ALLOY CONTROL ARMS:

Affordable Weight Loss For Your Early 911/912

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Vehicle performance is often judged by calculating the power-to-weight ratio, usually expressed as the number of pounds for each unit of horsepower. These numbers have a significant effect on how much time elapses in traveling from point A to point B. As the horsepower increases proportionately to weight, performance increases. It's interesting that a 300 HP, 3500 pound car is not quite the measure of another that has 200 HP carrying only 2300 pounds (all things being equal) as each unit of horsepower in the 3500 pound car must move 11.67 pounds while the 2300 pound car only has 11.5 pounds per horsepower.

An obvious way to tip this ratio in your favor is to increase engine power. Bolder camshaft timing, increased displacement, and higher compression ratios are some common methods of achieving this. On the other hand, one can also decrease car weight — remove unnecessary parts or replace necessary parts with alloy, plastic and other lightweight materials. By the way, car owners often overlook themselves as a source for a fundamental 10-20 pound (or more) weight savings.

Reducing car weight can only be carried to a certain degree in a livable street machine and is costly if one wants a serious amount of weight loss. Another ingredient of car performance is how well the car handles, and this too is related to its power-to-weight ratio. In this regard, Porsches have an innate advantage over other cars. But it is also in this area where Porsche owners can make improvements, both costly and inexpensive. The subject of this article is about the latter category of modifications.

Over the 30 years of its existence, the 911, like many cars, has acquired additional poundage due to mandatory safety equipment, comfort and luxury accessories and other weight-gaining systems (Figure 1). In 1974, to help offset the added weight and to reduce production and fabrication costs, the factory introduced some weight-saving parts — in the front, an aluminum crossmember, and in the rear a pair of aluminum control arms (often called swing arms or banana arms). Each rear alloy control arm is about 5.5 pounds lighter than the steel, fabricated arm used since the car was introduced in 1966 (Figure 2).

More important than the reduction in chassis weight is the significant side

Figure 1—Comparison of various 911s illustrating their differing power-to-weight ratios

Year/Model	HP (SAE)	Curb weight (lbs.)	Power-to-weight ratio	0-60 mph (sec.)
66/912	102	2138	1:20.1	11.5
66/911	130	2313	1:17.8	—
68/911R	230	1820	1:7.9	—
69/911S	180	2195	1:12.2	—
73/Carrera RS	230	1985	1:8.6	5.5
76/911S	157	2425	1:15.4	—
76/Turbo	234	2514	1:10.7	5.2
81/911 SC	172	2756	1:16.0	6.9
84-86/911 Carrera	200	2756	1:13.8	6.3
84/959	450	2458	1:5.5	4.9
87/911 Carrera	214	2756	1:12.9	6.1
88/911 Carrera Club Sport	214	2601	1:12.1	5.9
90/Carrera 2	247	3031	1:12.2	5.4
91/Turbo	315	3274	1:10.4	4.8
91/Carrera RS	260	2690	1:10.3	—
93/RS America	247	2954	1:12.0	5.4
95/Turbo	400	3308	1:8.3	4.4

