RAUCH & SPIEGEL

# TECHNICAL INFORMATION

## 1013.2 REV B

SSF P/N: 22.9984.208 R&S P/N: 272.241.B

SUBJECT: Improved design of Mercedes Benz 272 / 273 intake manifold tumble flap lever upgrade kit.

REASON: Professional feedback indicated that some found dealing with the spacer and shim necessary for installation of previous design a bit clumsy. Failure of the original pivot bolt during its removal or re-installation prevented re-use as called for with the previous design.

EXECUTION: The new design incorporates a stainless steel pivot bolt into the assembly as an integral part. No shims or spacers are required for installation as all necessary clearances and fits are accommodated for in the design of the new integral bolt. The lever component of the assembly with all of it's benefits and technical nuances, remains unchanged. The hybrid stainless / ceramic bearing specification remains unchanged.

INSTALLATION: Ease of installation has been enhanced considerably with the elimination of the need to manipulate and monitor a shim and spacer. Instructions from previous version have been modified to reflect the changes in technical requirements. Many of the original photo illustrations have been retained however, due to their continued applicability. The revised instructions should be reviewed carefully as some procedures and important specifications have changed.

# Model Year 2005 and Later 272 and 273 Engines
# Tumble Flap Bellcrank Upgrade Kit
## SSF P/N: 22 9984 208

**Please read through this entire document before proceeding with installation.**

**For Professional Use Only**

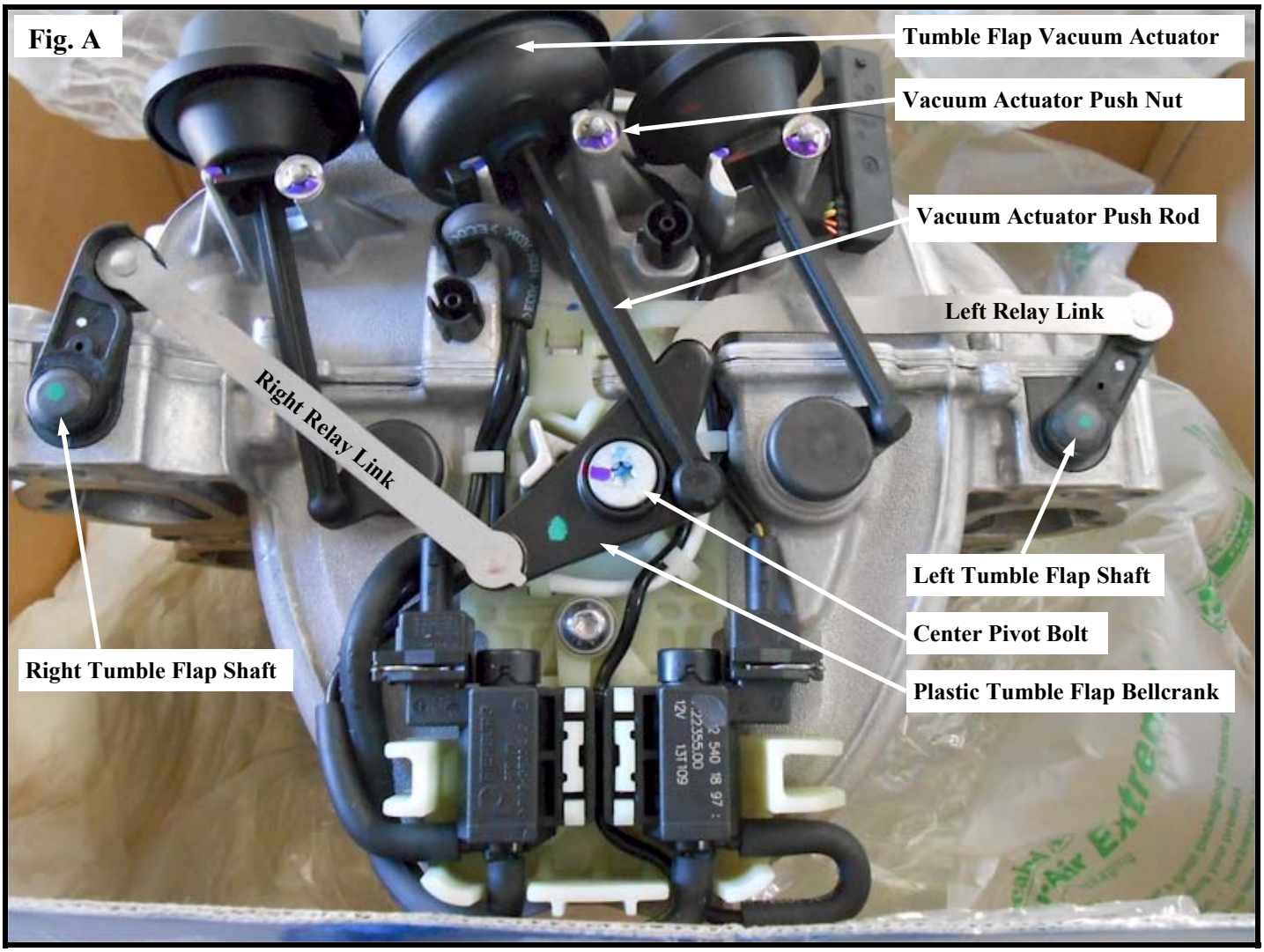



**FIG. A Front of V6 Manifold Shown**

**Conventions used in this document:** Front, back, left, right, top, bottom, horizontal, vertical, azimuth, above, below, etc. refer to the intake manifold orientation as mounted in the vehicle with you sitting in driver's seat. Therefore, most of the right-left references in the instructions will be shown reversed in the photos because you will be looking back at the front of the intake manifold.

**Handling and installation of the new Upgrade Bellcrank:** The high precision hybrid ball bearings used in this assembly are highly susceptible to damage from sharp mechanical shock. Even a short drop onto a hard surface can cause severe damage. In addition, attempting to remove the bearing or the special bolt from the assembly will ruin it. Warranty claims for mishandled or attempted removal of bearings or bolts will be denied.

In accomplishing this upgrade, you will be replacing the weakest link in the mechanism with the strongest link in the mechanism. Please read and follow the "Checks and Limits" section that follows in the "Step by Step" instructions below during installation of the new bellcrank.

