel box gears and shaft
- wheel box shaft weather seals.

Two important parts of the system that must be considered in selecting the lubricant(s) is the nylon gear and the Bundy tube.

First what is a Bundy tube? It is a thin wall steel tube lined with copper. The copper lining is the key to what grease to use for lubrication. The recommended type is NGLI grade GL1 grease, which will not negatively impact the copper lining as would any grease with EP additives. All the more common GL2 grease (wheel bearing) will have EP additives

.

Example of NGLI grade GL1 grease:

- Mobil Mobilux EP1 General Purpose Grease, lithium based, light brown color.
- Mobil Mobilux EP111 Gear & Chain Grease, lithium based, black color
- EP1 is a little "softer" and a little more "sticky" than EP111
- If they do not have EP additives why are they call it EP1 and EP111? It was probably marketing department decision without review by the engineering department.
- Both Mobil products can be purchased from McMaster-Carr on-line.

The sample of grease taken from a Lucas motor's nylon gear was very similar to Mobil EP111. There wasn't enough on the rack cable to obtain a decent sample.

Item	Recommendation
Armature bearings	Presoak in "electrical motor oil"
Gearbox's gear shaft bearing	Presoak in "electrical motor oil", if fairly loose clearance might add a thin film of Mobile Mobilux EP111
Gearbox's nylon gear teeth	Mobil Mobilux EP111
Rack cable	Mobil Mobilux EP1
Wheel box gear and shaft	Mobil Mobilux EP1
Wheel box spindle weather seal	Mix 30% Wintergreen oil with 70% Xylene to create a rubber softener. Wipe on and leave for an hour and then rinse with water. Then spray with a preservative like Lexol's Vinylex. (Note 1)

- Note 1: The **Austin-Healey 100-six Shop Manual** says to lubricate "the rubber grommet around the wheel-box spindle" with a few drops of glycerin. Probably what other literature call the "weather seal". It has been reported that the bad side of glycerin is its tendency to attract dirt.

Wiper Motor Assembly

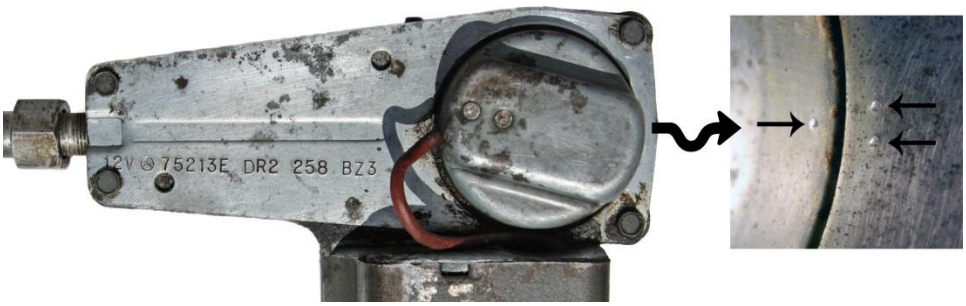
CAUTION: Don't lose any of the screws, because some are obsolete "British Association" BA size.

3.8 Gearbox

3.8.1 Disassembly

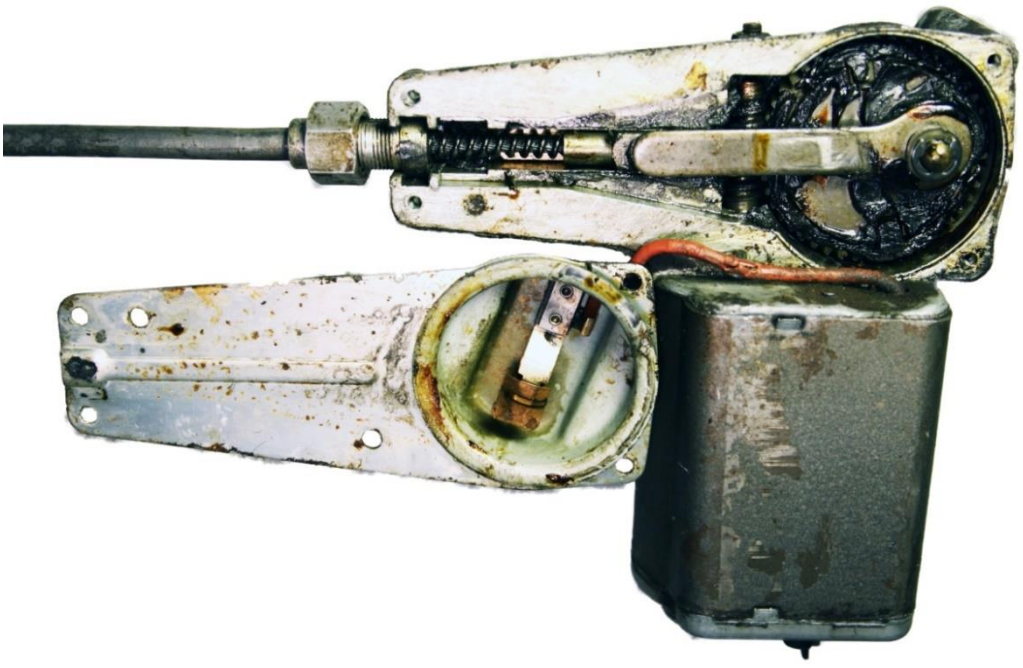
- **Caution:** before you remove the "wiper motor gearbox cover", mark the position of the "auto-park cover" (the 3" round cover) in relation to the gearbox cover. Otherwise the auto-parking position will be lost.

Auto-park Cap



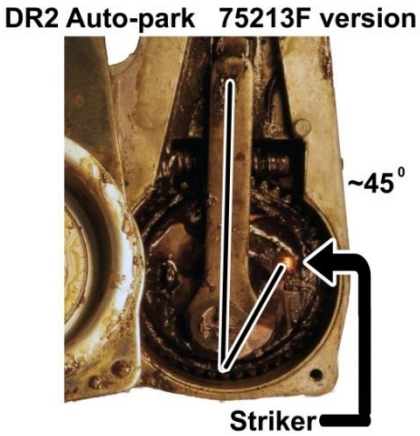
HINT: A punch mark will survive later cleaning of the pieces better than paint marks.

- The auto-parking mechanism's wire is connected directly to the motor without any removable connections.

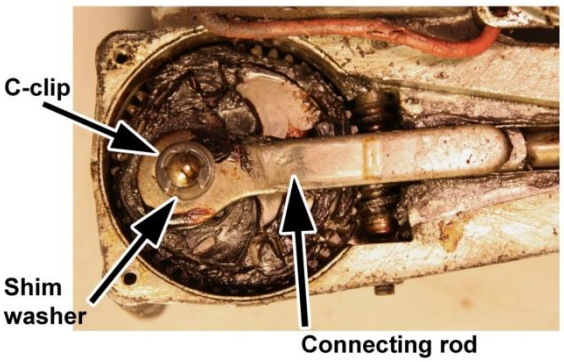


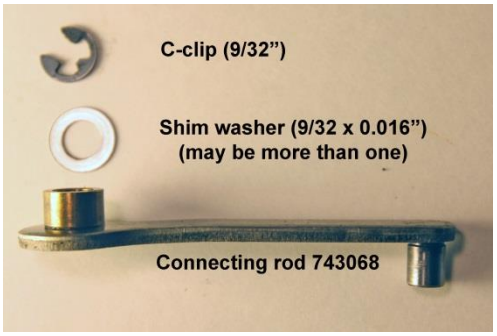
Wiper Motor Assembly

- **CAUTION**: if rebuilding a late DR2 (75213F or later) record the position of the auto-park contact before completing the next steps.

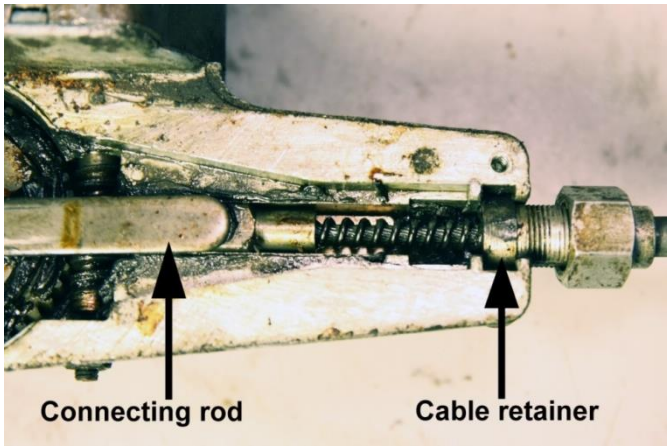


- **HINT**: Add a punch mark to top of rack cable eyelet, so it can be reverse on reinstallation to present an unworn surface to the wheel box gears on reinstallation.
- Remove C-clip
- If rebuilding a late DR2 (75213F or later) lift off the auto-park contact.
- Remove shim washer
  CAUSTION: there may be more than one
- Lift connecting rod straight up to disconnect from both the gear and the cable.





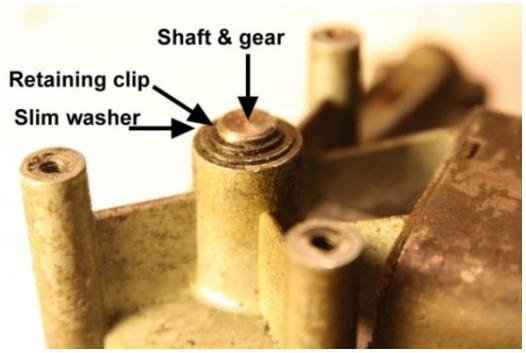
- Lift the rack cable retainer and the rack cable out of the gearbox housing.

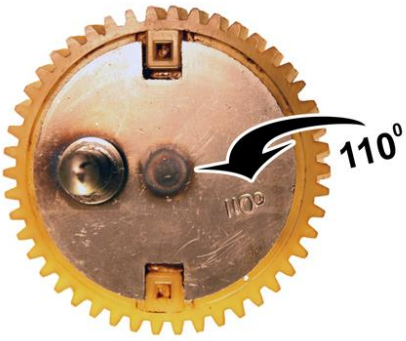


Wiper Motor Assembly

- Remove retaining clip (on exterior side of gearbox).
  CAUSTION: The clip should be tightly held, so use 2 screw drivers and somebody with their finger on the clip (or a magnet) so you don't lose it when it comes off suddenly.
- Remove the shim washer
- Lift off the shaft and gear assembly

External Shaft of Connecting Rod

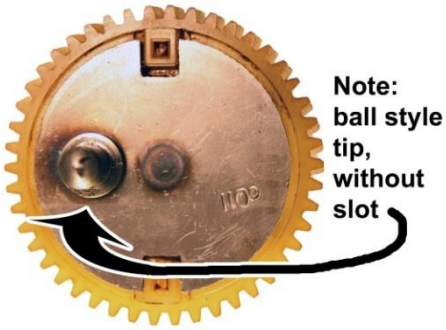




The nylon gear mounted on a steel shaft is stamped with the sweep angle of the blade.

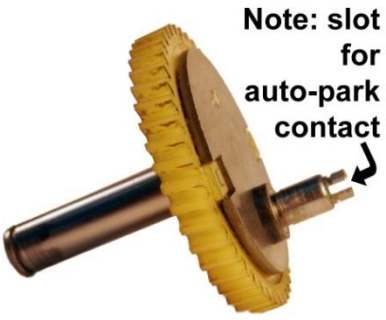
DR2 Early Auto-park Version (Probably 744536)

DR2 75213E style gear



DR2 Later Auto-park Version (Probably 744742)

DR2 75213F style gear



3.8.2 Cleaning

- Clean out all the old grease.
- **CAUTION**: When cleaning the armature bearings, be aware that the later version of DR2 has a felt oil retainers around the self-centering bearings. Unless the felt is badly contaminated, leave it alone. If a cleaner is used, be sure the felt is purged of any cleaning fluid and thoroughly dried.

Wiper Motor Assembly

3.8.3 Evaluation

- Examine connecting rod's brass bushing for scoring or excessive wear.
- Examine connecting rod's rack cable pin for scoring.
- Examine teeth of gear for damage.
- Examine gear's shaft for scoring.
- Examine porous bronze bearing for scoring or excessive wear.

Replacement preferred, but if not available the above damage this close to end is probably useable in this very low speed motor. The "rust groove" should be polished so it doesn't cause additional damage to bearing surface.

The example in the above photographs had more wear than other rebuilds, but clearances were still remarkable good. The shaft had a taper of 0.4056" to 0.4052", with an approximate bearing clearance of less than 0.001" (as best I can measure with available tools).

3.8.4 Repair

- If a bronze bearing is damaged it must be replace and sized to match gear shaft.
- For gear box with later type auto-park contact only:
  - Consider adding a shim washer, of appropriate thickness between the C-clip and the removable auto-park contact to eliminate wobble in contact point. Do not make the shim so thick that it restricts free turning of the gear's shaft.

Shim size is 6 x 12 mm of various thicknesses.

In one example, a 0.5 mm thick shim was added.

3.8.5 Reassembly

Delay until ready to reinstall rack cable.

3.8.6 Adjustment

Not applicable.

Wiper Motor Assembly

3.8.7 Hardware List

Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Fix cover to gearbox body	Screw – tapping	4	#6	N/A	0.38”	CAD	Hex head
Gear shaft– Interior side	E-clip	1	$^{9}/_{32}$”	N/A	N/A	N/A	Hardened
	Washer – Shim	(Note 1)	$^{9}/_{32}$ x 0.016”	N/A	N/A	N/A	
Gear shaft– Exterior side	C-clip	1	$^{23}/_{64}$”	N/A	N/A	N/A	Hardened
	Washer – Shim	1	$^{13}/_{32}$ x 0.031”	N/A	N/A	N/A	
Motor End-float adjuster	Set screw	1	#10	32 tpi	½”	Brass	
	Nut	1	#10	32 tpi	N/A	CAD	

- Note 1: always one, but may be more.

Originally provided by Carl R. Davis
Send correction to carl750@sandprairie.net

3.9 Auto-park Mechanism

3.9.1 Disassembly

There is nothing to disassemble in the switch itself.

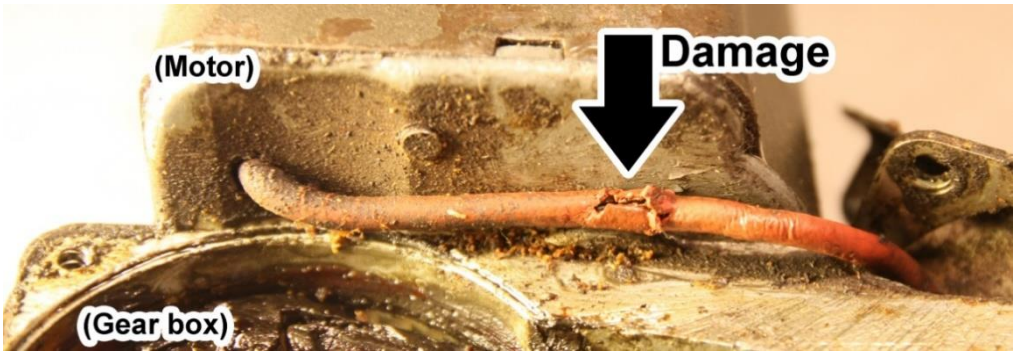
3.9.2 Cleaning

- There shouldn't be any grease on the contacts, but there probably is. Clean it out.
- Clean switch contacts with "electrical contact cleaner". Unlike what is probably found at disassembly, there should be no grease on the contacts, contact disks, or strikers.
- For the later style (75213F), thoroughly clean where the lead wire's insulating block edges where they come in contact with the metal cover. Otherwise, dirt will cause partial conductivity.

3.9.3 Evaluation

- For the early style (75213A-E) verify:
  - Both contacts inside the cover are clean and corrosion free.
  - Use an ohm meter to verify:
    - Both contact in their natural position that there is conductivity between the lead wire attachment point and the auto-park cover.
    - Push the contact the "stricker" hits away from the other contact while verifing there is then no conductivity between the lead wire attachement point and the auto-park cover.
- For the later style (75213F) use an ohm meter to verify:
  - The lead wire's insulation block shows no conductivity with the auto-park cover.
  - The ground contact disk (inside cover) shows no conductivity with the auto-park cover.
  - The lead wire and the ground contact disk have no reistance (~ 0 ohms).