PHOTOS BY AUTHOR

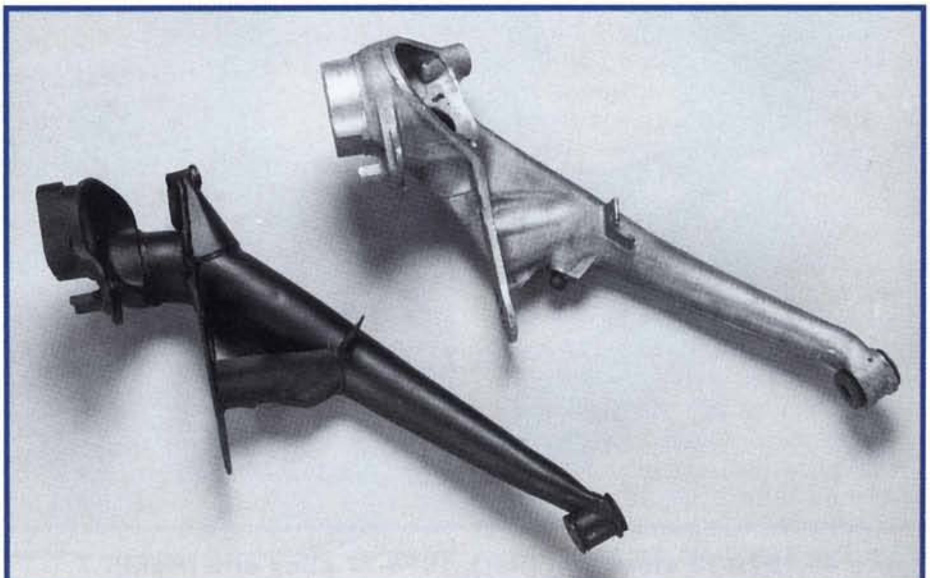


Figure 2—Steel vs. alloy control arm. Each alloy arm saves 5.5 lbs.

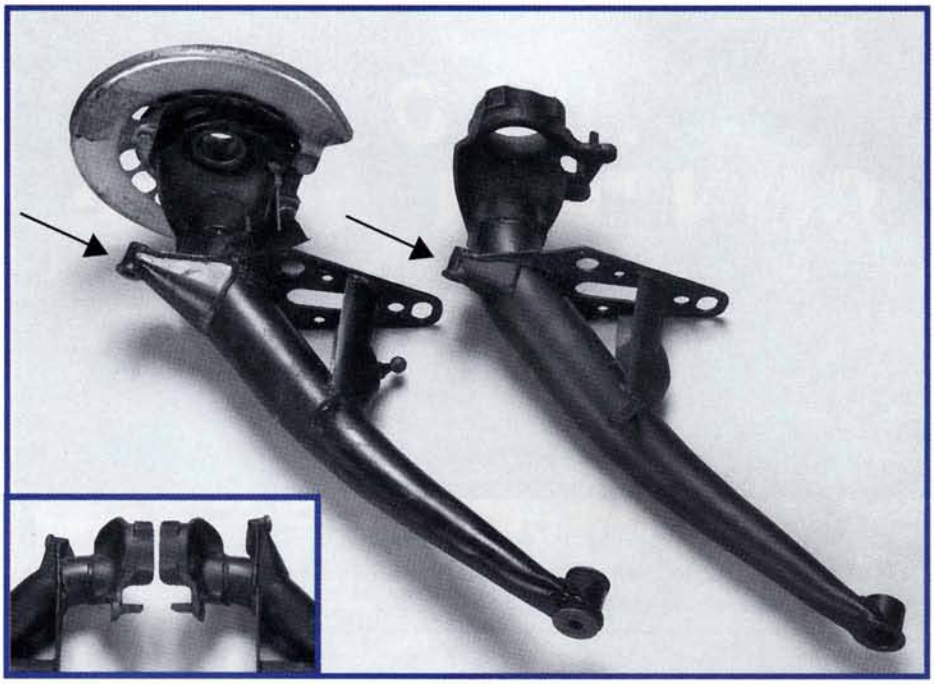


Figure 3—1972-73 (left) and 1969-71 (right) steel arms. Note difference in lower shock mount. Arms are otherwise identical.

benefit of less unsprung weight. Sprung weight is the weight of the vehicle the chassis springs must support while unsprung weight is the weight of the car (usually suspension parts) not supported by the springs. Unsprung weight includes the wheels, tires, brakes, lug nuts and a portion of the sway bars, suspension arms and shocks. The primary benefit of less unsprung weight is improved suspension control and vehicle handling. Less unsprung weight also results in a better ride and longer lasting shocks (less heat energy created). This weight reduction is akin to replacing those wonderfully lightweight and sturdy forged Fuchs alloys (with their aluminum lug nuts) with an even lighter set of wheels but this is accomplished at a fraction of the cost.