# INSTALLATION NOTES and TIPS

**Background** Tumble flaps are nifty little airfoils that, when actuated by the engine management system, partially block the air flow to the intake ports in such a manner that they create a great deal of turbulence and increased velocity . This turbulent or "tumbling" air acts to help keep injected fuel in a more atomized state on its way to the combustion chamber. This contributes to better fuel economy and lower emissions under light-load, part-throttle driving conditions. When more power is demanded of the engine, the tumble flaps quickly rotate out of the air stream and tuck-away into pockets in the side walls of the intake manifold runners, allowing the intake system to attain maximum air flow.

The common failure of this system is breakage of the plastic central actuating bellcrank that translates the motion of the vacuum actuator to operate the tumble flap shafts. The general under-hood environment combined with the frequent cyclical stresses of operation eventually will cause the original plastic lever to fracture, usually from one of the molding segment lines that form the ball stud to the stress riser at the nearest sprue removal point. Because the ECM monitors the positions of the tumble flap shafts with sensors at the rear of the manifold, the ECM will set the CEL and store code(s): **P2004** (tumble flaps stuck in actuated position); **P2006** (stuck in non-actuated position) and/or **P2005** (mechanical fault of one actuating lever) when the bellcrank fails.

**Overview** This upgrade is really pretty simple and straight forward. To begin, you'll be removing the old Plastic Tumble Valve Bellcrank (or whatever is left of it) by disconnecting it from the (3) ball and socket joints and by removing the Center Pivot Bolt. Installation of the upgrade bellcrank is now even easier than before! Bolt the new up-grade lever onto the manifold by threading in the integral bolt and snap the ball and socket joints back together. You could easily figure this out on your own if someone just handed you the parts included in this kit.

