

## **Silicone Rubber Oil Pan Gasket Installed With Tabbed Lock Washers**

I just completed my second replacement of the oil pan **gasket** on my 90' S4.

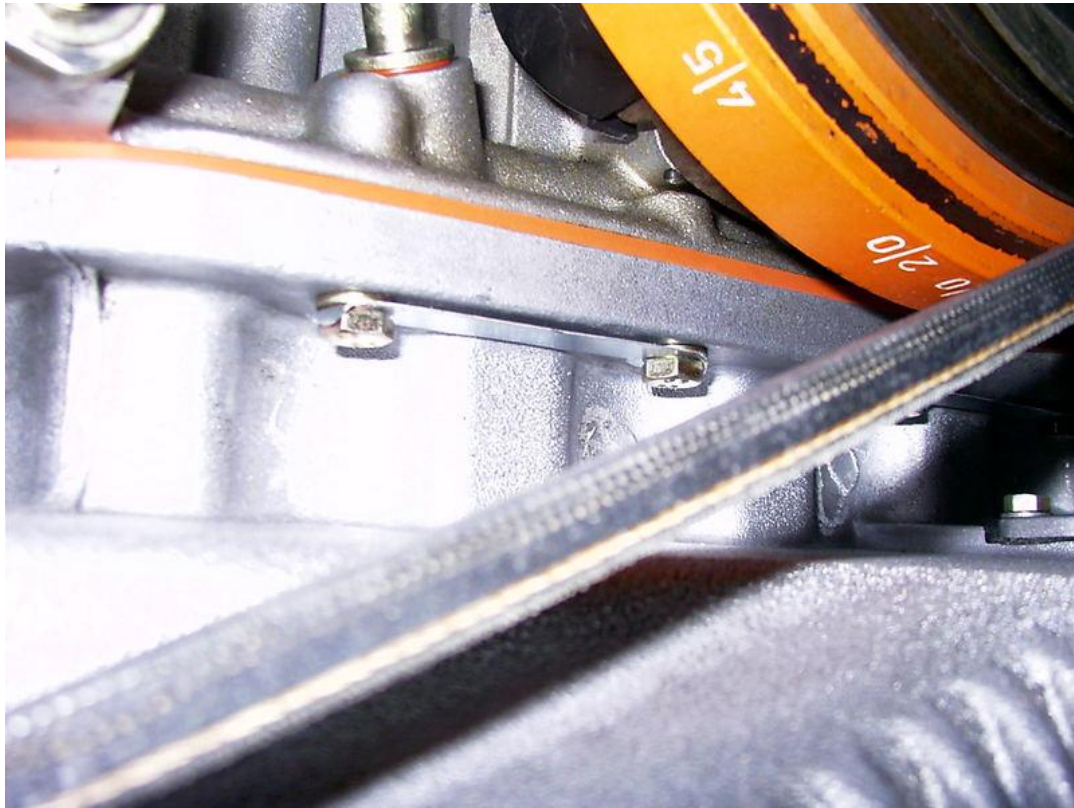
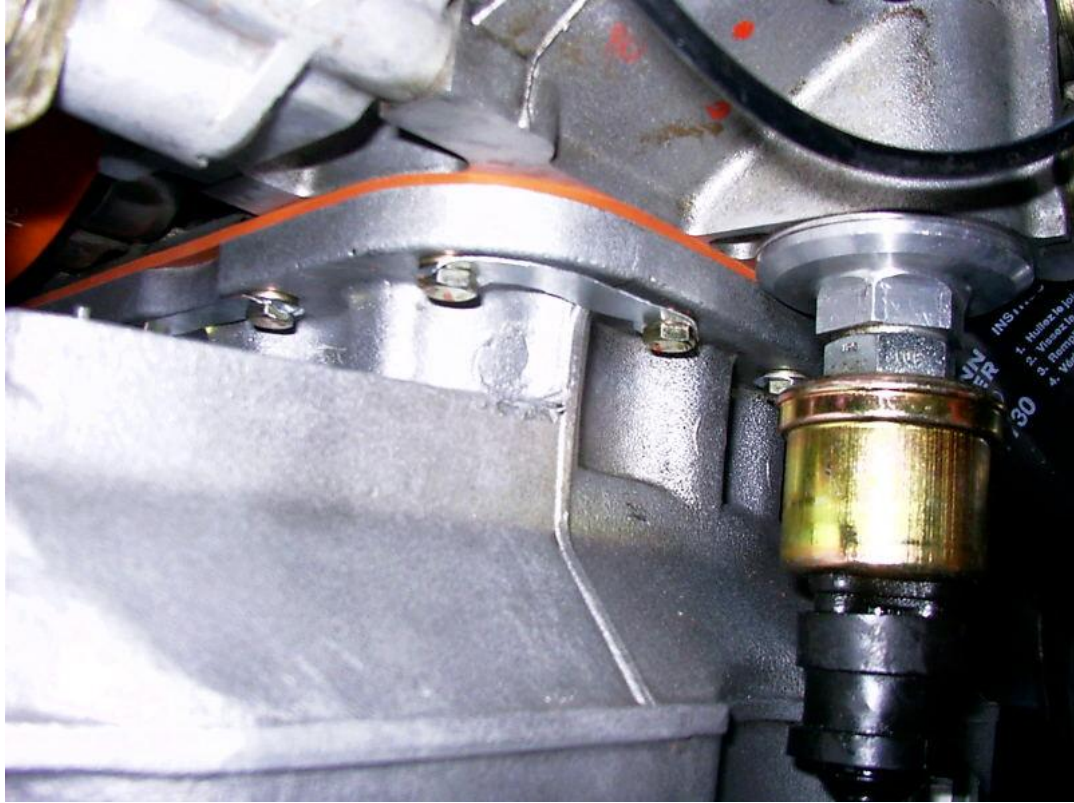
The aftermarket cork **gasket** I installed in 2003 was starting to weep oil, so I replaced it with the **silicone** rubber **gasket** by RealGaskets.