Caution / Hint: always replace the "auto-park lead wire". In three rebuilds, all three had deteriorated insulation on these 50 year old wires.



3.9.4 Repair

The only option is part replacement.

3.9.5 Reassemble

Delay reassembly if the motor must be worked on.

3.9.6 Adjustment

See **Auto-park Adjustment** section later in this document.

3.9.7 Hardware List

Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Auto-park electrical lead wire	Insulated wire – fine strand	1	20 gauge	N/A	(Note 1)	Red (reddish-brown)	High temp insulation

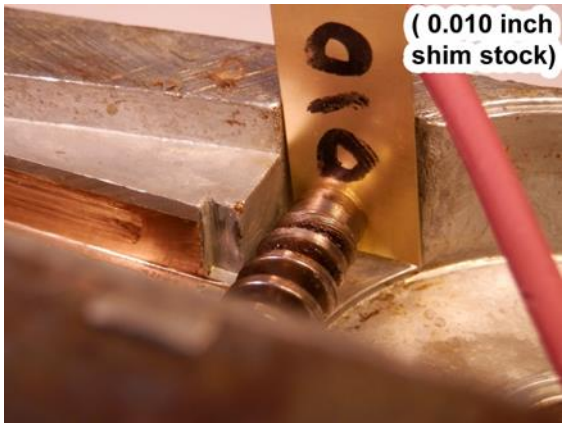
- Note 1: based on three samples the length varied from 7 ¾" to 8 ¾" (the longer version is easier to work with).

3.10 Electric Motor

3.10.1 Evaluation – Before Disassembly

Measure the end-float of the motor to obtain an indication of amount of general wear of the motor.

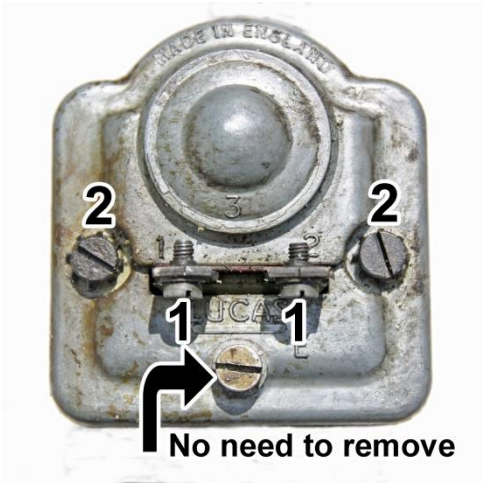
- By accessing the motor's armature from the gearbox, push the armature shaft all the way into the motor and then use a feeler gauge to measure the "end-float" of the armature.



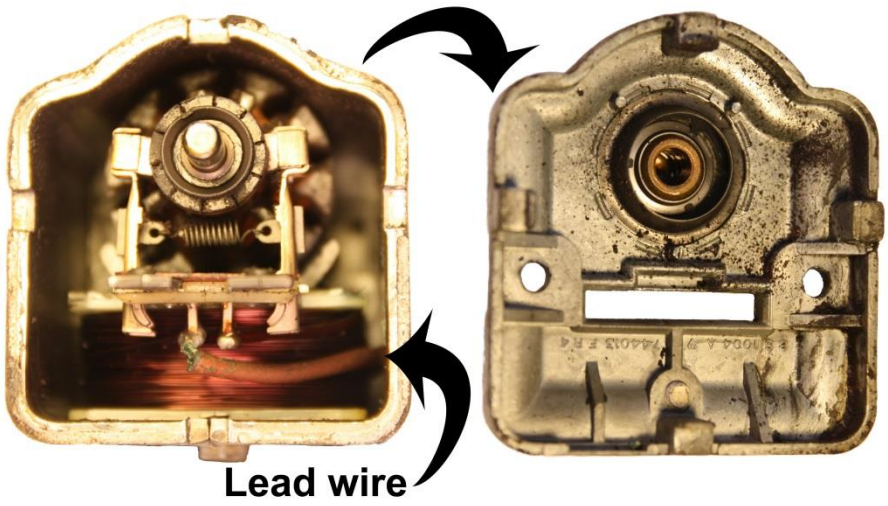
- While the specification is listed as .008-.012", upon examining a two used motors 0.006 was found on one and 0.020" on the other. You would expect clearance to grow as the brass adjustment screw wears, but too little clearance can only be explained by the Lucas technician not paying attention or incorrect prior rebuild (unlikely in this case since the motor came from low mileage 1962 owned since 1968).

3.10.2 Disassembly

- Remove two screws labels "1"
- Remove two screws labels "2"
  Hint: there is no need to remove the other screw
- Lift off the cover (nothing should fly or drop out when cover is removed)



Wiper Motor Assembly



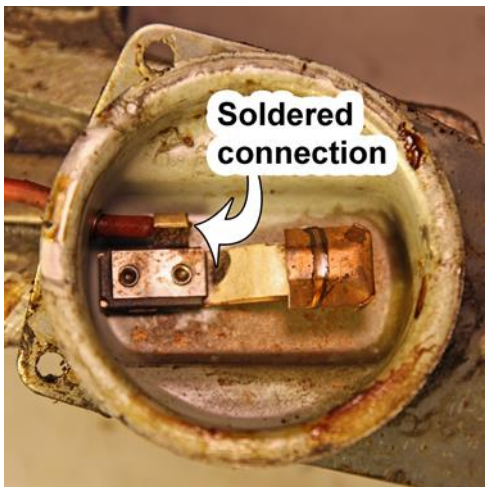
Observe: auto-park lead is tightly squeezed between coil and the case.
Observe: the self-centering bronze bearing in the photo is the early style found in a 75213E motor

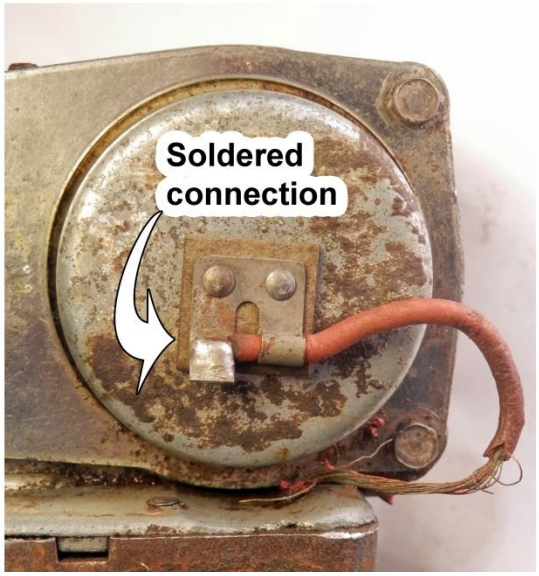
HINT:Use two colors of paint (or similar) to mark right and left brushes and brush holders before removing (which also marks top versus bottom) so they can be reinstalled in the exact same position to retain their wear pattern.

Interestring observation: 50 year old unit still had good looking oil in the bushing cavity.

Decide if auto-park lead wire must be replaced (**HINT**: always replace this 50 year old wire).

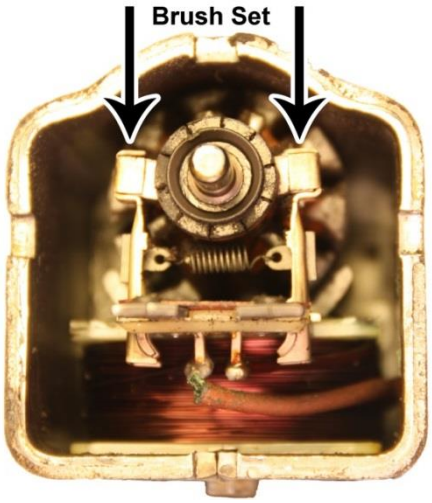
- If "no", rotate gearbox cover so that the auto-park round cover is in a position to allow its lead to be pulled through motor housing as far as possible to do the next steps.
- If "yes", de-solder the lead at the auto-park switch, so the wire can be pulled out along with the motor in the next steps.



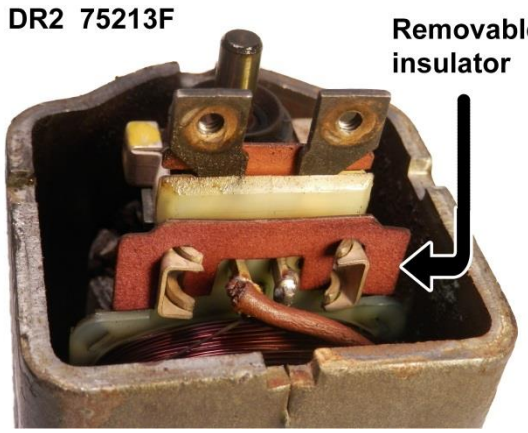


Wiper Motor Assembly

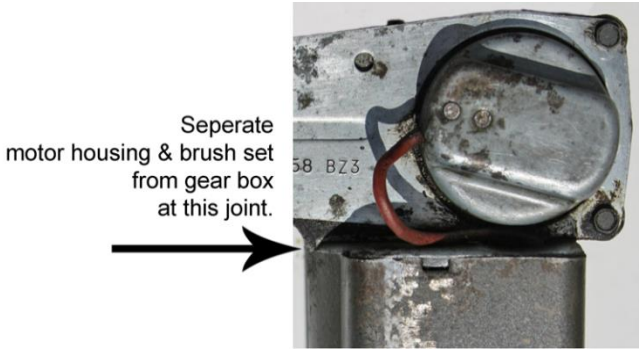
- Remove the brush holder set (Lucas's term is "brush gear").
  Caution: the carbon brushes are only held into the brush holder by friction. They may fall out, so be ready to catch them.



- **Caution**: The late DR2 (75213F) have a removable fiber board as part of the brush set, but earlier versions do not.

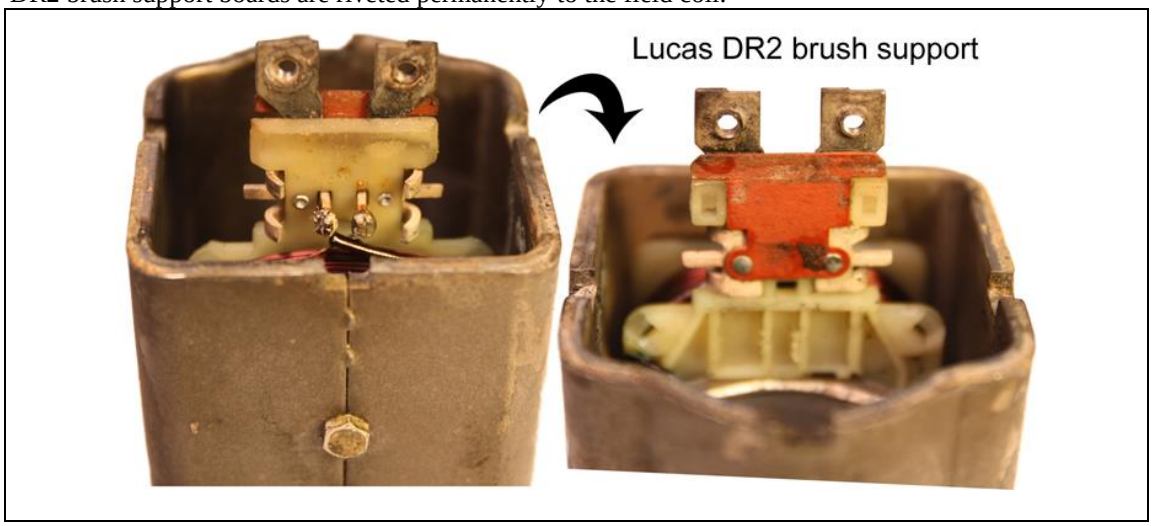


- Separate the motor housing (Lucas's term is "yoke") from the gearbox (see photo below).
- While holding the armature in place, pull the housing off the armature.
  HINT: There is a "stop" built into the case that prevents the armature from being extracted while leaving the housing in place.

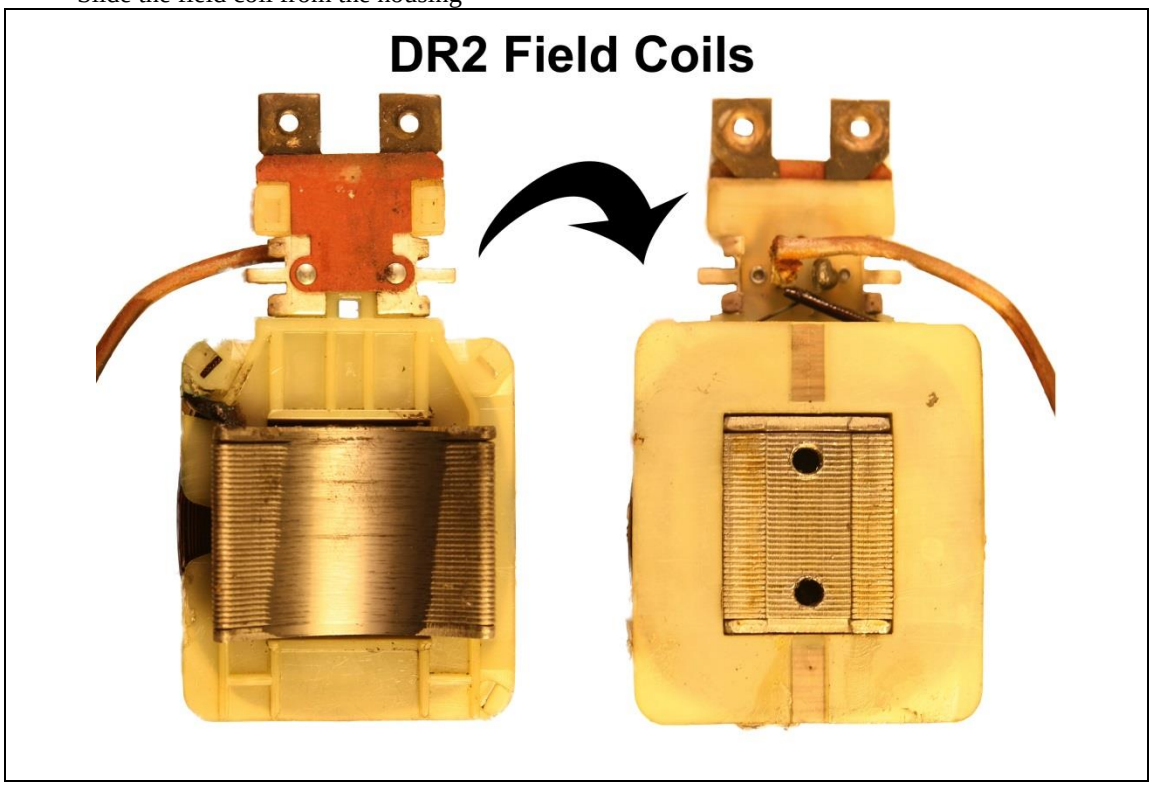


Wiper Motor Assembly

- DR2 brush support boards are riveted permanently to the field coil.

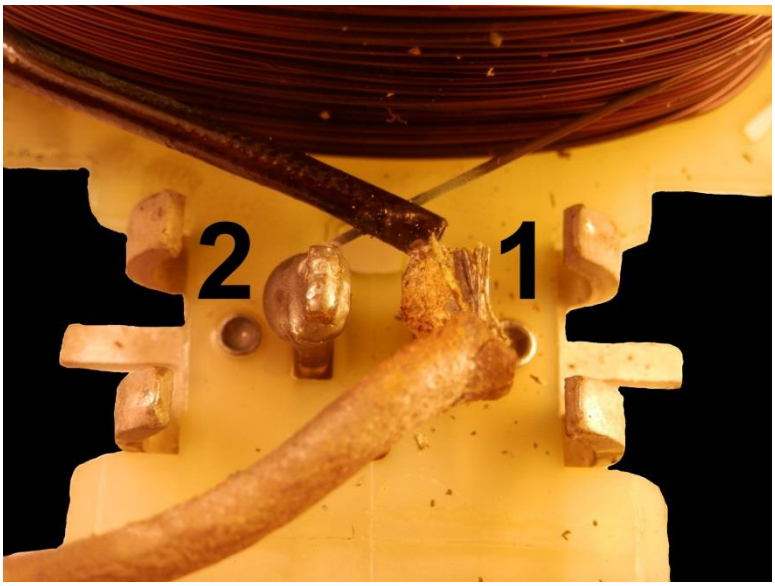


- If the "auto-park lead wire" is to be replaced:
  - Mark the upper screw, so it is put back in same hole during reassembly (this is recommendation **Austin-Healy 100-6 Shop Manual**). It makes sense, because these are sheet metal screws.
  - Remove the two screws.
  - Slide the field coil from the housing



Wiper Motor Assembly

- With the field coil removed it is easier to see how the wires are soldered to the terminals.