The purpose of what follows is mostly to help you **preserve the mechanism parts which must be reused** by avoiding damage to them, particularly during disassembly. The mechanism parts that you will be re-using / re-attaching are all mostly made of plastic or thin stamped steel. They are all fragile in one way or another. Extreme caution must be exercised during disassembly not to bend a relay link or damage its' ball stud in any way. When disconnecting the plastic Vacuum Actuator Push Rod from the Old Plastic Bellcrank, always bear in mind that your objective is to preserve the plastic ball socket of the push rod in a pristine condition.

## Tips

**Removal of the old Plastic Bellcrank:**

While the design of the ball and socket joints used in this mechanism allow for adequate radial motion, it allows for very little angular deflection in the axial plane. There is barely enough deflection allowed by the ball and socket joint on one end of a link to allow for separation of the ball and socket at the opposite end without bending the Relay Link that connects them. This shouldn't be a problem if all unintended or uncontrolled accidental separating forces are eliminated. For instance, if one were to simply pull hard enough by hand on one of the original ball and socket joints to cause separation, the resulting uncontrolled over-travel caused when the joint suddenly "pops" apart will most likely either bend a Relay Link or break the plastic lever attached to the Tumble Flap Shaft. Obviously a slow and controlled separation of the joint is what's needed here.

We have found that the pincers of ear-clamp pliers work very well for separating the (3) ball and socket joints from the original Plastic Bellcrank. By locating the sharp edges of the pincer jaws on either side of the joint in the small space between the Plastic Bellcrank and the ball or socket being removed and slowly, gently squeezing the handles together, the jaws should easily and controllably separate the joint by wedging it apart evenly from opposite sides with no over-travel. Damage to the steel ball studs on the Relay Links can also be easily avoided by using this method due to the amount of control afforded by it.

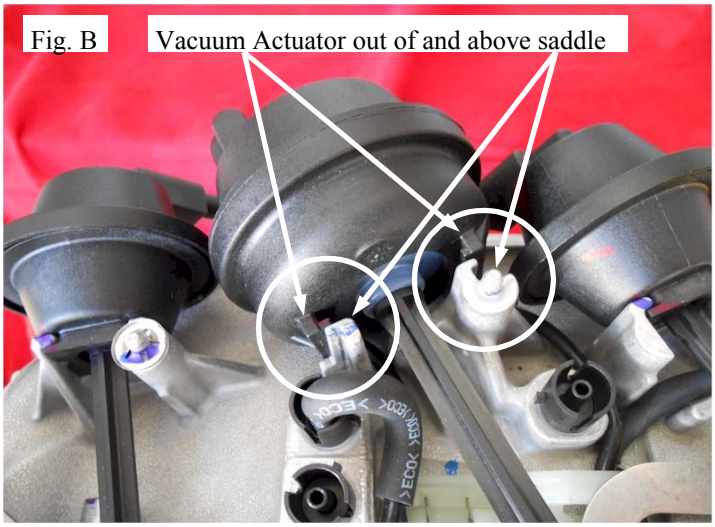
No matter what method you decide to use to remove the old Plastic Bellcrank from the mechanism parts which must be re-used, please just take your time, think ahead and don't bend, break or damage anything.

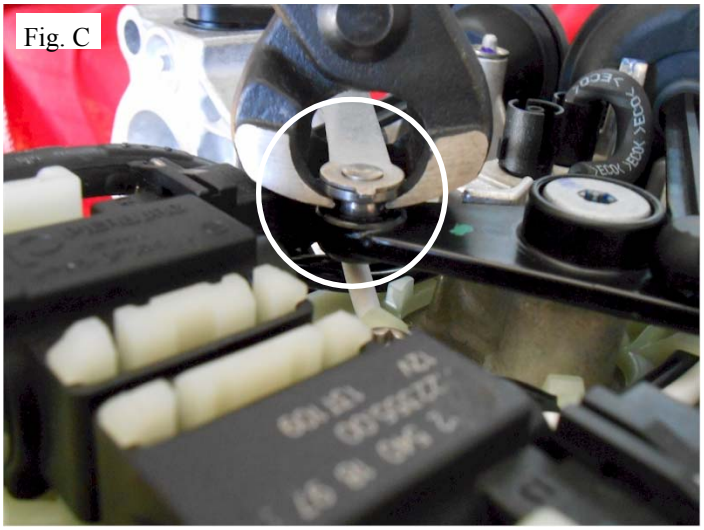
1) Remove the intake manifold from the engine following the manufacturer's recommended procedures and with the observation of all cautionary statements.