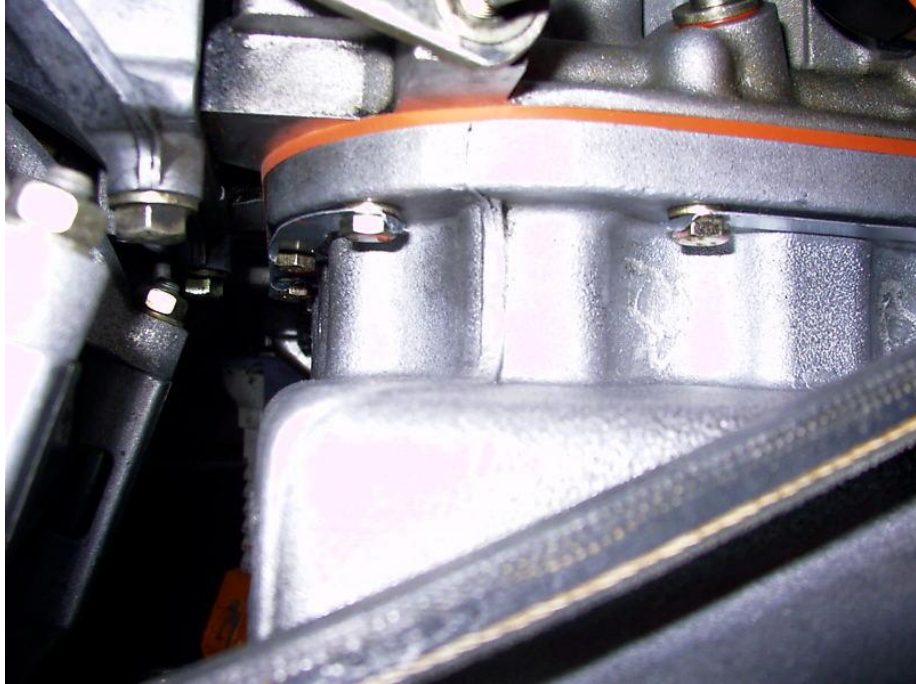
RealGaskets recommends tightening the pan **gasket** bolts to between 20 and 30 inch-pounds. That's not much torque that the bolts won't work loose rather quickly without using a thread locker compound or by using one of the stud kits with lock nuts.

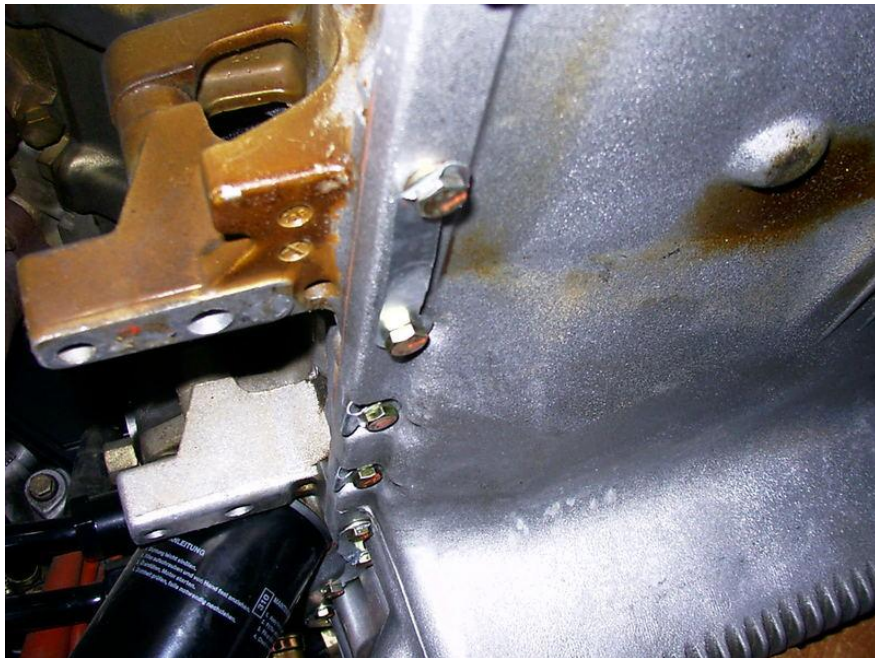
As an alternative to studs or locking compound, I made and installed a set of tabbed lock washers that were easy to fabricate.