Since 1974, all 911s have had alloy control arms, so no additional weight savings can be gained in this area for these models. However, the early chassis with their heavier steel arms can benefit. Besides being lighter, the alloy arms use a larger wheel bearing to support increased cornering loads. As German history books tell it, the short wheelbase 1966-68 models and the longer wheelbase 1969-71 cars share their own steel control arms. In 1972, the factory made a slight modification to the shock mount location. According to the factory workshop manual, the lower shock mount on the 1972-73 steel arm is moved 10mm to the rear (the difference is more like 25mm (1.00") on the arms I measured, Figure 3). The upper shock mount in the chassis was also relocated. These modifications provide more room for larger shocks and clearance for the axle flanges for the then new 915 transaxle. Since 1974, all 911s share essentially the same alloy control arm.

Figure 4—1972-73 steel arm (left), 1974-77 alloy arm (right). Except for a larger diameter shock mount, this is a near bolt-on replacement.

Upgrading the 1972-73 Chassis

This is the easiest conversion as there are fewer fitment obstacles with these model years. The alloy arms are an exact replacement for the steel factory arms (Figure 4). Except for upgrading to late model shocks and mating the existing CV joints/drive axles to the alloy arm drive flanges, everything should bolt right in (see the section on general fitment issues).

Upgrading the 1969-71 Chassis

This installation requires more thought as additional issues must be addressed. In my case, I struggled with each one as I went along.

Initially thinking this was a bolt-on project, I went ahead and installed the new arms. I then had to find some shocks, so I asked various shock suppliers if there were any anticipated installation problems with my setup. In addition, I reviewed my collection of Porsche publications and other research sources. There was very little or no mention of the upgrade nor of any problems associated with it. I went on-line. I left messages on the bulletin boards. Is no news good news? Not necessarily. As no dire warnings were issued, I proceeded.

Based on their reputation, adjustability and warranty, I purchased Koni's latest gas pressure shocks (designed for the 1974-89 models) for the attempted installation. Other brands may pose their own installation challenges, but my efforts were spent adapting these particular units.

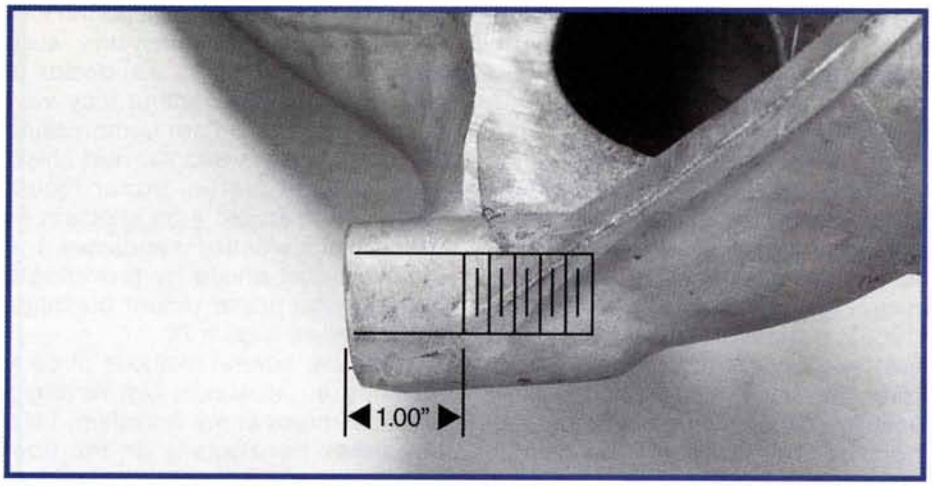


Figure 5—Lower shock mount on alloy control arm. Some material can be removed from non-threaded area to provide more heat exchanger clearance.

Numerous trial fittings showed insufficient room to align the shock and install the lower shock bolt regardless of the position of the control arm (clearance with the heat exchangers increases as the suspension compresses). If this was a race car, I probably wouldn't have heat exchangers to worry about. However, since this is primarily a street car, I had an interference problem.

Before trying to solve any problems with my favorite 26 ounce hammer, I decided to make a few inquiries. A cross-section of repair shops had different solutions, but all seemed valid as their handiwork commonly appears in street, time trial and racing events. One shop's solution is to shorten the threaded aluminum shock mount boss on the control arm to obtain the needed clearance (Figure 5). This is accomplished by trimming the unneeded material on a 3-axis milling machine. The mount hole has about an inch of unthreaded material before the threads begin, so sufficient material exists for this modification. However, this changes the shock angle, so your machine shop should keep this incision to a minimum. Remember to shorten the 14mm mount bolts the corresponding amount.