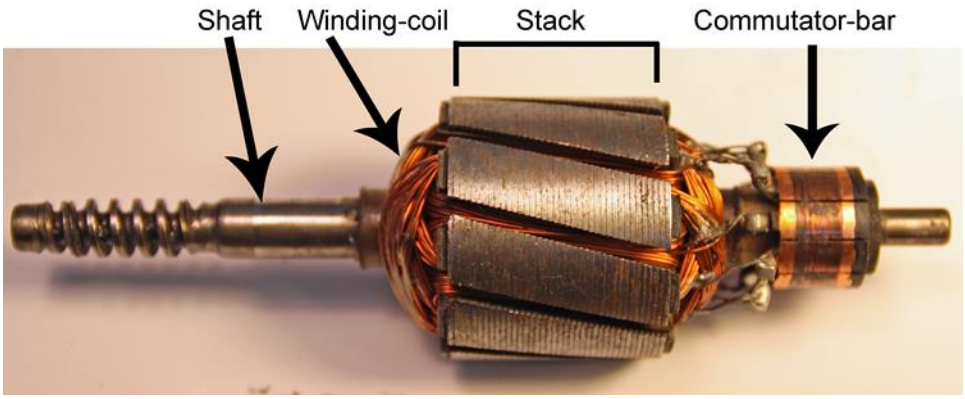
  - The thin wire from the coil winding connects to terminal "2". It passes underneath the other wire.
  - The other coil wire, with protective sleeve, connects to terminal "1"
  - The auto-park wire also connects to terminal "1"
- Carefully de-solder the auto-park wire from terminal "1".
  CAUTION: Don't let solder flow onto other wires.

3.10.3 Cleaning

- After the motor housing is separated from the armature and gearbox, spray the entire motor interior and field coils with a heavy application of electrical motor cleaner or electrical contact cleaner.
- Spray the armature with a heavy application of electrical motor cleaner or electrical contact cleaner.
- Use a needle to clean carbon out between the commutator bars (should clean out easily, don't overdo it).
- Spray the armature commutator bars a second time.
- **CAUTION**: When cleaning the motor's endcap, be aware that the later version of DR2 has a felt oil retainers around the self-centering bearings. Unless the felt is badly contaminated, leave it alone.
  If a cleaner is used, be sure the felt is purged of any cleaning fluid and thoroughly dried.

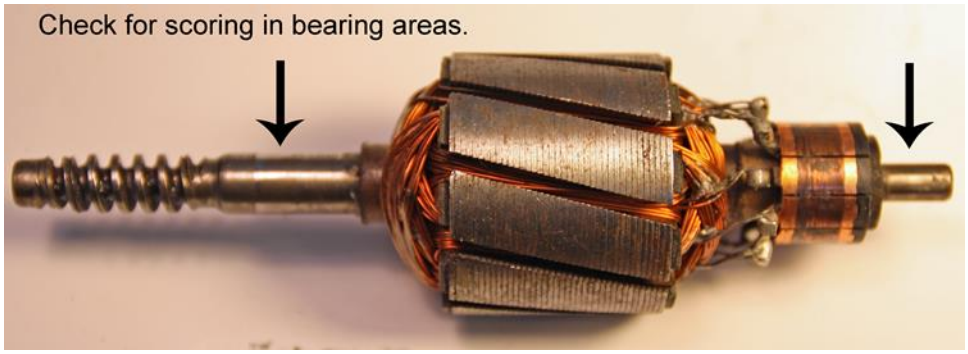
3.10.4 Evaluation

3.10.4.1 Armature

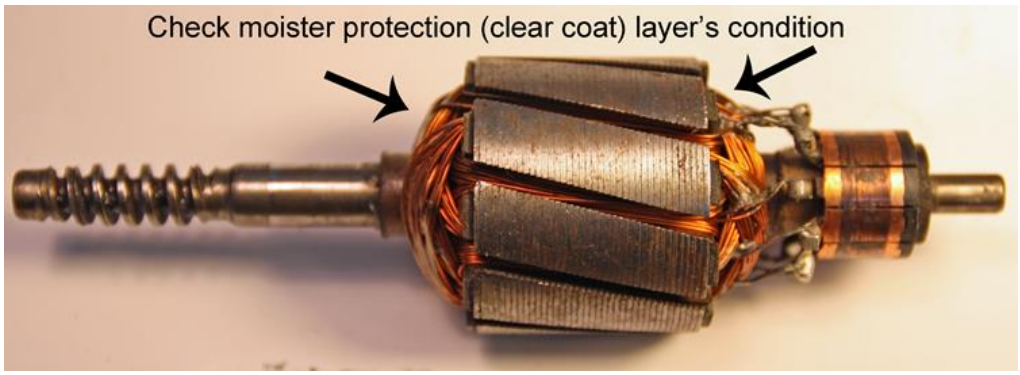


Investigate physical condition of armature.

- Check for scoring in areas that contract the bearings.

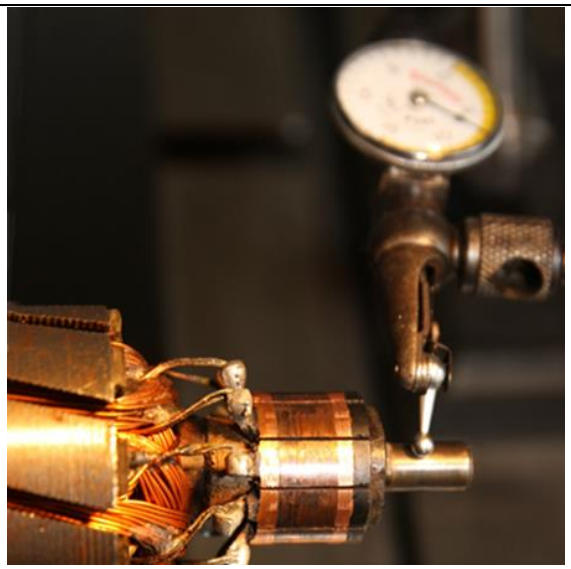


- Check moister protection (clear coat) layer's condition
  Armatures might look "cooked" [dark brown], but may be OK. Tests described later will make final determination



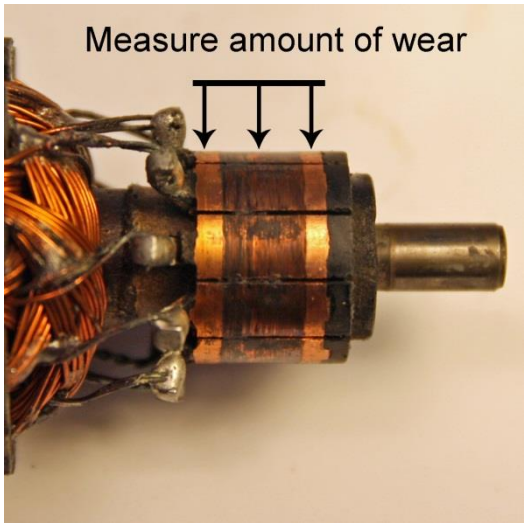
Wiper Motor Assembly

- If you have a lathe available check the trueness of the armature shaft



Example showed 0.009 inch wobble. Good enough for slow speed motor.

- Check for wear in brush commutator bars.
  The commutator surface under the brush should take on a darker bronze color with use. This is due to self-generated film caused by normal commutation. This coloration should be even, without blotches or black areas. A shiny copper color or black streaks in the brush tracks are signs of contamination.



Example shows the center had **0.002 inch** wear compared to non-contact area. Not bad

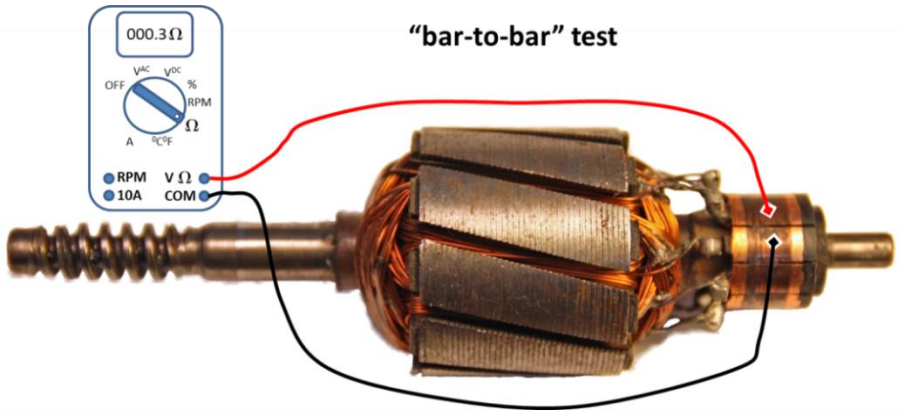
- While performing the following ……
  CAUTION: Don't be too aggressive, it is not necessary to get all the "carbon black" off.
  CAUTION: Do not use emery cloth as it contains electrically conductive materials.
- If the wear is significant, the armature's commutator bars will have to be resurfaced. This is probably a task that will need to be outsources to a shop that works on starters, generators, or electric motors. Even then, because of the thinnest of the commutators and the plastic at the end (right side in photo) cutting on a lathe will endanger the viability of the armature.
- If the wear is slight, polish with 150-grit; then 220-grit sandpaper (garnet paper).
  HINT: if a lath is available polish with sandpaper held straight with a file or something similar while the lathe spins.
- Repeat the steps listed in the above **Cleaning** section

Originally provided by Carl R. Davis
Send correction to carl750@sandprairie.net

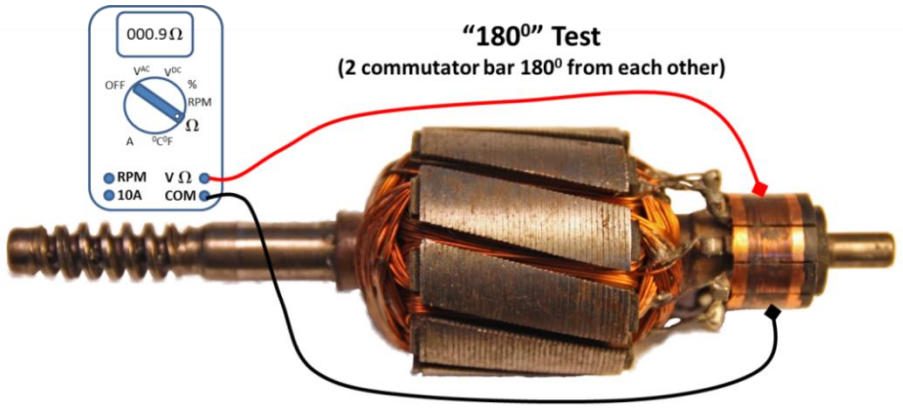
Wiper Motor Assembly

- Perform the following tests

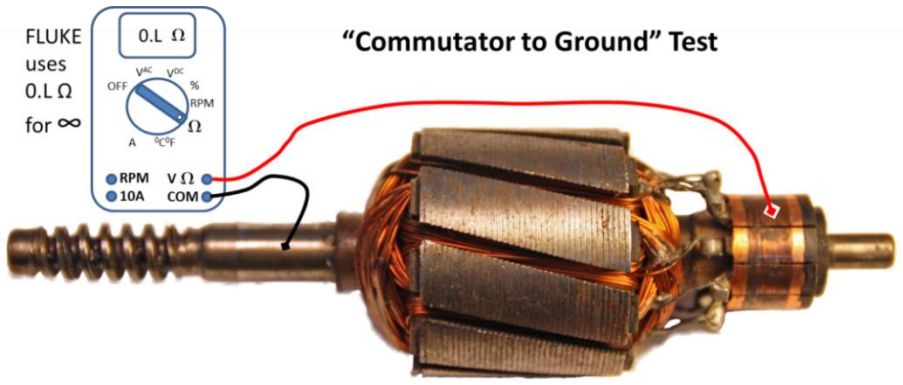
- Lucas provides specification to the "hundredth of an ohm". Consumer quality meter do not read finer than "tenth of an ohm" and then not to laboratory accuracy.
- Look for values reasonably close to specification listed.
- Remember to subtract out your meters inherint resistance from the observed reading.



- Lucas manual specifies the range of **0.29-0.35 ohms**.
- There are 9 adjacent pairs to measure.
- Hint: if you encounter too low a reading, clean between bars with needle, contact cleaner, and then blow dry.



- Lucas does not provide a specification. It will be a higher resistance than bar-to-bar. Look for approximately the same answer for each pair.
- There are 5 opposing pairs to test.



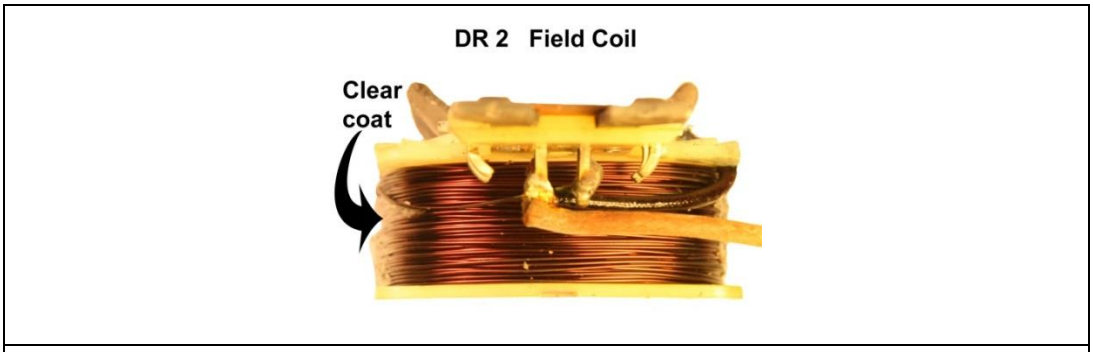
- There should be no connectivity between commutators and the armature shaft.
- There are 10 bars to test.

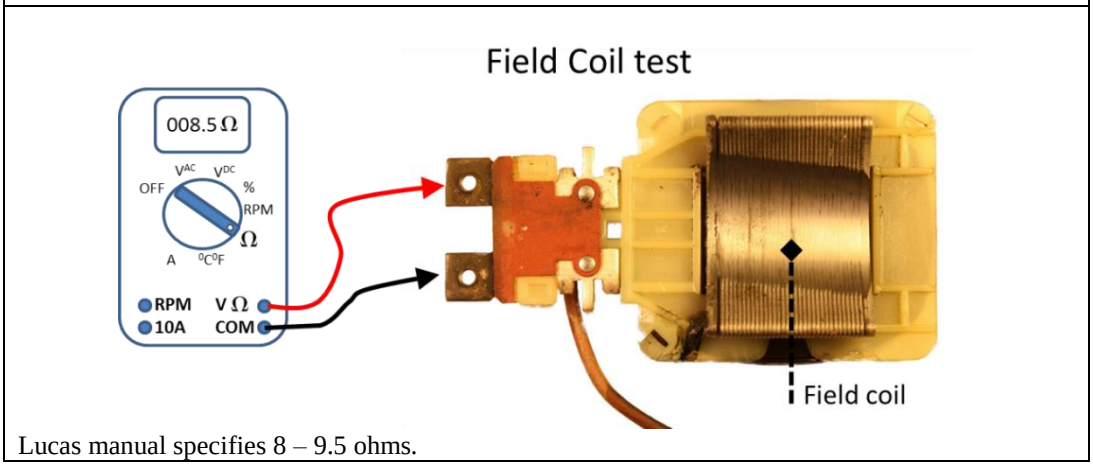
Wiper Motor Assembly

3.10.4.2 Field Coils

Investigate the field coil for damages windings

- Check condition of protective clear coat.
- Measure the field resistance.