Here's some photos of the the tabbed lock washers layed out on the new **gasket** and after being installed....









Instead of applying a torque wrench to the pan bolts, I tightened them by counting the number of fractional turns. I used a grease pencil to mark the bolt heads where tightened at the finger tight position, then tightened all bolts to ½ turn, in 1/8 turn increments, working my way around the pan.

Because of some irregularities of the washers being seated against the pan, finger tightness is not that precise. During final run of tightening, I maintained bolt torque by feel, which kept some bolt positions slightly less than full ½ turn. I didn't consider the non-uniform bolt spacing on the oil pan as a significant factor.

Just for comparison, I tried to measure the torque on the bolts as I tightened them in increments, but unfortunately my torque wrench scale is 40-100 inch-pounds, so I can't say with any certainty what the maximum torque I used on the pan bolts, but it probably was about 30 inch-pounds (My ¼" Snap-on wrench can be turned down about 10 inch-pound below the scale, but may not be accurate there).

I found that bending the tabbed washers over the bolt head flats was easy. After bending the tabs up slightly for starters, a pair of needle nose pliers finishes the job. I used either a paint lid opener or flat screwdriver to initiate bending for each tab. Locating each M6 flat washer below the tabbed washer makes bending the tab much easier.

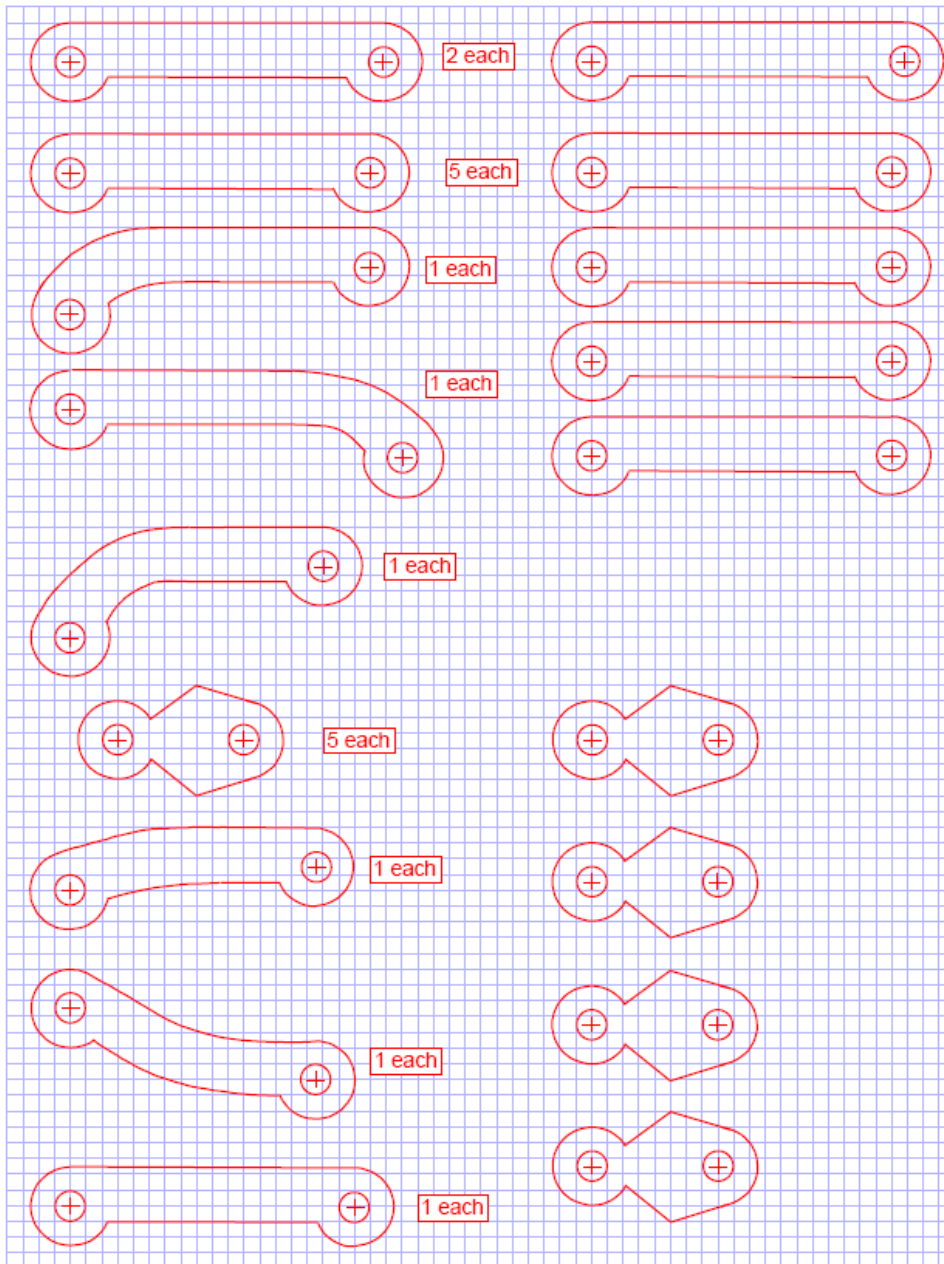
The factory bolts (30) can't be reused with the tabbed washers due to the bolt's captive washers. So the tabbed lock washers require standard bolts with standard flat washers. Since the **silicone gasket** is only 3.15mm thick compared to the factory cork **gasket** of 4.0mm, shorter bolts can be utilized to prevent the bolt bottoming out in the threaded cavity. I used mostly M6x1.0x25 hex head bolts, and some longer M6x1.0x30 where the bolt threads can be seen extending outside the engine block. My using a few 30mm long bolts was probably unnecessary, as using all 25mm long bolts would be just fine.