Another shop TIG welds another mount boss on the control arm closer to its original location in the steel arm. In this way, you get the needed clearance and the correct shock angle is maintained. If you choose this option, select your chassis and welding expert carefully. Another option is to modify earlier, smaller diameter shocks (69-71) to fit. You'll need to enlarge the lower shock mount opening to accept the 14mm attachment bolt. With its smaller, outer diameter, there should be minimal heat exchanger-to-shock clearance problems. 1969 was also the last year of the 912. With two less cylinders, there should be minimal shock installation problems.

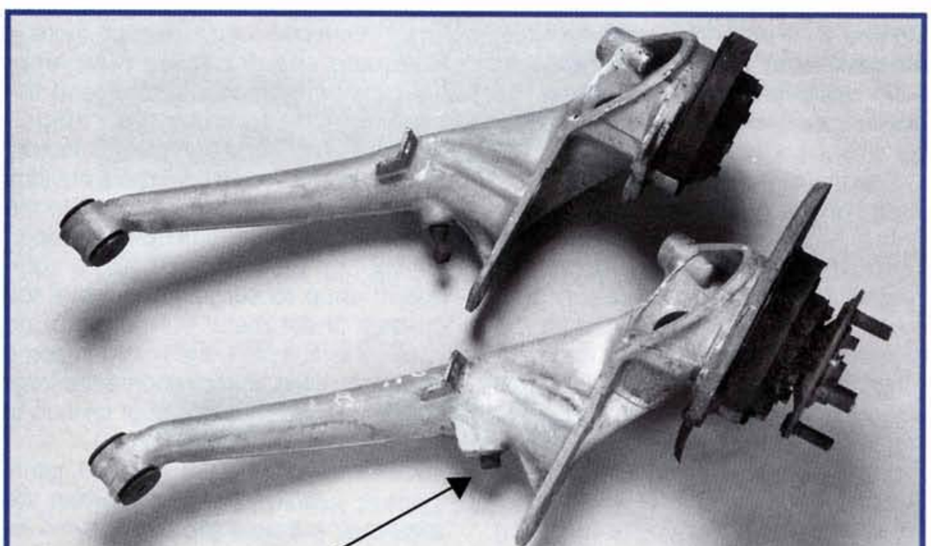


Figure 6—Alloy arms, 1974-77 (top), 1978-89 (bottom). Late arms use bolt-on sway bar attachment (arrow).

Upgrading the 1966-68 Chassis

These models use the short wheelbase "A" chassis so the steel control arms used in this chassis are shorter than the later, long wheelbase 911s. However, the upgrade is still possible. Installing the late steel or alloy arm and related parts (spring plates, etc.) creates a long wheelbase chassis, so when contemplating this upgrade, any visual clues to the car's original wheelbase must be addressed. This includes correcting the rear wheel-well openings, fenders and rear bumpers to accommodate the now 57mm (2.24") longer wheelbase. The "A" chassis also uses a Nadella universal joint/axle assembly. These were superseded in 1968-69 by the superior Löbro constant velocity joints. When upgrading the early chassis, choose the 1969-74 CV joint/axle combination to mate to your new control arms. 912s of this vintage share the same concerns as their 6 cylinder cousins.

General Fitment Issues

Depending on the chassis to which the alloy arms are being fitted, there are some installation issues to be considered. Removing the existing control arms is one that is shared by all. Replacement requires removing the control arm pivot bolt and nut. First remove the spring plate bolts and shock; then disconnect the outer drive axle, hydraulic and parking brake lines and sway bar end. Then it's a matter of unthreading the pivot bolt nut, sliding the bolt out and removing the arm — but only if the bolt head is facing toward the outside of the car. The more likely scenario has the bolt head facing the other direction (inward) and its complete removal is blocked by the transaxle housing. The natural inclination is to swear a little and begin removing the engine/transaxle assembly to extricate the bolt. A less drastic solution is to slide the bolt toward the transaxle housing as far as it will go, then cut the head off. This method requires two new pivot bolts but avoids removing and replacing the complete drivetrain. You'll also need a set of eccentric bolts for the alloy arms so the rear end can be aligned after installation. Eccentric bolts for the steel arms are different.