Lucas manual specifies 8 – 9.5 ohms.

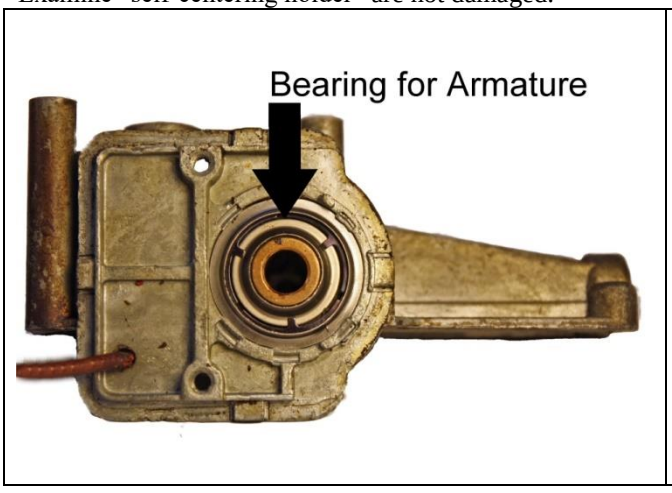
3.10.4.3 Brushes

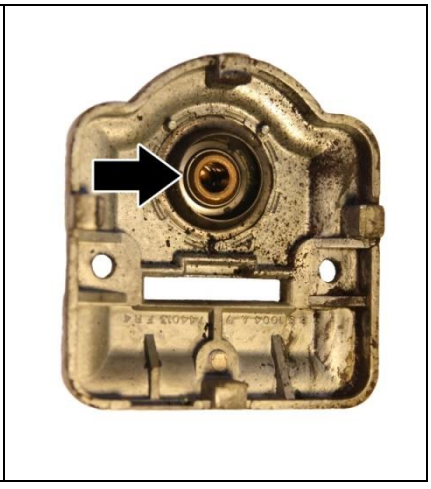
- Examine the brushes for damage and size.
  (New Lucas 729367 brushes are 6.2 x 6.2 x 8.5 mm.)
- Verify that the brush tension spring is in good condition.

It was noticed that the brushs from one unit had “CM2” embossed into it. Meaning is unknown.

3.10.4.4 Bearing

- Examine the armature’s two bearings for wear or scoring.
- Examine “self-centering holder” are not damaged.





Wiper Motor Assembly

3.10.5 Repair

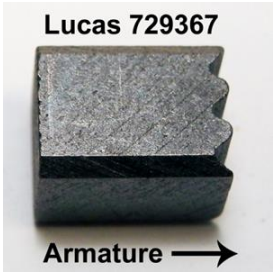
- If the armature fails any of the above tests, it must be replaced.
- If a self-centering bearing is damaged, the amount of required machining is probably not practical and a replacement motor unit will be needed.
- Verify the brush holders are still free to move.
- Strip, clean, and paint the housing

The following has been provided by others and has not been personally verified.

- The brushes are not "plain carbon brushes"; look for "starter type" brushes.

3.10.6 Hardware List

Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Fix field coil to motor housing	Screw – sheet metal	2	#10	#10	0.75"	CAD	Hex head
Fix motor end plate	Screw – part thread	2	Mystery!		92 mm	Black	Slotted, Cheese head, Only 21 mm threaded
	Washer - Exterior tooth	2		N/A	N/A	Black	
Wiring harness connection	Screw	2	BA4	BA4	0.29"	CAD	Slotted, Cheese head
	Washer – Flat			N/A	N/A	CAD	Permanently attached to screw
Ground strap	Screw	1	BA2	BA2	0.27"	CAD	Slotted, Cheese head



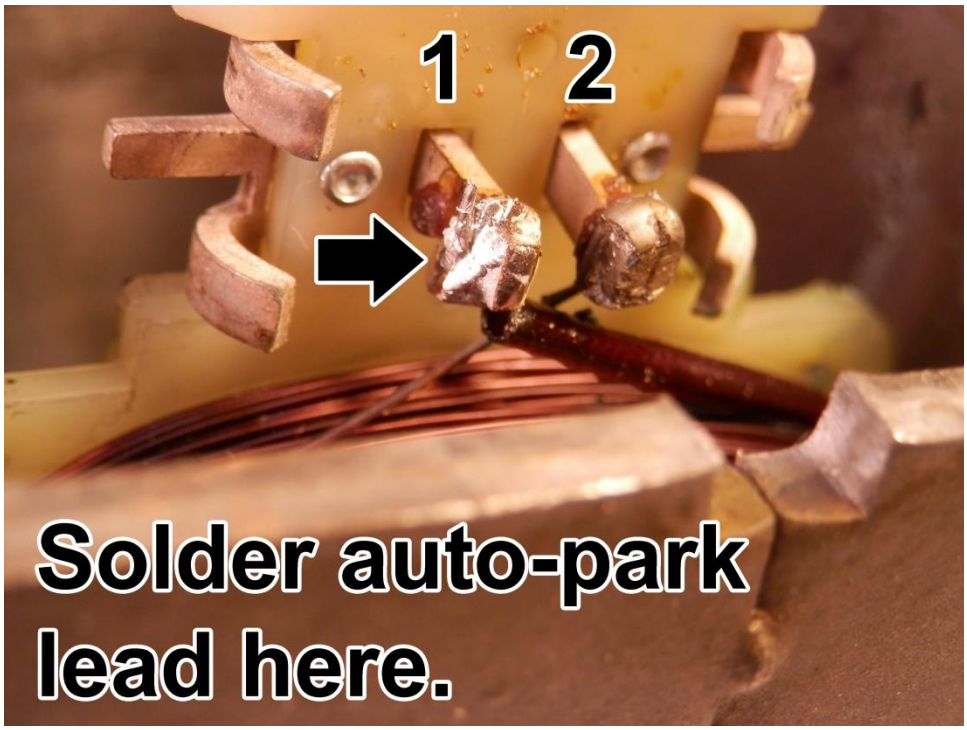
6.2 x 6.2 x 8.5 mm

Wiper Motor Assembly

3.11 Reassembly – Part 1

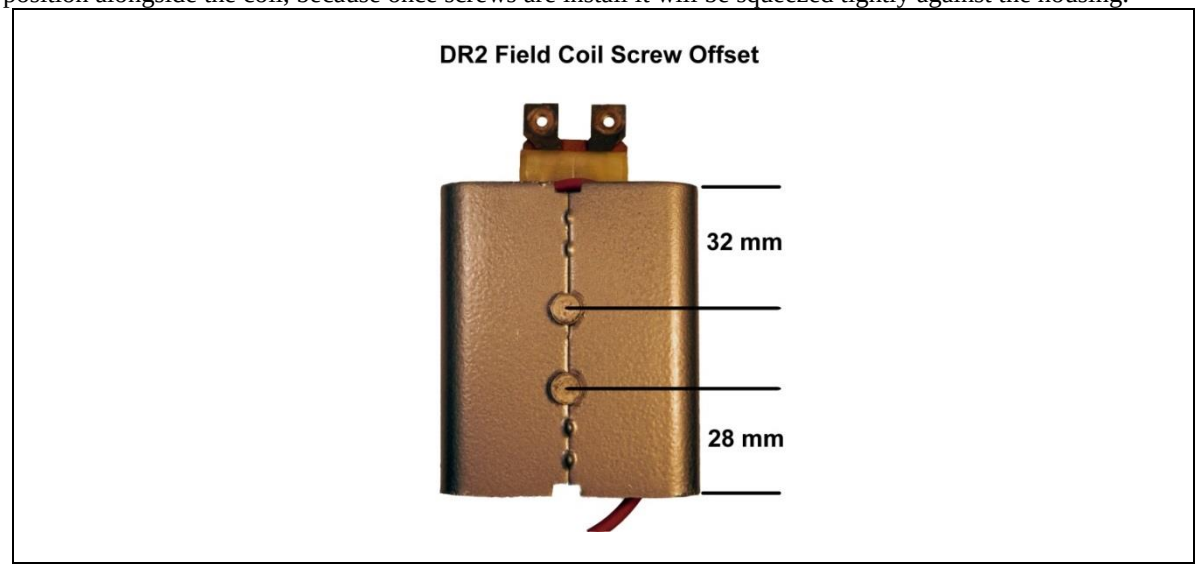
- Soak the three bearings in warm (200^0 F) "electric motor oil" for a couple of hours.
  The three bearings: one in motor cover and two in gearbox housing.
- If the "auto-park lead wire" is to be replaced, carefully solder it to "motor contact #1" on the brush support.
  CAUTION:
  - Do not allow solder to harden the other wire already soldered to terminal #1.
  - Do not allow solder to drip onto the bare wire connected to terminal #2.
  - Do not allow solder to drip onto the coil.

Photograph was taken after the auto-park lead wire had been de-soldered.

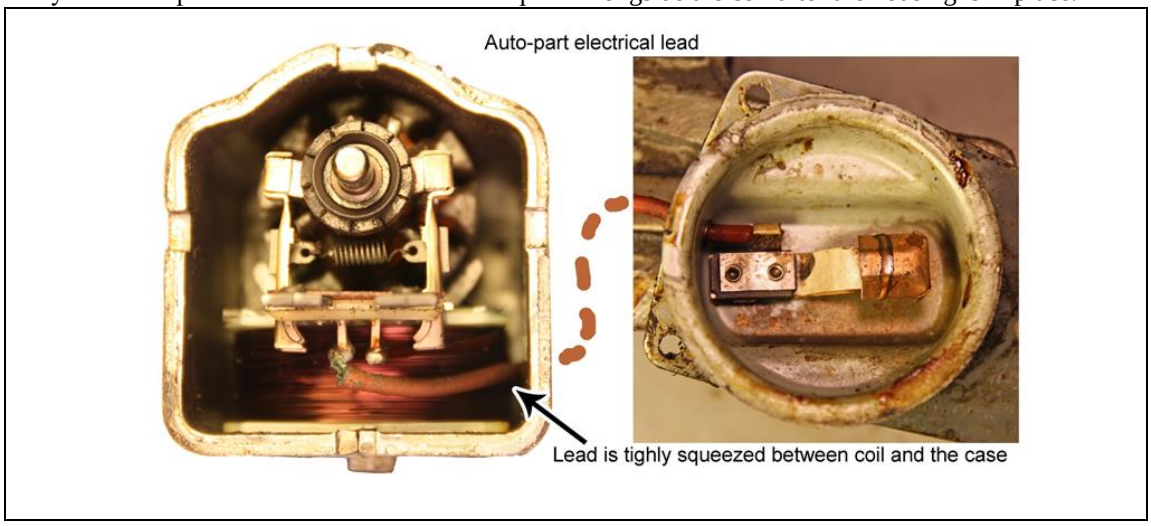


Wiper Motor Assembly

- Slide the field coil back into the housing.
  Observe: the screw holes for fixing coil to housing are offset (see illustration below).
  CAUTION: be sure to pull the auto-park lead wire all the way through the housing and place it in the correct position alongside the coil, because once screws are install it will be squeezed tightly against the housing.

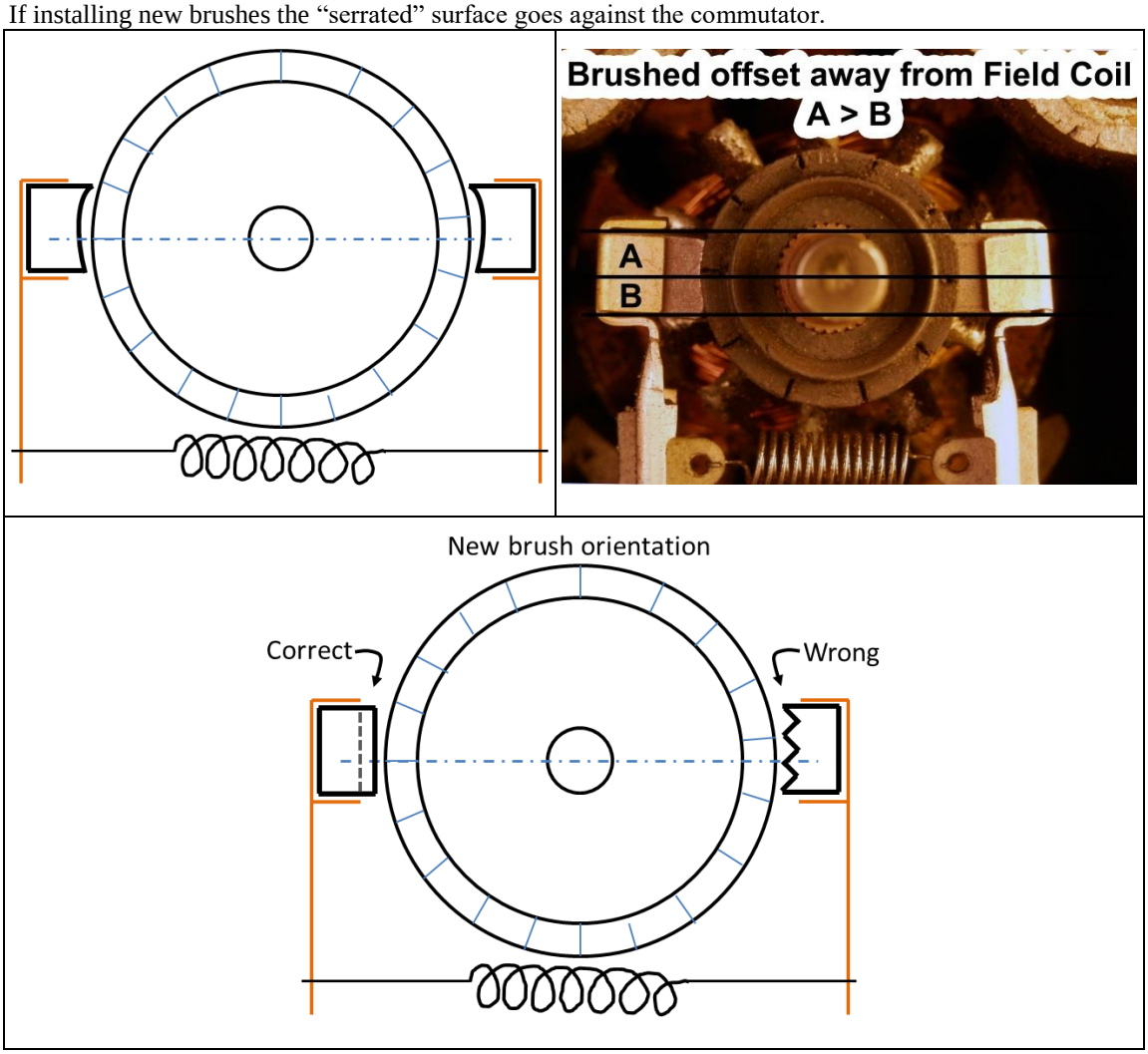


- Install the field coil fixing screws back into their original holes (remember you marked the upper screw).
  CAUTION: hold the coil straight as you tighten the screws, so it will align with armature.
- Fill gearbox housing cavity and auto-park gear teeth with grease such as Mobil Mobilux EP111.
  CAUSTION: keep the grease off the auto-park contact!
  CAUSTION: keep the grease out of the gear shaft bearing.
- Add a few drops of "electric motor oil" to the armature shaft and gearbox's bearing and then install armature into gearbox.
- Thoroughly grease gear teeth.
- Add a few drops of "electric motor oil" to the shaft and bearing as the auto-park gear is installed into the bearing
  CAUSTION/HINT: this gear is set in place at this time, because it is difficult to install after the motor housing is in place without damaging the insulation of the auto-park lead wire.
- Install gear's external retaining washer and clip.
- Route the auto-park lead wire from the field coil through the hole in the gearbox housing as you slide the motor housing / field coil over the armature.
- Verify the "auto-park lead wire" is in the correct place alongside the coil after the housing is in place.