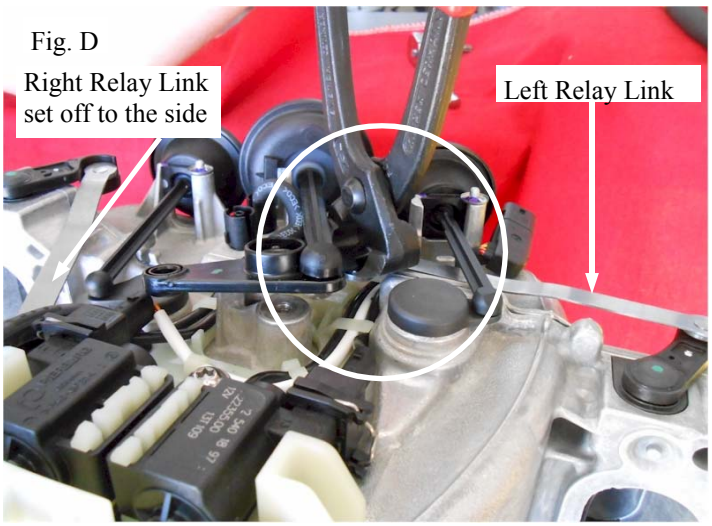
2) Referring to **Fig. A** on Page 2, locate the **Vacuum Actuator Push Nut**. Remove the push nut. **Be careful not to damage the cast aluminum pin.** These push nuts are one-time-use items and aren't intended to be re-used. Not to worry! We have included a new push nut for use later during re-assembly.

3) With the push nut removed, carefully slide the **Vacuum Actuator** forward off of its' mounting saddle. If the old Plastic Tumble Valve Bellcrank is still intact where it attaches to the Vacuum Actuator Push Rod, this will un-load the spring pressure from the actuator on the mechanism and the actuator will "pop" up. Don't pull the actuator off the saddle any further than necessary to get it to clear and get the vacuum chamber portion of it above the saddle mounting. (**Fig. B**)

4) Carefully disconnect the ball and socket joint between the Right Relay Link and Plastic Bellcrank (**Fig. C**) Lift the ball stud out of the socket only far enough to get it out and off to the side of the bellcrank. (**Fig. D**) Don't damage the ball stud !! (Remember the right link is on your left and visa-versa in pics.).



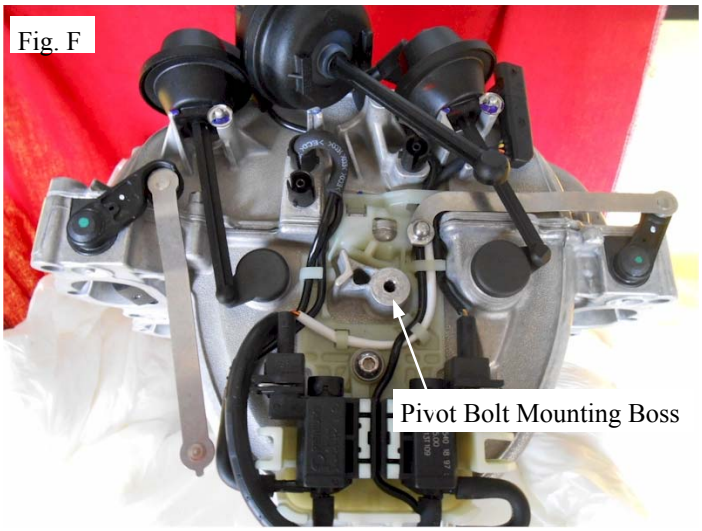


5) Remove the Center Pivot Bolt (Torx #30 Tool). This will give you a little room to move things around. Don't force, bend or break anything! Reposition things if necessary to get a clear shot at the joint, just be careful.
Note: This new REV B. version does not re-use the original pivot bolt.