Make sure the drive axle/CV joint assemblies are compatible with the drive flanges on the transaxle and control arm. 911s up to 1971 use the type 901 transaxle. These cars use 10mm Allen-head bolts to attach the CV joint/axle assembly onto the inner and outer drive flanges. Early 915 transaxles (up to 1974) keep this same CV joint configuration while the later 915s use slightly narrower CV joints and 8mm Allen-head bolts.

With a 901 transaxle, a convenient solution is to upgrade to an early (1974) control arm to keep the drive axles compatible. Vehicles upgrading to or using a 915 transaxle can attach any post-74 control arm with the corresponding CV joint/drive axle combination. While a transaxle upgrade is not exactly inexpensive, the later transaxles, although slightly heavier, are much sturdier power transfer units.

Alloy arms differ in one small detail. Early alloy arms (74-77) use a steel ball pivot pressed into the casting to attach the rear sway bar end link. This is the same method of mounting the rear sway bar that was used in previous years. If you're keeping the early sway bar, then it's a simple matter of connecting it to the early alloy arms. The later alloy arms have a threaded boss to attach the sway bar end (Figure 6), so the later factory sway bar will bolt on.

Some sway bar manufacturers use this bolt-on attachment point to mount their adjustable sway bar ends. In certain situations (such as in racing and time trialing), this location provides increased ground clearance over other over-the-counter sway bars that mount their end links on the spring plate. For street applications and occasional time trialing, however, any alloy arm should be more than satisfactory. By the way, to identify the exact vintage of any alloy arm, the model year is cast into the control arm. For those of you wondering whether 930 Turbo or RSR control arms will work: Sorry, this is not an option as the chassis geometry on these cars is different. When purchasing used control arms, it's a good idea to verify they're not bent before you install them. Some Porsche dealers have a fixture to check them for proper alignment.

Installing the Shocks

All late model shocks use a 14mm bolt to clamp the bottom shock mount into a threaded steel insert in the alloy arm. Early shocks (66-73) use a 12mm nut and bolt attachment on to the steel control arm. In my personal situation (1969), a trial fitting resulted in the heat exchanger interfering with the Konis. This interference was due to the location of the lower shock mount on the alloy arm. It placed the shock in direct competition with a corner of the heat exchanger.

Figure 7—For additional space, discard dust shield and replace with steel washer as a base for upper shock mount hardware.

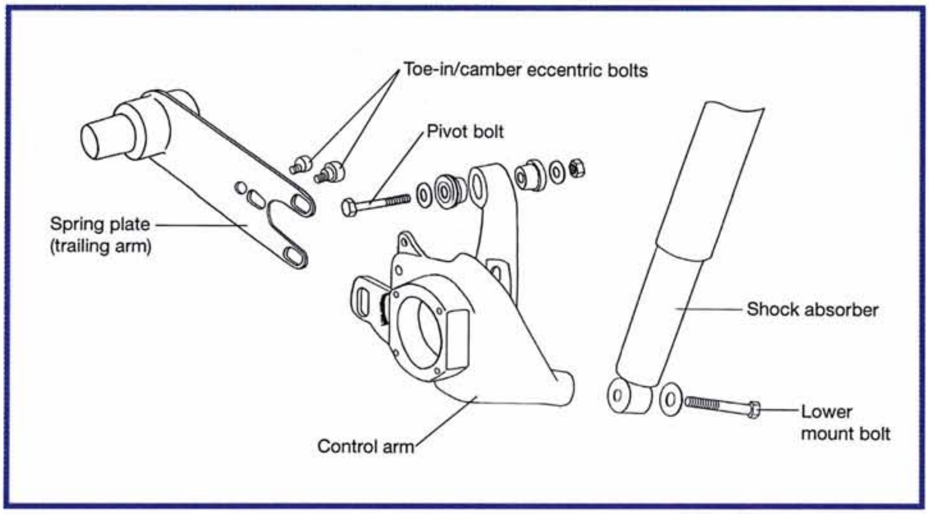
This installation is also made slightly more difficult due to the gas pressure in the Konis that fully extends the unloaded shock stem. With pure hydraulic shocks, you can easily compress the shock before installation. With the alloy arm/gas shock combination, there is insufficient room with the extended shock to align the shock with the control arm and install the #9 bolt without threat of crossthreading it. Depending on the year of your car and the brand of shocks you're installing, you may also have to remove the shock's dust shield to obtain adequate installation maneuverability.