Wiper Motor Assembly

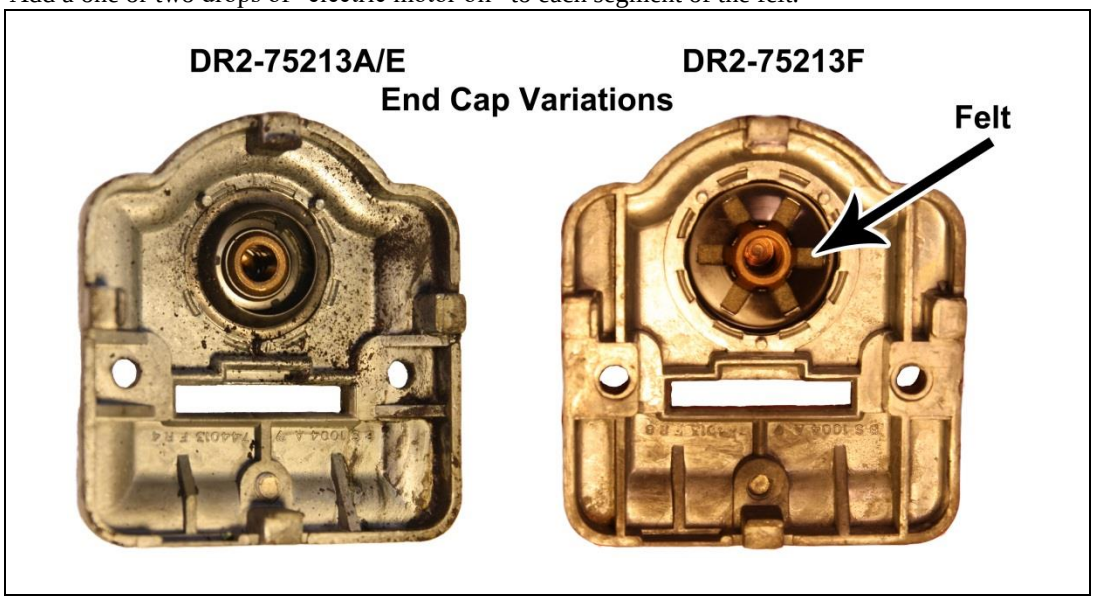
- Install “brush assembly”.
  CAUTION:
  - If reusing brushes, use the paint marks you added during disassembly to put them back in the original positions (because of wear pattern).
  - If installing new brushes the “serrated” surface goes against the commutator.



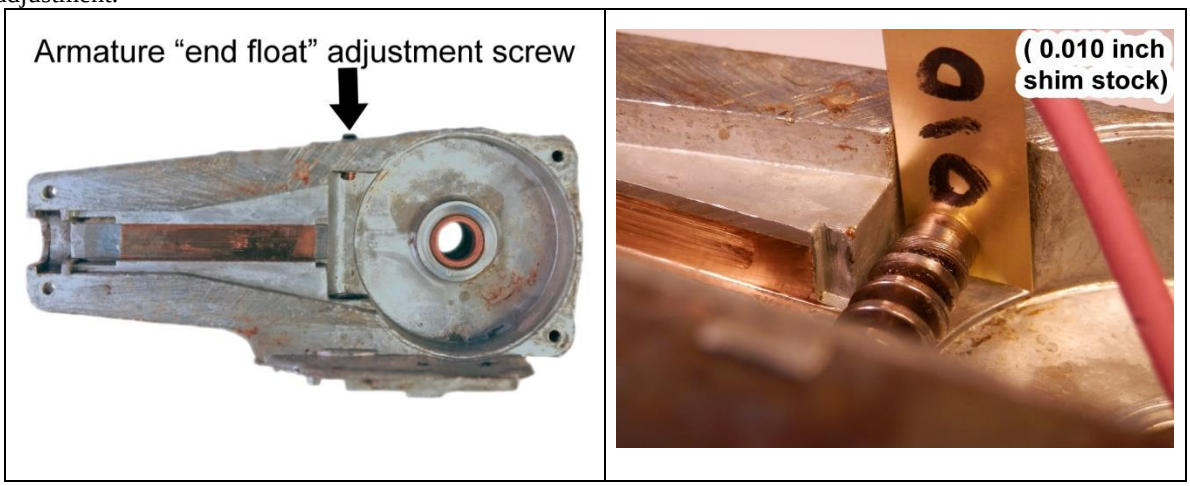
- **CAUTION**: if rebuilding a late DR2 (75213F or later):
  - Reinstall the removable fiber board as part of brush set.

Wiper Motor Assembly

- **CAUTION**: if rebuilding a late DR2 (75213F or later):
  - Be sure the endcap bearing felt has been purged of any cleaning fluid and thoroughly dried.
  - Add a one or two drops of "electric motor oil" to each segment of the felt.

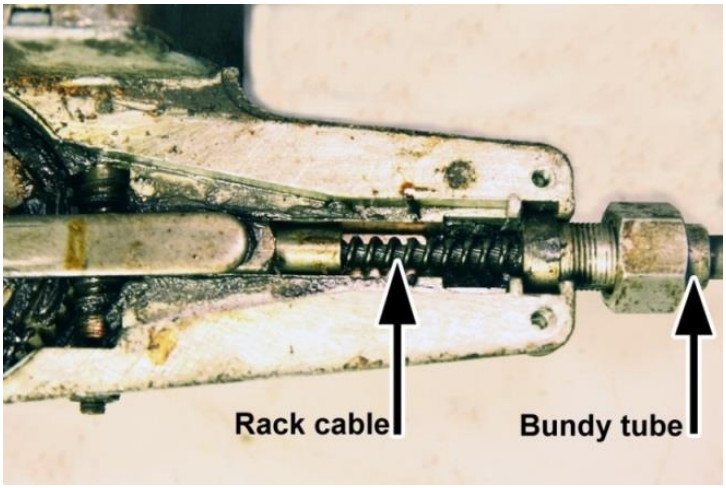


- Add a one or two drops of "electric motor oil" to the endcap bearing.
- Holding the unit so the oil does not run out of the endcap bearing, install the endcap.
- Lightly tap the cover solidly against the housing with a non-marring hammer.
- Install the long endcap retaining screws.
- Adjust the screw on the side of the gearbox housing to set the armature end float to specified value.
  Hint: use a small screw driver to pry the armature fully back into the motor housing before making this adjustment.



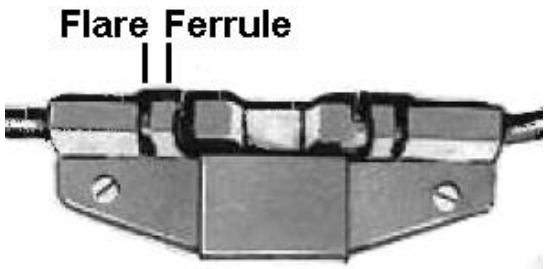
- Test run the motor briefly.
  WARNING: if new brushes were install, anticipate a "chattering" sound until the new brushes wear in.
- Verify that the motor's end-float has not changed.
- Verify the armature worm drive and the gear teeth are fully lubricated.
  CAUTION: do not add some much grease that it will migrate onto the auto-park contacts.
- Delay the rest of the reassembly until after the Bundy tube and wheel box reassembly is competed.

3.12 Bundy Tube & Rack Cable



3.12.1 Variations

Lucas Technical Service / Section 8 states that early production Bundy tubes for DR2 motors used ferrules at the wheel boxes and a later version flared the ends of the Bundy tube.



Vehicle Serial# Range	Bundy Tubes		
	Near motor	Long	Short
Sprint & Sprint Veloce			
750-101	1495.80.009	1495.80.005	1495.80.006
Spider & Spider Veloce			
Spider up to 1495.01088	1495.80.004	As above	As above
• Spider after above • Spider Veloce from 1st car	1495.80.009	As above	As above

On a Sprint, the section closest to the motor does have a slight curvature.

3.12.2 Disassembly

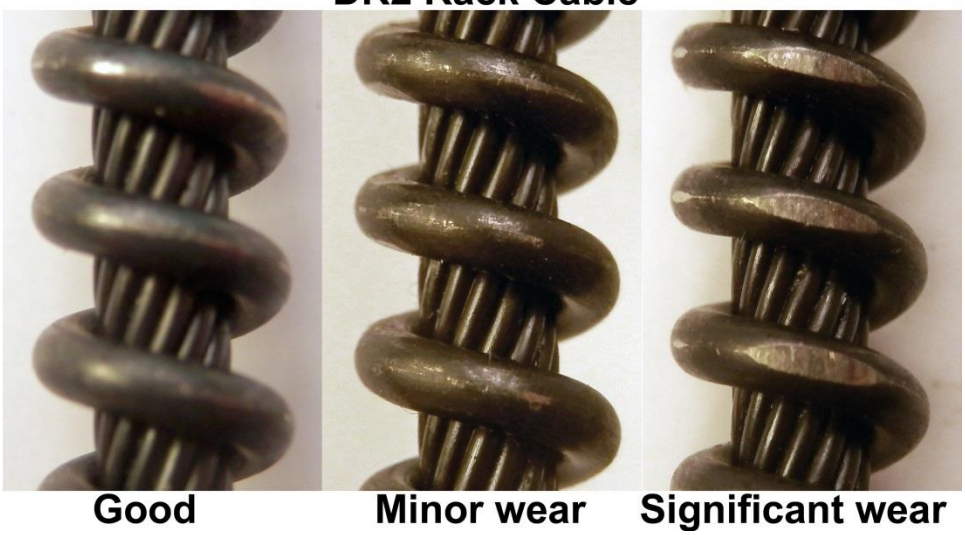
Once the Bundy Tube is disconnected from the Gearbox, the internal cable can be pulled out.

3.12.3 Cleaning

Clean inside of tube and internal cable in standard “parts cleaner”. Blow dry. Pull scrap of cloth through.

3.12.4 Evaluation

- Examine rack cable for excessive wear.
  The wear appears to happen where it slides against the wheel box clamp more than where is engages the wheel box teeth. This is probably because the teeth are softer metal than the rack cable.



While the final picture shows considerable wear, turning over the cable will probably be all that is needed.

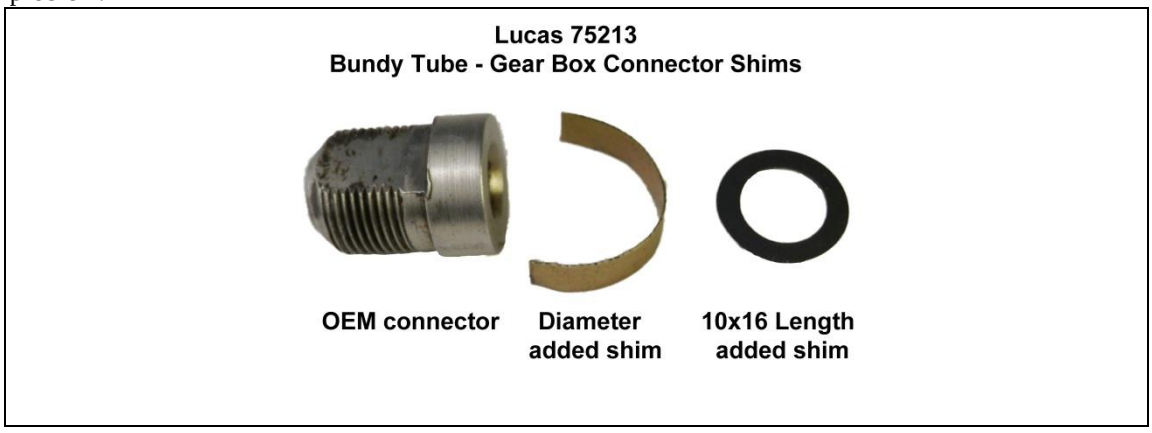
- Examine the Bundy tubes for distortion.
  Lucas Technical Service / Section 8 stated that the maximum allowed curvature of the Bundy tube is a 9 inch radius.

The following was provided by others has not been personally verified.

The system is particularly fussy about a smooth curve in the first section of tube from the motor to the wheel box. This often led to motors burning out.

3.12.5 Repair

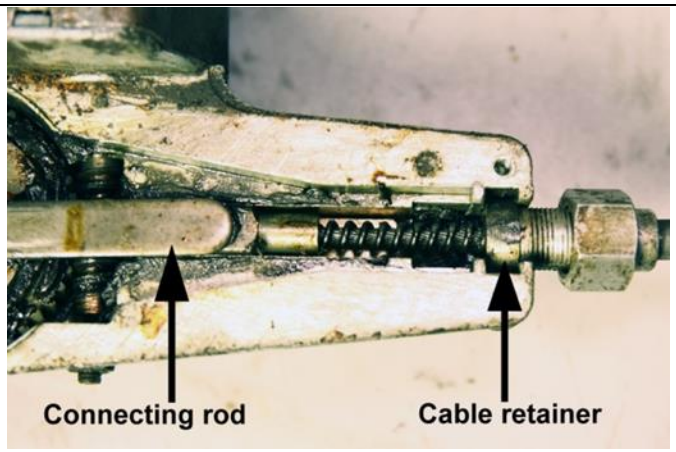
- If the Bundy tube has become slightly bent (no kinks) it can be gently put back to its original contour. If parts are damaged, they will have to be replaced.
- It is likely that the Bundy tube to gear box connector fits poorly, which always it to turn when turn-on torque to the cable occurs when the motor turns on or off. Consider adding shims to eliminate the problem.



Wiper Motor Assembly

3.12.6 Reassembly

- Thread the cable retainer into the Bundy Tube locking nut, but leave it just loose enough so you can rotate the Bundy tube inside the locking nut.
  CAUTION: be very careful that the retainer is correctly started onto the lock nut. It is very easy to cross thread it and the aluminum threads are easily destroyed. This is a very odd threads-per-inch, so it would be difficult to repair if damaged.



- Lubricate the rack cable using something like Mobil Mobilux EP1.
- Slide the rack cable through the cable retainer and into the Bundy Tubes.

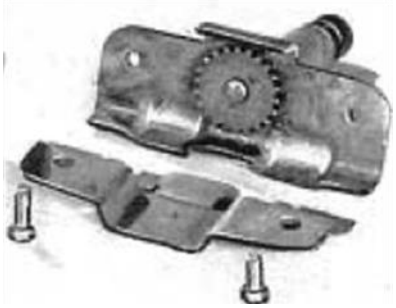
3.12.7 Adjustment

See **Wheel Box / Adjustment** section.

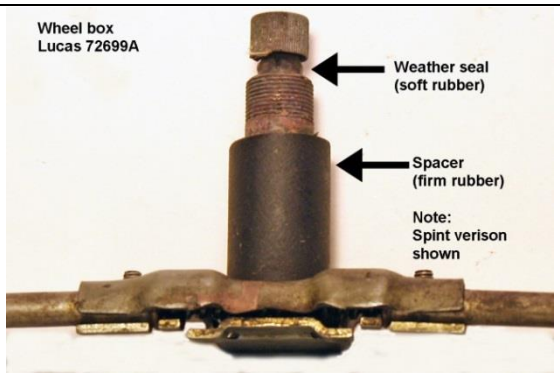
3.12.8 Hardware

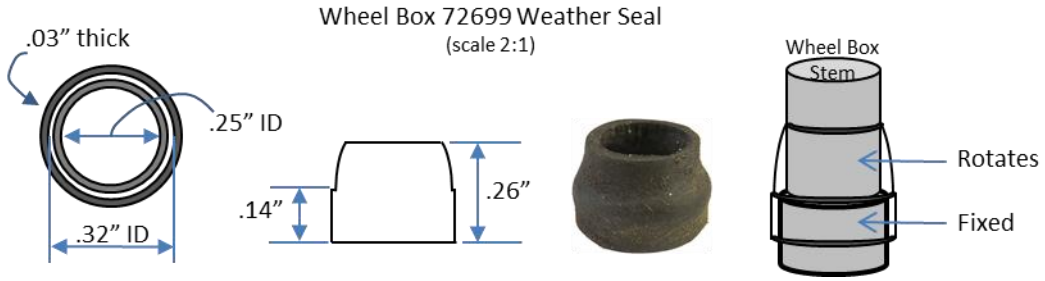
Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Fix Bundy tube to gearbox	Special nut	1	$^{9}/_{16}$”	26 tpi	N/A	CAD	Not industry standard tpi

3.13 Wheel Box



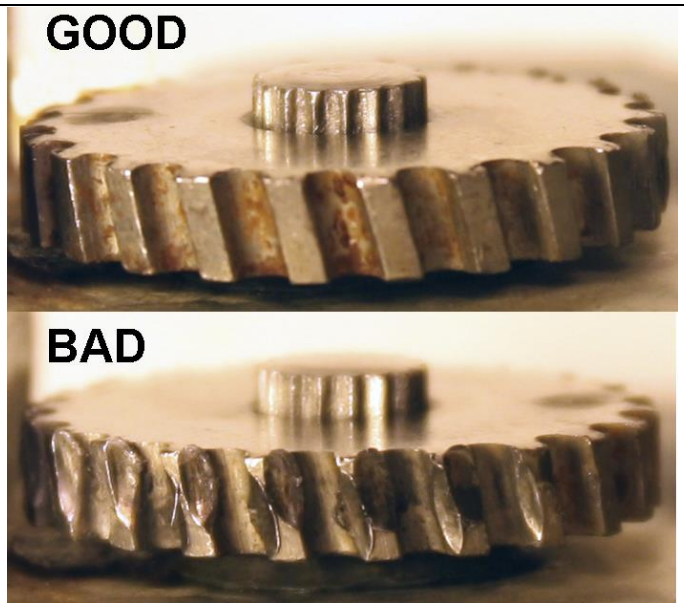
Screws: 10-32”





3.13.1 Evaluation

- Verify the correct wheel boxes are present, 72699 has 22 teeth.
- Verify the teeth are in good condition, at least the ones that will contact the rack cable. These gears can be rotated to contact better teeth.