My decision to tighten the bolt to ½ turn was based on my own compression testing. I had bought two gaskets, one for testing, the other to install on the car. I did two sets of tests, one at room temperature, and the other using an oven bake for 1 hour at 300F. Here's the test data on Excel:

RealGasketCompressionTest [Compatibility Mode]					
A	B	C	D	E	F
1	'Real Gasket' Compression Testing, Porsche 928 Silicone Oil Pan Gasket				
2					
3			Gasket Thickness:	3.15	mm
4			M6 Bolt Thread Pitch:	1.00	mm/turn
5					
6	Room Temperature Test				
7	Step	Bolt Tightening (# turns)	Compressed Thickness (mm)	Compression (%)	Post Test Thickness (mm)
8	1	0.25	2.90	7.9	3.15
9	2	0.50	2.65	15.9	3.15
10	3	0.63	2.53	19.8	3.15
11	4	0.75	2.40	23.8	3.15
12	5	1.00	2.15	31.7	3.15
13	6	1.25	1.90	39.7	3.15
14	7	1.50	1.65	47.6	3.15
15	8	1.75	1.40	55.6	3.10
16	9	2.00	1.15	63.5	3.06
17					
18					
19	Oven Bake (1 hr @ 300F)				
20	Step	Bolt Tightening (# turns)	Compressed Thickness (mm)	Compression (%)	Post Test Thickness (mm)
21	0	0	0.00	0	3.15
22	1	0.25	2.90	7.9	3.15
23	2	0.50	2.65	15.9	3.15
24	3	0.63	2.53	19.8	3.15
25	4	0.75	2.40	23.8	3.13
26	5	1.00	2.15	31.7	3.12
27	6	1.25	1.90	39.7	3.12
28	7	1.50	1.65	47.6	3.11
29	8	1.75	1.40	55.6	-
30	9	2.00	1.15	63.5	-
31					

To make templates for all the required shapes, I used Adobe Acrobat Standard and it's Comment and Markup Tools.

Here's a screen capture of the finalized Acrobat file...



You can duplicate this template for your own use, by using this hyper link to the file I created: [http://members.renlist.org/glenmac/tabbed\\_washers3.pdf](http://members.renlist.org/glenmac/tabbed_washers3.pdf) Thanks to fellow RENNLISTER Glen McCartney for making this link possible.

With the templates designed, it was a simple matter of printing the template with a laser printer, gluing the templates to a piece of sheet metal with rubber cement, then cutting them out with sheet metal shears, sheet metal nibbler tool, and then punching the bolt holes with a sheet metal hole punch (1/4" hole). For all shapes, I used a 12"x24" sheet of 26ga galvanized sheet metal.





Last edited by borland; 04-29-2011 at 12:40 AM.

the oil pan bolts which needs 25 of M6x28 and 5 of M6x25