To install the gas Konis, I also had to compress the stem to install the lower mount bolt. Again, this step depends on the shocks you decide to use, and this requirement may vary from car to car. Before compressing the shock, I discarded the dust shield and installed a steel upper mount washer from an old Koni shock in its place This washer simulates the removed dust shield by providing a base for the upper mount bushings and hardware (Figure 7).

There are several methods of compressing a gas shock. Not having a hydraulic press in my workshop, I laid the shock horizontally on the floor between two immovable objects (a concrete step and a wall) along with a scissors jack and several 2x6s. Using the jack to compress the shock, I then tied a length of nylon twine around both ends to keep it restrained. With the shock in this position, it's easier to thread the lower bolt into the arm. A floor jack with a soft pad under the control arm helps fine-tune the exact height needed to facilitate shock alignment and bolt installation. After installing both ends of the shock, cut and remove the nylon cord. Before tightening the top and bottom mounts to specifications, lower the car and settle the suspension to minimize distorting the shock mount bushings.

Depending on which of the aforementioned clearance strategies you adopt, you may still have to carefully reshape (i.e., dent) the heat exchanger sheet metal to provide additional clearance. You may be averse to attempting this method if the control arms are attached to your "off-the-fully-enclosed-trailer" concours car. However, there is adequate space between the inner heat exchanger sheet metal and the header pipes to make this "adjustment." If alloy arms and the full factory look is your objective with no obvious signs of tampering, you can go to the next level. After performing the needed control arm modifications, hire a competent shop to surgically remove the chassis sheet metal surrounding the upper shock mount, then weld in some new material to accommodate the larger diameter shocks and dust shields of your choice.

Once the shocks are installed, verify there is sufficient clearance when the suspension travels up and down. As the suspension drops, shock clearance decreases, so watch for any interference at full suspension rebound.



1974-88 911 left rear suspension parts.

With the clearance problem solved, you'll notice the shocks rest disturbingly close to the heat exchangers. Even on stock suspensions and race cars modified for off-road maneuvers, the shock remains close to the exhaust system Reasoning that hot air radiating from this surface isn't good for shock seal longevity and consistent shock control, even at breeze-creating, on-ramp entry speeds, I opted to clamp some reflecting insulation material around the exposed shock body. At this point I'm not sure how effective or necessary this is, but at a later date I'll put a temperature probe in this area to confirm my theory.

Summary

Upgrading the early 911/912 chassis with aluminum control arms provides a distinct weight savings, and there are performance and handling benefits to enjoy with reduced unsprung weight. When you study the alternatives, the cost-to-benefit ratio is good compared with other, more costly modifications. I have attempted to address the many issues concerned with this conversion on early 911s. A few questions may be unanswered until you begin, but these will depend on your car and the assortment of parts you decide to purchase, keep and install.

Given access to a modest budget, the needed alloy arms and a desire to tinker, this project should keep you busy until the next issue of Excellence arrives. In lieu of this modification, consider the new 18" hollow spoke wheels on Zuffenhausen's latest Turbo. There are some clearance problems to really consider, but these wheels save a few pounds too — at a cost of approximately $5,000. Now was that with or without aluminum lug nuts?

I would like to thank Steve Alarcon, Galen Bieker, Tony Callas, Joe Cogbill, Rob King and Dave Aase for providing information or parts to be photographed.