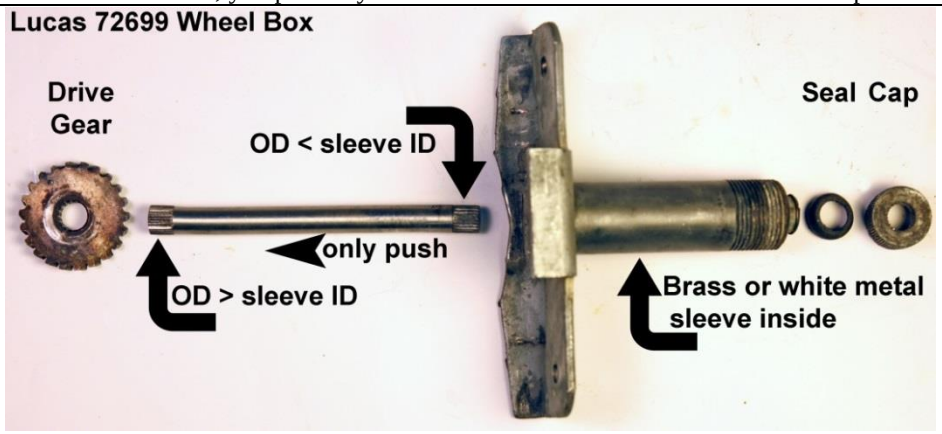
- Verify that the spindle freely rotates inside the wheel box housing.
- Verify condition of rubber weather seal under wiper arm attachment point.
- Verify condition of “firm rubber” spacer (or is it plastic or Bakelite).

Wiper Motor Assembly

3.13.2 Disassembly

Caution: once the wheel box screws are removed to free it from the Bundy tube, be careful pushing on the "wiper arm end", so you do not damage the weather seal (see annotated photo above).

While it is possible to disassemble, you probably never will. Read CAUTIONS below before proceeding.



This one was disassemble because the splined shaft was bent during a serious automobile accident.

If you do disassemble, there is only one way:

- **CAUTION**: Press work must be from the "cap" end since the OD of the stem's cap end will slide through the sleeve, but the "drive gear" end will not.
- **CAUTION**: the cap where the arm sits is peened; lightly file off the peen to prepare for press work.
- **CAUTION**: be careful how you position the support under the "cap" so you don't destroy the weather seal (if still present)
- Press the stem through the cap.
- Remove the cap
- Slide out the stem & gear as a unit. If you have to press out the stem, it is probably bent.
- If the gear is what you are replacing, press the gear off the stem.

3.13.3 Cleaning

Remembering the caution statement to not damage the "weather seal", while cleaning out old grease around gear.

Use a scribe to clean out 50 years of dirt and corrosion in each of the tiny splines in the head for easy installing and de-installing the wiper arms.

3.13.4 Repair

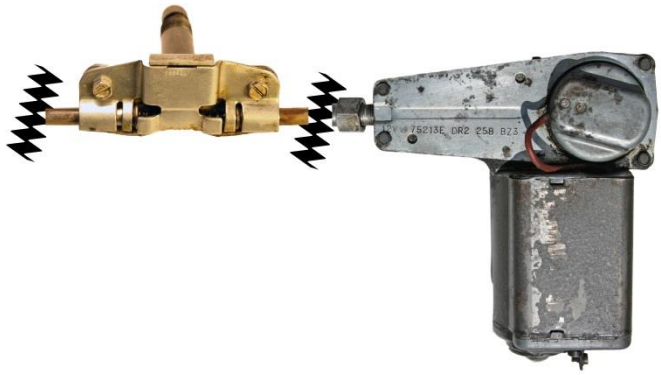
The "cap" comes off fairly easily, so replacement of the weather seal is possible.

Repair of other parts would require some serious machining skills; so replacement is probably the only realistic choice. These wheel boxes are unique to Alfa, so only used ones are available.

Wiper Motor Assembly

3.13.5 Reassembly

- **HINT**: Add a drop of paint to the wheel identifying the good section of the gear (it is hard to tell after gear is covered with lubricate.
- Lubricate the top and underside of the gear in the wheel box with something like Mobil Mobilux EP1.
- Lubricate where the rack cable will slide along the wheel box.
- Rotate the gears so that previously unused teeth engage the cable when attached to Bundy tube.
- Place the wheel boxes between the Bundy tube sections.



With the motor to your right and the auto-park cover faces upward, the wheel boxes are position so they a "above" the Bundy tubes with their spindles pointing away from the motor's square housing.

- For the wheel box furthest from the motor fully tighten the two wheel box screws to clamp it to the Bundy tube pieces. (Access to these screws is not available once installed.)
- Tighten the other wheel box screws just enough that the Bundy tube flares (ferrules) are caught between the stops.
  You will fully tighten the screws after aligning wheel boxes to the vehicle's body panel.
- After connecting to the Bundy tubes pull the cable in and out to verify smooth performance.
- Preserve and lubricate the spindle's weather seal with the Wintergreen oil / Xylene plus Lexol's Vinylex.as described in the **Lubricant Recommendation** section.

3.13.6 Adjustment

Postpone until **Reassembly – Part 2** section.

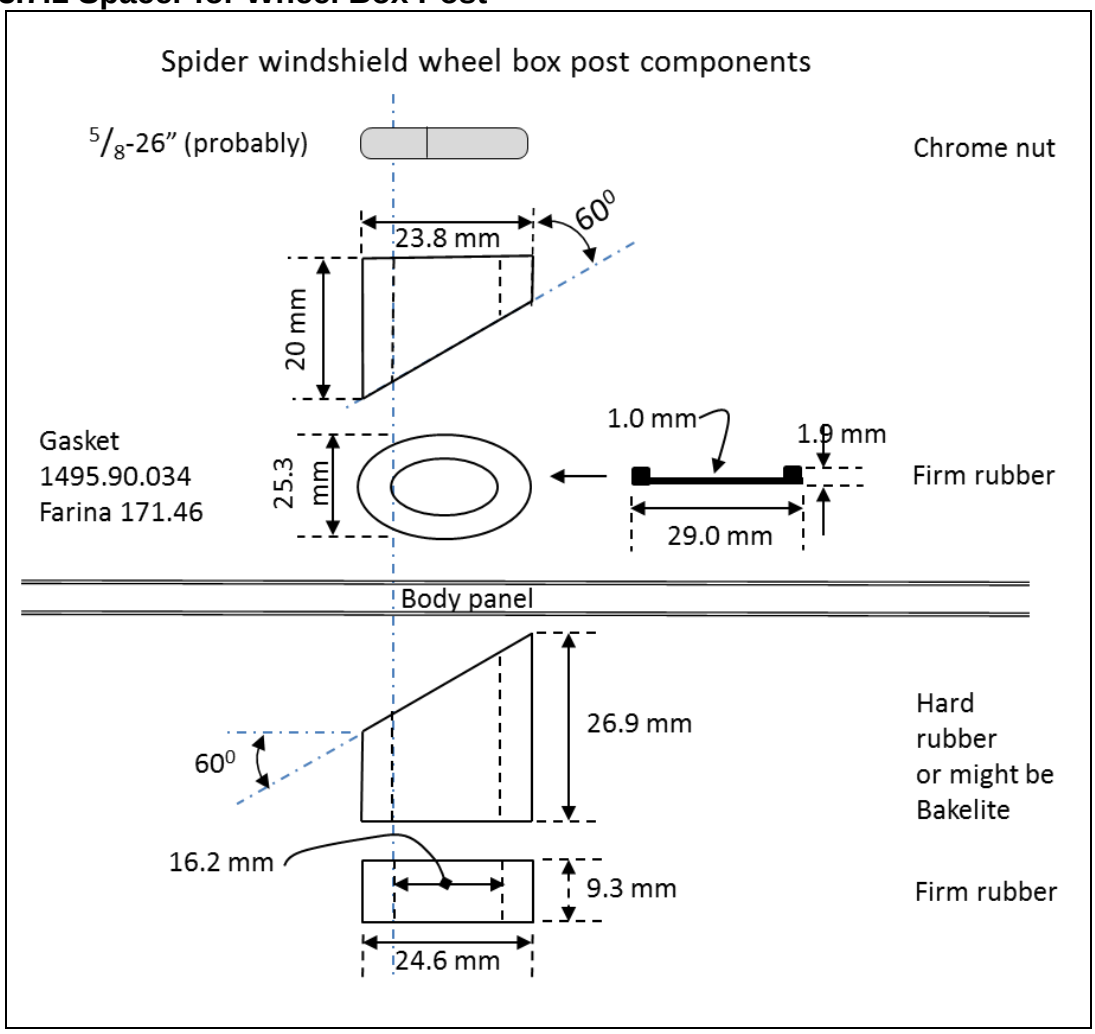
3.13.7 Hardware

Purpose	Description	Count	Size	Pitch	Length	Finish	Details
Fix halves of wheel box	Screw	2 per	#10	32 tpi	0.38"	CAD	Slotted, hex head ($^{11}/_{32}$") machine screw
Fix wheel box shaft against body panel	Nut	1 per	$^{5}/_{8}$"	26 tpi	N/A	Chrome	Not an industry standard tpi
	Washer – "cap"	1 per	See diagram on next page			Chrome	Sprint only

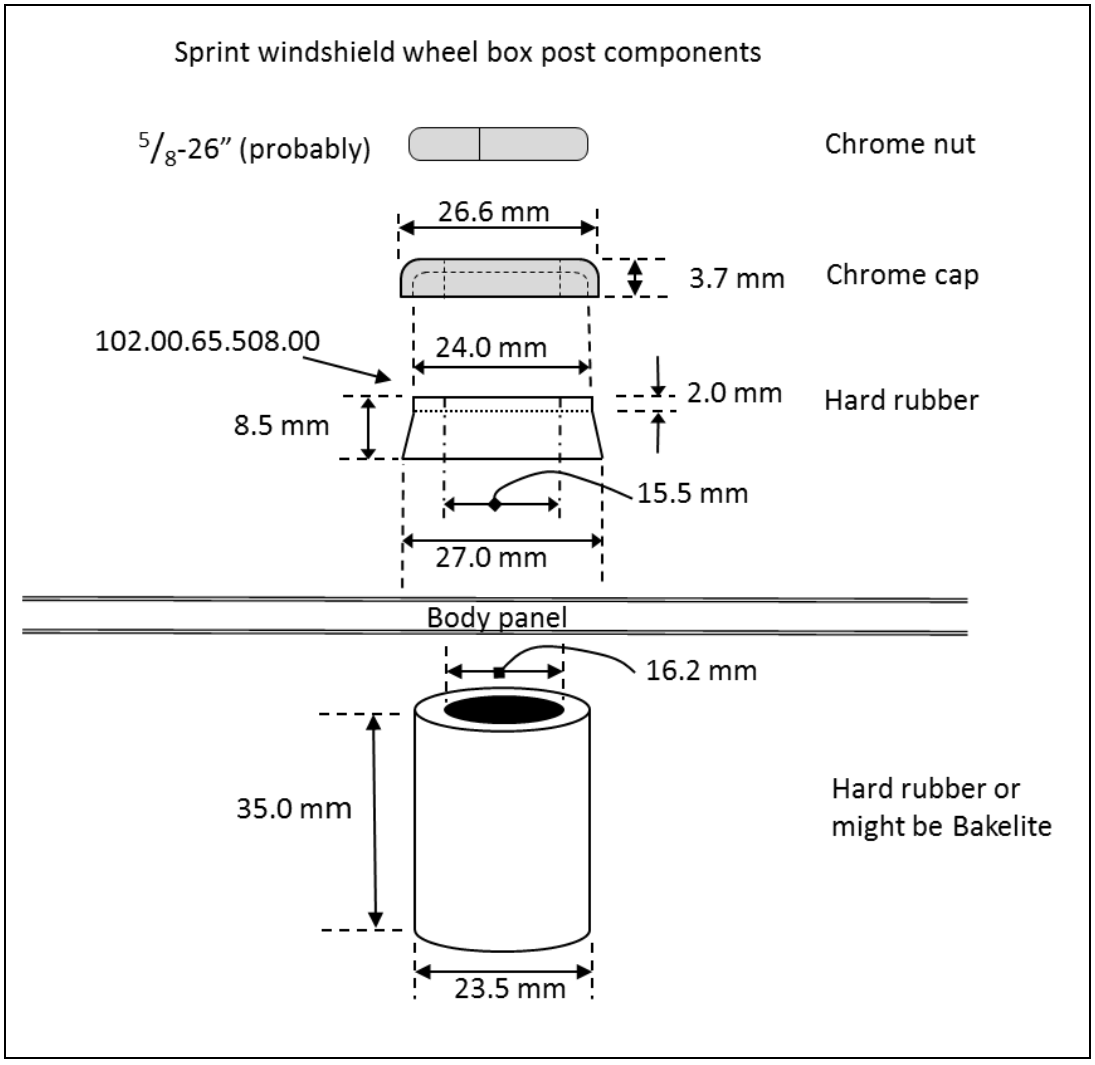
- tpi = threads per inch

Wiper Motor Assembly

3.13.7.1 Spacer for Wheel Box Post



Wiper Motor Assembly



3.14 Reassembly – Part 2 – At Bench

- Install rack cable into gearbox housing.
  Remember to install the rack cable eyelet with the "punch mark" you added downward, so the wear spots on the rack cable are in a new location.
- Add a little grease to the eyelet of the rack cable.
- Add a drop of oil to the connecting rod's bush.
- Install connection rod on auto-park gear's pin and into the rack cable's eyelet at the same time.
- Install the shim washer on the auto-park gear's pin.
- **CAUTION**: if rebuilding a late DR2 (75213F or later):
  - Reinstall the removable auto-park contact back into its original position.
  - Install a shim washer, as needed, to eliminate contact wobble (without restricting shaft rotation).
- Install C-clip.
- If the auto-park lead wire was replace, then
  - Install the auto-park cover into the gearbox cover, paying attention that the part number embossed in the cover is on the top side.
  - Re-solder the lead wire to the auto-park contact.
- Reinstall the gear box cover (four screws).
- Connect short wiring harness
- Connect ground wire.
- Briefly run the motor to verify the rack cable is running smoothly.
- **HINT**: do not install the motor mounting hardware at this time, since you cannot move the motor into place with the special bolts in place.

3.15 Reassembly – Part 3 – In Vehicle

This procedure is probably different from what others have recommended, because of a bad experience with a cross-threaded Bundy tube locking nut to the rack cable retainer.

Note: These instructions were created during the installation on a Sprint; therefore, some adjustments might be required during a Spider installation.