6) Carefully disconnect the ball and socket joint between the Left Relay Link and Plastic Bellcrank (Fig. D) Don't damage the ball stud or bend or twist the relay link! Note: Ball stud enters bellcrank from behind and is hard to see. There is not enough room behind bellcrank to separate the joint completely with the bolt fully installed.

7) Carefully disconnect the ball and socket joint between the Vacuum Actuator Push Rod and Plastic Bell-crank (**Fig. E**) **Don't damage the plastic ball socket** on the end of the Push Rod! Front of intake manifold should now look like (**Fig. F**).

8) Looking into the intake ports while gently operating the Tumble Flap Shafts by hand, check for any deposits on the plastic tumble flaps or their plastic seats that could impede the tumble flap's rotation from fully closed to fully open ( about 56° total rotation ). Clean away any offending deposits and re-check for full and smooth Tumble Shaft rotation. **Don't force anything**! This stuff is all plastic and there are no travel stops on the Tumble Shaft levers. Clean and inspect the Relay Link ball studs and carefully remove and polish any nicks or burrs that might have been inflicted on the balls during joint separation. Ball diameter, surface finish, roundness and cleanliness are all important. Place the Relay Links approximately in the positions shown in (**Fig. F**) below.




9) Remove all dirt, grease and oil from the face of the pivot bolt mounting boss (Fig. F) and the working faces of the bellcrank stop flanges (Figs. J & K). Check for and carefully remove any burrs or damaged thread material that might be protruding above the mounting boss face. Thoroughly clean and inspect the threads in the mounting boss. This is fairly easily accomplished by simply chasing them with an M6 x 1.0 bottoming tap and blowing-out with compressed air (wear safety glasses).

10) Apply Loctite® 242 or similar anaerobic to the first few threads on the end of the new upgrade lever's integral bolt. Start the threads of the integral bolt into the mounting boss threads by hand. You will need a **Torx #27** tool to turn this bolt. After threading-in approximately 3-5 turns and with the new bellcrank oriented as in (Fig. J), squeeze the ball stud of the Left Relay Link into the corresponding ball socket of the new bellcrank with your fingers until it snaps in. (Ball stud enters from behind and little effort should be required). Continue threading-down bolt until it's shoulder lightly seats against the mounting boss face. Torque the bolt to 70 inch pounds. (8 newton meters). **DO NOT** over-tighten!

Operate the new bellcrank and left tumble flaps gently by hand through the full range of motion and make sure that there is no binding or interference and that motion is smooth and effortless. Bellcrank stop flanges (**Fig. J & K**) should control the limits of motion, NOT the tumble flaps. Correct any problems.

11) Connect the Right Relay Link to the new bellcrank by snapping the link's ball stud into the new bellcranks socket with your fingers. (**Fig. L**) Check as in #10 above for full, smooth and proper operation and travel. Correct any problems.

## CHECKS and LIMITS

12) Referring to (Fig. J) and (Fig. L), make sure that the cast-in bellcrank travel limit stops are controlling the limits of travel of the mechanism as a whole and NOT the tumble flaps. Hold the bellcrank gently against one of the stop flanges and check that there is no tension or compression being exerted on the Relay Links for either side. Hold the bellcrank gently against the other stop flange and check for tension or compression in the Relay Links. In the absence of tension / compression, the ball and socket joints at ends of the new bellcrank will feel slightly loose in the fore-aft (longitudinal) direction. Correct any problems and re-check.

13) Referring to (**Fig. M**), connect the plastic ball socket of the Vacuum Actuator Push Rod to the stainless ball stud on the new bellcrank by snapping it on with your fingers. Reset the Vacuum Actuator into its'

saddle and install the new push-nut (included in kit) fully onto the cast pin to retain the actuator.