- **CAUTION**: Did you attach wiring harness and ground wire to the motor? Access is very limited once motor is mounted.
- **CAUTION**: At least for Sprints, there is a scrap of vinyl (not cut to specific shape) glued to the back side of the dash as a precaution against the motor terminals shorting out against the metal dash. Is it still there and securely glued?
- If installing new rubber motor mounts, the available reproductions appear to be closer to Durometer 90 than the original softer Durometer 50 (approximately).
  HINT: soak in very hot water for a few minutes before attempting to install.
- With the wheel box closest to the motor temporarily removed, install the complete unit into the vehicle without distorting the Bundy tubes.
- Install and tighten motor mount studs, washers, and nuts
- Loosely reinstall the wheel box, paying attention to align the good part of the gear with the cable.
- Align the wheel box post sleeves to chassis.
- Install and tighten wheel box spindle nuts and associated pieces.
  CAUSTION: do not install wiper arms at this time.
- Now that wheel boxes are aligned with vehicle's body, finish tightening screws on wheel box
  CAUTION: make sure the flare (or ferrule) of the Bundy tubes are in the correct position against the wheel box stops.
- Finish tightening the Bundy tube / gearbox locking nut.
- Briefly run the motor to verify that all components are lined up for smooth running.
  HINT: use amp meter to verify "light running" is within specification.
- **CAUTION**: Complete the auto-park alignment described next before installing wiper arms.

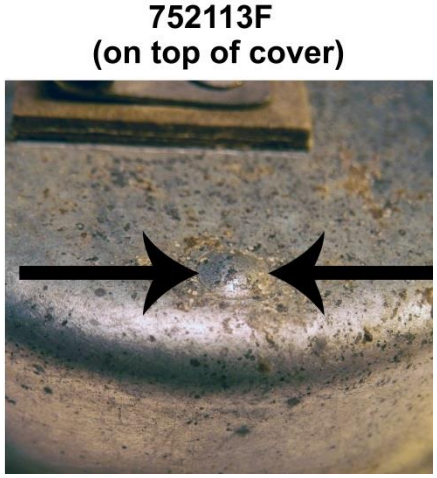
3.16 Auto-park Adjustment

The Lucas wiper motor should sweep 110 degrees of glass. The location of the sweep is regulated by:

- Position of the wiper arms on the wheel box spindle splines (5^0 per tooth)
- Position of the "auto-park cap" (the one you put a reference mark on earlier).

If the alignment marks were not made during disassembly or for some reason you suspect the original alignment, a starting point (according to **Austin-Healy 100-six Shop Manual**) is as follows.

- Align the bump on the cover with the groove in the gearbox cover (but 180^0 away from the actual groove).
- Then rotate the auto-park cover 25 degrees anti-clockwise.



Proceed as follows:
(Assumes entire system has been installed in the car, but without arms and blades.)

- Switch the motor "ON" and then "OFF" to let it auto-park.
- **CAUTION**: Installed simulated arms and blades made of plastic rods or straws so they are resting in the correct park position.
  HINT: Look in hardware store for vinyl "screw covers" the right size to fit over the spindles. Make a horizontal hole in them for the straw.
- Turn on the motor and check the sweep and auto-park positions.
- As needed, adjust the position of wiper arms on wheel box spindle splines and/or the position of the auto-park cap. Mark arm position.

This assumes that the beginning setting is approximately correct.

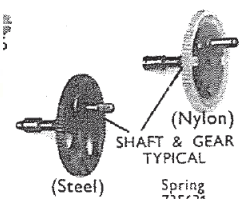
- Now install real arms and blades
- Wet the windshield and run the motor to see how they track.
- Make final parking adjustment.

Wiper Motor Assembly

3.17 Lucas Part Numbers

Much of the following comes from **Lucas Catalog 400E** which apparently was published about 1960.

Apparently the 5-digit part number has a letter added when a modification is made by Lucas. In the Lucas parts catalog there may appear a number like 75213A/E, which means all parts included in the A, B, C, D, and E versions are fully interchangeable. However if there is listed 75213A/E and 75213F in separate lines or columns in the catalog, this mean there are parts unique to the F version not found in A/E versions.

							
Year	**Lucas Model**	**Lucas Part #**					
		Motor	**Wheel Box**	**Brush + Holder**	**Brush**	**Guide Wheel Shaft Gear**	
Lucas Spare Parts 1942 – 1962 Catalog							
1956	DR2	75238 (Note 1)	72665	743171	729367	743268 (100^0)	
1957	DR2	75213	72699	as above	as above	744536 (110^0)	
1958-60	DR2	75213D	72699				
Lucas Catalog 400E / Section R (published 1960?)							
1956 Spider	DR2	75295 (Note 1)	No listing	735631	729367	743268	
1956-58 "1900"	DR2	75213A/E	No listing	743171	729367	744536	
1957-59 Spider Veloce							
1958-59 Sprint Veloce		75213F	No listing	as above	as above	744742	
101-1600 Alfa Parts Manual							
101-1600	DR3	(Note 2)	No listing	as above	as above	744912	
101-1600	DR3A		No listing				
As Found							
(Note 3)	DR2	75213E	72699**A**			Nylon teeth on steel disk & shaft	
(Note 4)		75213F	72699**A**				
(Note 5)			72699**B**				

- Note 1: Motor 75238 is in the **Lucas Catalog 400E** as being superseded by 75295.
  Motors 75238 and 75295 are listed as having a 100^0 sweep, instead of the 110^0 sweep of 75213.
- Note 2: based on being the only 110^0 sweep, single speed DR3 motor, the part number is probably 75356A/B.
  The listed brushes and guide wheel are based on that assumption.
- Note 3: 1958/August, 750E Transition Sprint Veloce 1493.06920
- Note 4: 1959/mid-year, 101 Sprint Normale 1493.20716
- Note 5: 1959/November, 101 Sprint Normale 1493.21091

Wiper Motor Assembly

Cross reference from **Lucas Catalog 400E**

- Motor 75295 also used on 1958-60 Morris Minor 1000 and others.
- Motor 75213 also used by 1959 AH Sprite and 1957 Morris Minor 1000.
- Motor 75213F also used 1959-1960 AH Sprite
- Wheel box 72699 is unique to Alfa Romeo.
- Brush set and brushes common to many vehicles
- Guide wheel / shaft gear is unique to Alfa Romeo

3.17.1 Part Sources

eBay store "Classic Bits" in the UK has brushes, motor mounts, and other parts.

- Note that with their complete motor mount kit; the stud is shorter than the original (0.88" vs. 1.15") and the washers have ¼" holes instead of #10.

The following has been provided by others and has not been personally verified.

- NOS Locators, eBay #200804937435.
- Holden UK is well stocked with windscreen wiper system parts, even new splined posts and racks. They also have wiper arms especially designed to fit on worn out splines.

3.17.2 Substitute Motors

The following has been provided by others and has not been personally verified.

- 105 Bosch wiper motor will fit.
- DR3 motors come in both single-speed and 2-speed and various sweep angles
  - Use a 2 speed motor out of a Triumph Spitfire. It bolted right in.
- DR3A 2-speed motor used in Triumph TR4A

Wiper Motor Assembly

4 Thermal Switch (Circuit Beaker)

Lucas Catalog 400E / Section R only list one thermal switch, part number 78316.

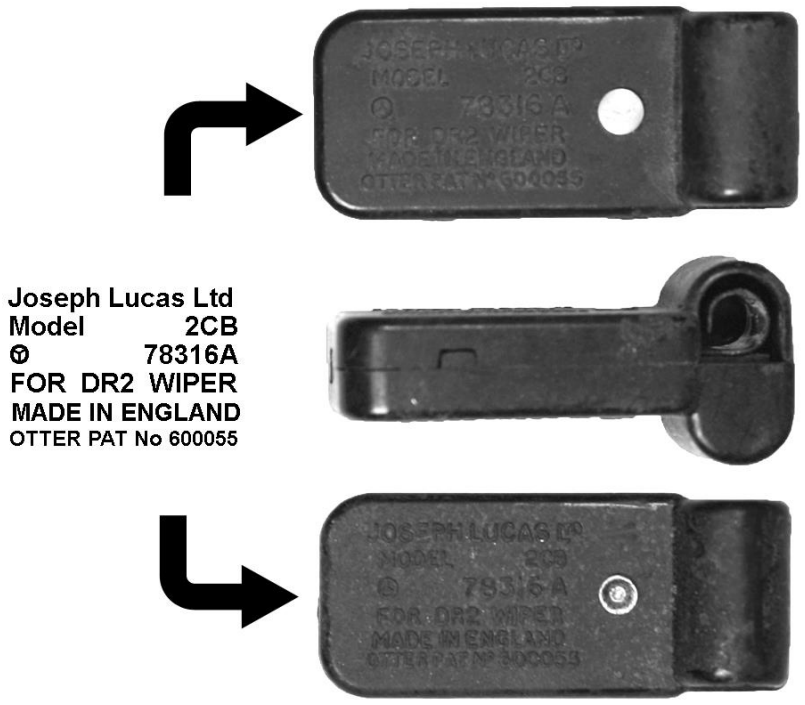
While Alfa included a thermal switch in-line with the +12 volt feed to the DR2 wiper motor, **Lucas Technical Service / Section 8** states:

> "The DR2 is not thermostatically controlled, since the motor is designed to withstand stall current for considerable time."

However, embossed on the 78316A thermal switch is "FOR DR2 WIPER".

The older DR1 was thermostatically controlled.

No Alfa Part Number



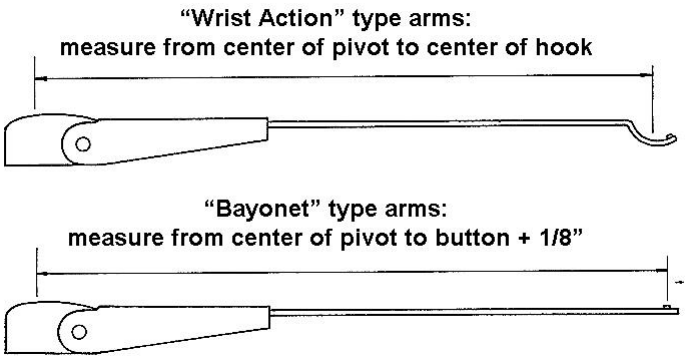
The following has been provided by others and has not been personally verified.

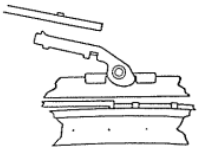
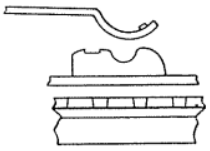
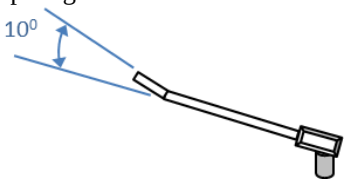
> The original can be replaced with a modern thermal relay such as used for Ford power windows. They can be purchased in various amperages.

5 Wiper Arm

5.1 Application by Alfa & Vendor Numbers

The following is from 750-101 parts manual, 101-1600 parts manual and From Lucas Catalog 400E / Section R.



Bayonet	Wrist Action	Tip Angle
		

- R.H (right hand) and L.H. (left hand) is as viewed from the driver's seat.
- The catalog does not correctly indicate that Sprint or Spider place direction of tip bend on opposite sides.

Vehicle Serial# Range	Arm Brand	R.H. Alfa / Vender #	Tip Angle	L.H. Alfa / Vender #	Tip Angle	Comments
Berlina & t.i.						
Not listed	Marelli	Not listed / T.G.E. 628A	?	Same as right	?	
Not listed	AVOG	1488.80.015 / M.10-212	?	Same as right	?	270 mm length
Not listed	S.W.F.	1488.80.019 / Not listed	?	Same as right	?	Wrist Action
		1488.80.021 / Not listed	?	Same as right	?	Bayonet
Not listed	Marelli	1488.80.022 70410301	?	Same as right	?	
Sprint & Sprint Veloce						
Sprint up to 1493.00300	S.W.F.	1493.80.002 wvs301/150a/r	?	1493.80.009 wvs301/150a/l	?	
Sprint after above up to 1493.03402	S.W.F.	1493.80.012 wvs201/150a/r	?	1493.80.011 wvs201/150a/l	?	
Sprint 1493.03403	S.W.F.	Same as "up to 1493.00300				For one car?
Sprint Veloce	S.W.F.	Not listed / wos20/150r	?	1493.80.002 wos201/150a	?	
Not listed (Note 1)	Lucas Style A	1495.80.013	10^0	1493.80.021	10^0	Bayonet
	Lucas (Rainbow) Style B	1495.80.002		1493.80.017		Wrist Action

Wiper Arm

101-1600 with DR3 motor	Not listed	102.04.65.504.01		102.04.65.505.00		Bayonet (based on parts manual drawing)
Spider & Spider Veloce						
Same as Lucas Style A and Lucas (Rainbow) Style B above.						
SS						
All	Marelli	101.20.65.504.01	15^0	101.20.65.505.01	None	Bayonet 355 mm length
SZ						
All	Marelli	101.26.65.505.00	?	Same as right	?	?

- Note 1: These numbers also cover 101-1600 Sprints with DR3A motors, but not those with DR3 motors. (A parts manual error?)

5.2 Lucas

5.2.1 Correct Width, Length & Offset

- Sprints and Spiders used the same arms.
- Lucas spinal diameter is 0.54”
- Lucas width for original equipment blade tip was 0.20”
- Lucas produced wiper arms with 10^0 and 15^0 offsets. Which is correct?
  - The original owner of a 1958 Spider, with original wiper arms, verified that they were 10^0.
- Lucas produced wiper arms in several lengths. Which is correct?
  - Again the one owner 1958 Spider verifies 11 $^1/_2$” wrist action style was original to his car.

5.2.2 Lucas Numbers

The following data is from Lucas Catalog 400E / Section R.

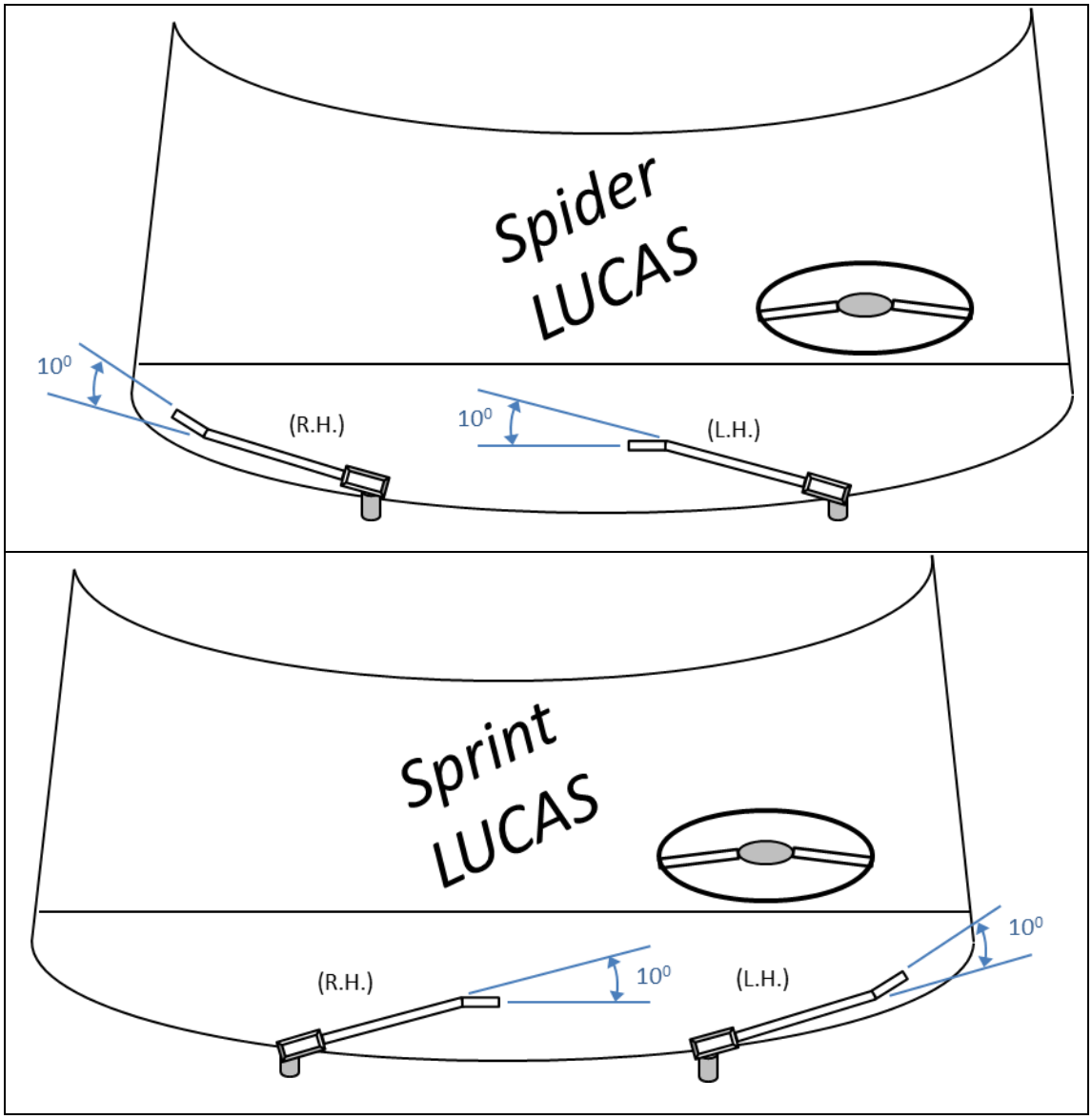
- Arms appropriate for Alfa is apparently “spline fixing” type, also labeled “cranked” type.

Length	Finish	Tip Angle	Lucas #	Position	Color Spring Anchor Pin (Strength)
• R.H and L.H is as viewed from the driver’s seat. • The catalog does not specify Sprint or Spider, which place direction of tip bend on opposite sides.					
Bayonet type					
11 ½”	Chrome	10^0	54711536	R.H.	Blue (7-9 ounce)
			54711537	L.H.	
			54711434	R.H.	Red (9-11 ounce)
			54711212	L.H.	
Wrist Action type					
11 ½”	Chrome	10°	54711555	R.H.	Blue (7-9 ounce)
			54711556	L.H.	
			54711561	R.H.	Green (5-7 ounce)
			54711562	L.H.	
			54711573	R.H.	White (11-13 ounce)
			54711574	L.H.	

- Which spring strength is correct has not been determined, but since “blue” is the only one for both arm styles; it is the most likely.
- A check of the wiper blade pressure on the screen is important. It needs to be just enough to keep the blade in contact with the screen. Excessive pressure leads to burning out armatures when operated on a nearly dry screen.

Wiper Arm

5.2.3 Arm Orientation



- Moving the wiper blade arm one tooth on the wheel box spindle changes the arm position 5 degrees.

5.2.4 Substitute

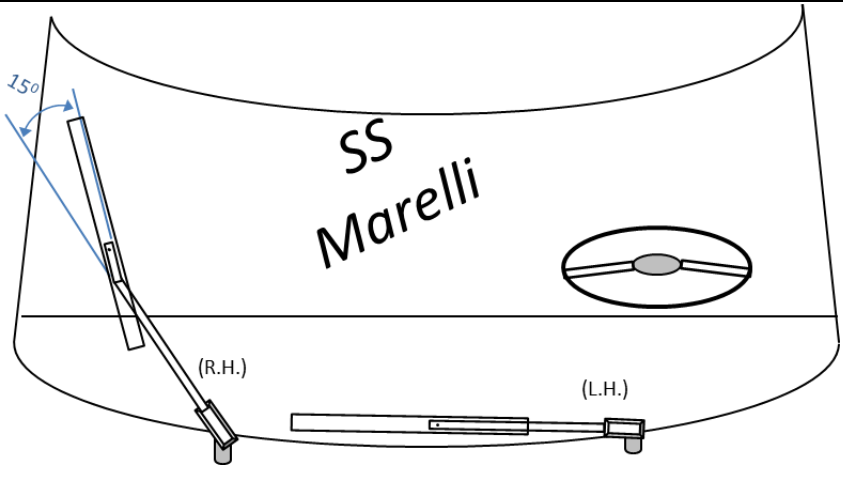
- 1955-57 Chevy wiper arms, ones purchased 2017 from Tamraz's Parts Discount Warehouse, 10022 South Bode Road, Plainfield, Illinois 60585*8776 were close enough at:
  - Chrome, for 0.55" spindle, 0.20" width, 11 ¾" length
- **Lucas Equipment and Service Parts CCE902/69** list 54711536 for Standard-Triumph.

5.3 Marelli – SS only

5.3.1 Correct Length

Based on measurement of Giulia SS AR381130 the length from the center of pivot to the retaining prong is 355 mm. If you use the Lucas method of measurement (add $^1/_8$") it would be 388 mm.

5.3.2 Arm Orientation



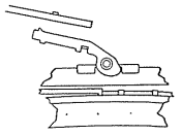
5.3.3 Substitute

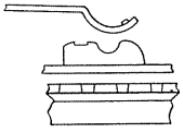
2600 Berlina

6 Wiper Blades

6.1 Application by Alfa & Vendor Numbers

The following is from 750-101 parts manual, 101-1600 parts manual and From Lucas Catalog 400E / Section R.

Bayonet 

Wrist Action 

Vehicle Serial# Range	Blade Brand	Alfa # / Vender #	Length	Comments
Berlina & t.i.				
Not listed	Marelli	1495.80.001 / T.G.E.608/20B	?	
Not listed	AVOG	1488.80.014 / M.100-73	?	
Not listed	S.W.F.	1495.80.001 / Not listed	?	Wrist Action
		1495.80.023 / Not listed	?	Bayonet
Not listed	Marelli	1488.80.023 / Not listed	?	
Sprint & Sprint Veloce				
Sprint up to 1493.00300	S.W.F.	1488.80.010 W.P.B. 28	?	
• Sprint after above up to 1493.03402 • Sprint Veloce – all implied	S.W.F.	Not listed / W.P.B. 28	?	Must be same as above
Sprint 1493.03403	S.W.F.	Same as above		For one car?
Not listed (Note 1)	Lucas Style A	1488.80.023	11” (Note 1)	Bayonet
	Lucas (Rainbow) Style B	1495.80.001		Wrist Action
101-1600 with DR3 motor	Carello	101.02.65.503.00		Bayonet (based on parts manual drawing)
	Lucas	101.02.65.503.01		
101-1600 with DR3A motor	Lucas (Rainbow)	Same as above Lucas (Rainbow) Style B		
	Carello	101.02.65.503.00	11” (Note 1)	Bayonet (based on parts manual drawing)
	Lucas	101.02.65.503.01		

Washer

Spider & Spider Veloce				
750 & 101-1300 are same as Lucas Style A and Lucas (Rainbow) Style B above.				
101-1600	Same as 101-1600 Sprint with DR3A motor			
SS				
all	Marelli	102.00.65.503.00	(Note 2)	Bayonet
SZ				
All	Marelli	Same as SS		

- Note 1: Lucas blade length of 11 inches is based general consensus of 750-101 group.
- Note 2: Probably 310 mm (12 inch) length.

6.2 Lucas

6.2.1 Correct Width & Length

- Sprints and Spiders used the same arms.
- Lucas width for original equipment blade tip on wiper arm was 5.2 mm.
- Lucas produced wiper arms with lengths of 8”, 9”, 10”, 11”, 12”, and 14”. Which is correct?
  - The consensus appears to be 11”.

6.2.2 Lucas Numbers

The following data is from Lucas Catalog 400E / Section R.

Length	Finish	Lucas #	Difference
Bayonet type			
11”	Chrome	54711281 54711282	?
Wrist Action type			
11”	Chrome	737897 (Note 1) 54711280	?

- Note 1: 737897 “new old stock” package also lists additional numbers B1841 and WB3.

“Rainbow” blades also sold under the Trico label.

6.2.3 Substitute

The following has been provided by others and has not been personally verified.

- **Lucas Equipment and Service Parts CCE902/69** list 54711281 for Standard-Triumph.
- Centerline’s Anco brand blades don't fit securely on the arms - they pull off too easily.
- TR250 and Spitfire
  - The blades are 11”; however, some vendors list them for 5 mm arms and some list them for 7 mm arms. Use of 7 mm wide would require also using non-original 7 mm wide wiper arms.

The following would not be correct:

- 7.1 mm width arms, although these are 11” blades: Hillman Avenger Estate 1975-78, British Leyland 1100, 1300 Mk2 & Mk3, Marina Estate 1975-78, Mg 1100, 1300 Mk2 Mk3 1968-71, Riley Kestrel Mk2 1968-69, Triumph Gt6 Mk2 1969-70, Triumph Tr6 1969-72
- 12” blades: MGB

6.3 Marelli – SS only

6.3.1 Correct Length

Based on measurement of non-original, but functional, blades used on Giulia SS AR381130 the length is 310 mm.

6.3.2 Substitute

Caste iron 2000.

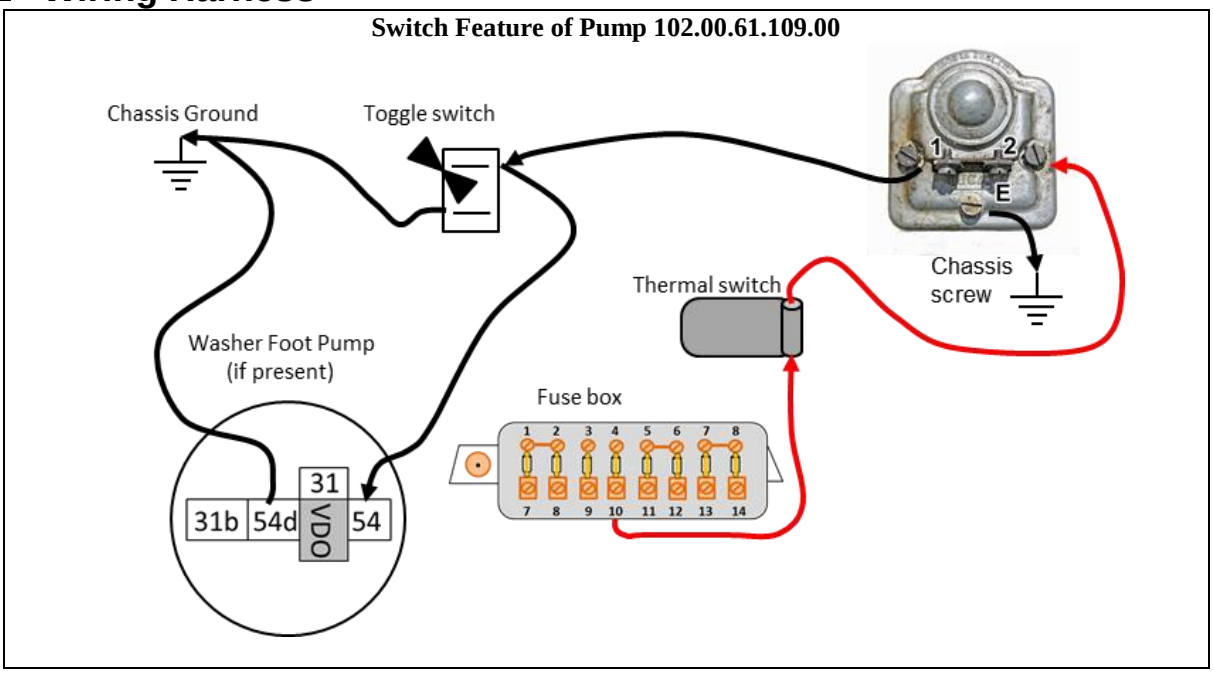
7 Washer Bottle, Bag & Pump

7.1 Application by Alfa Numbers

Model	Brand	Alfa # / Vendor #		Comments
		Bottle or Bag	Pump	
Sprint	Tudor	1493.86.718 / Not listed	1493.86.715 / Not listed	Hand pump. bottle
	VDO	102.00.61.108.00 / Not listed	102.00.61.109.00 / Not listed	Foot pump, bag

7.2 Wiring Harness

Switch Feature of Pump 102.00.61.109.00



8 British Association Fasteners

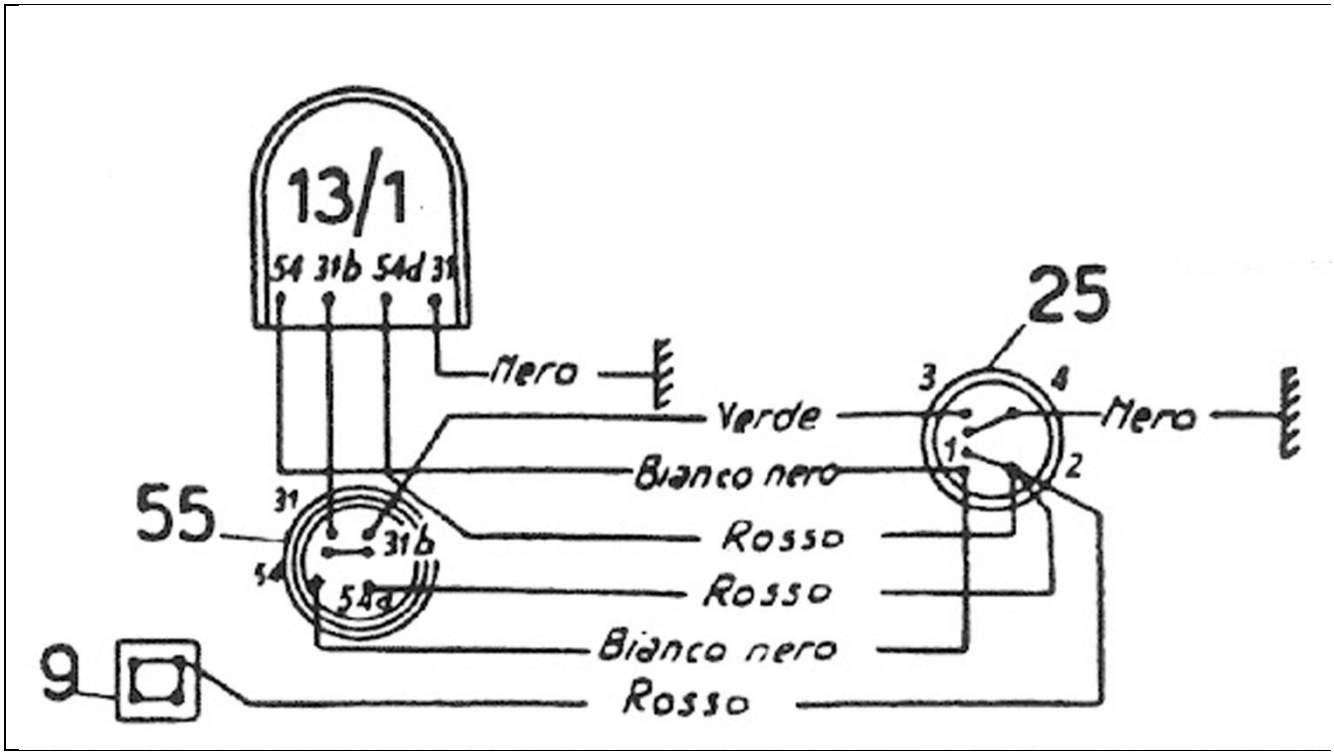
From Wikipedia:

BA sizes are obsolete fasteners that were defined by specification from the British Association in 1884.

The angle of the thread is 47.5 degrees which is different than Whitworth (55 degrees), US Unified threads (60 degrees) and ISO Metric (60 degrees).

British Association Fasteners			
BA	**OD (mm)**	**Threads per inch**	**OD (inch)**
0	6.00	25.40	0.2362
1	5.30	28.22	0.2087
2	4.70	31.36	0.1850
3	4.10	34.79	0.1614
4	3.60	38.48	0.1417
5	3.20	43.05	0.1260
6	2.80	47.92	0.1102
7	2.50	52.92	0.0984
8	2.20	59.07	0.0866
9	1.90	65.13	0.0748
10	1.70	72.57	0.0669
etc.			
25	0.25	352.78	0.0098

9 SWF Wiring


13/1
54 31b 54d 31
25
3
4
1
2
Nero
Verde
Nero
Bianco nero
55
31
31b
54
54a
Rosso
Rosso
Bianco nero
9
Rosso