14) Re-install the intake manifold per manufacturers recommended procedures. Check for proper operation and clear any related stored trouble codes.

Fig. J

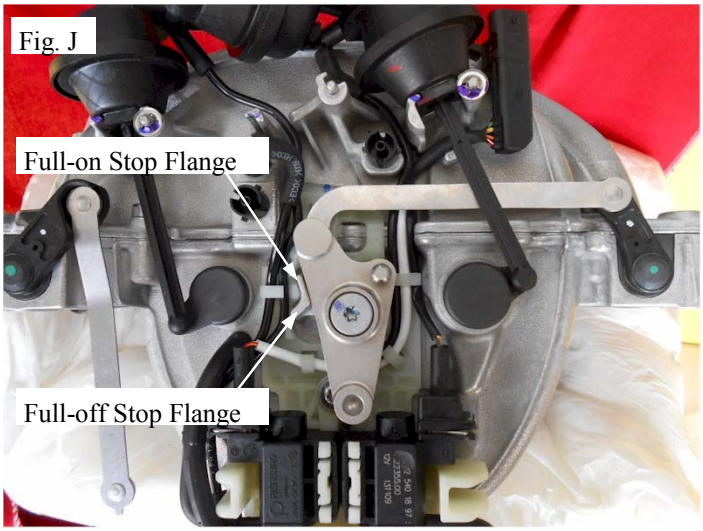



Fig. K

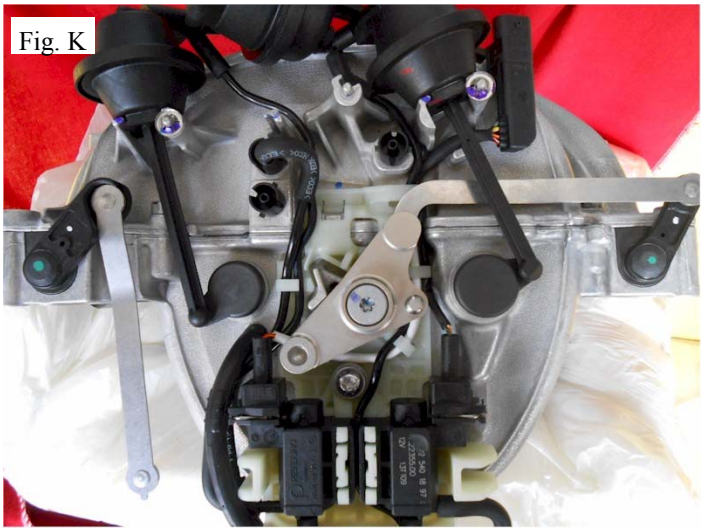


Fig. L

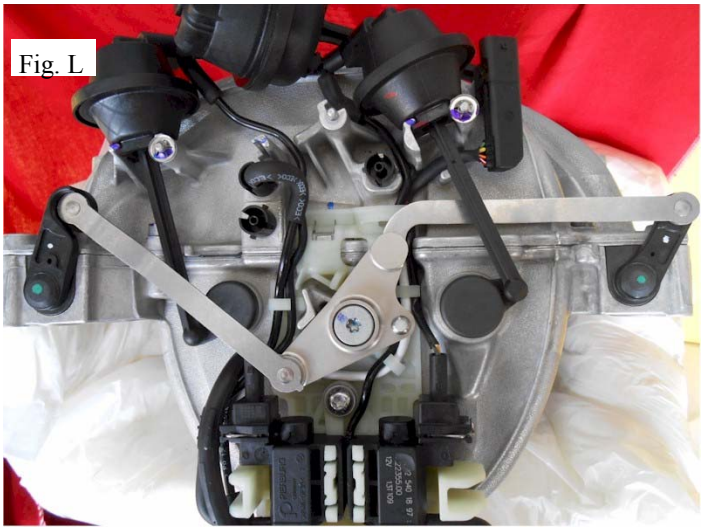


Fig. M