# *W A Technology*

## Jacking A C8, C7 Grand Sport & C7 Z51 Corvette

**This PDF is for those who are: 1) Considering what they should purchase to lift their car, 2) Not happy with their current method, 3) Curious about the options available and 4) WARNING: *A Hydraulic Jack must move into the C8 or C7 when lifting!***

**Background: Worked on many cars with my Dad years ago. After we jacked up a car we would use cement block(s) under the frame (our jack stands!) I recall Dad would not allow the use of a lighter, but weaker cinder block! Even with that, would have to hit the car with my shoulder to be sure it was stable and could not fall! Dad had a friend crushed and killed while working under a car that fell off the supports; he was justifiably very careful!**

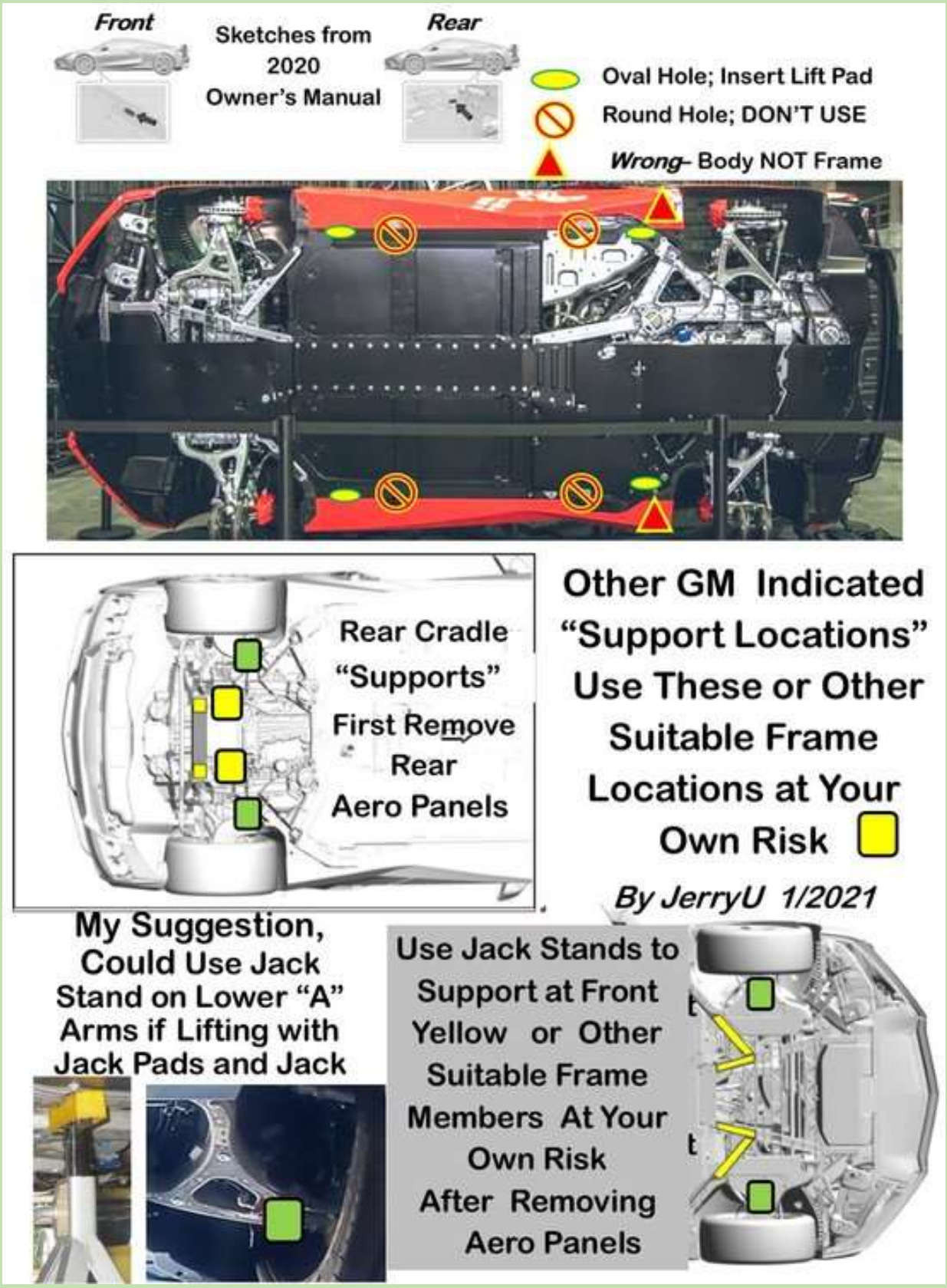
## Jacking C8

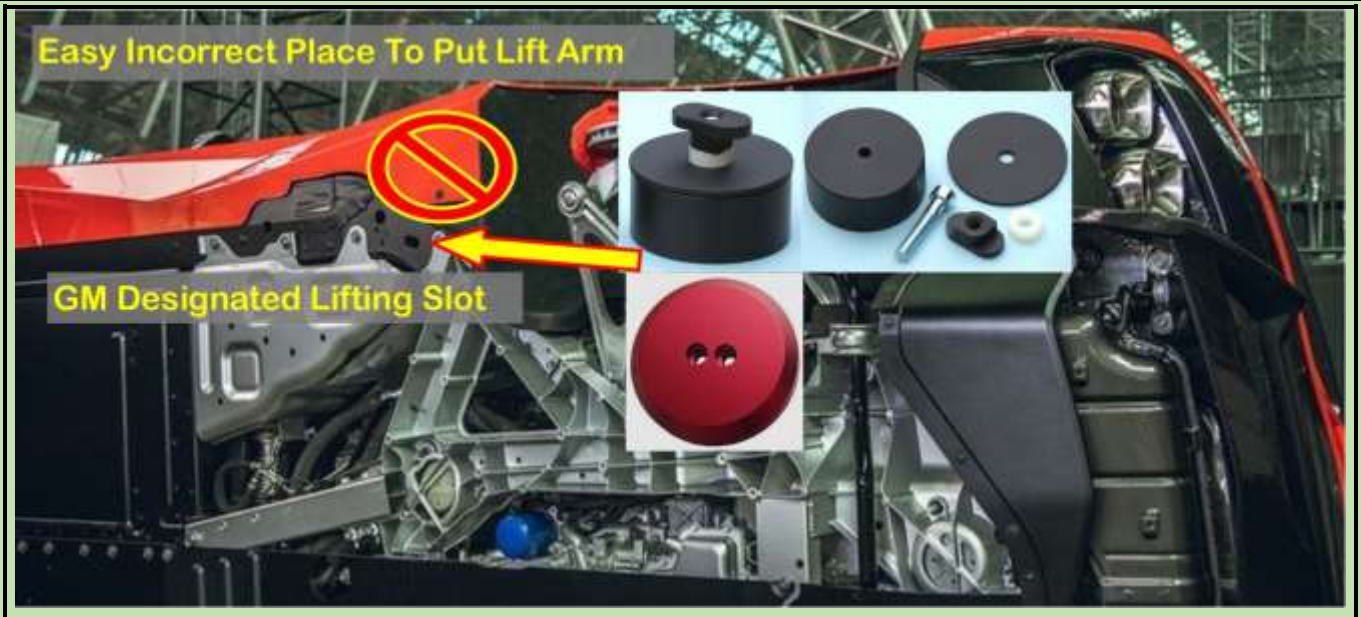
## The C8 Corvette Has 60% Weight on the Rear

**That weight distribution requires more care and IMO requires using Jack Pads so particularly the rear is lifted where GM recommends and not where it can look safe!**

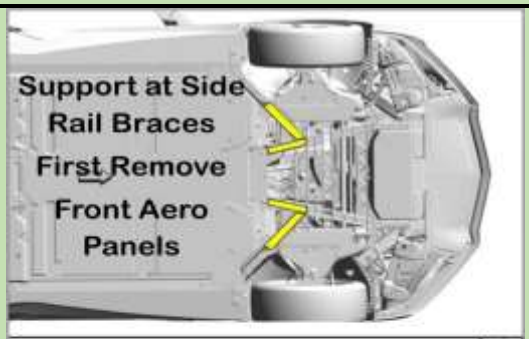
**This "Lift Failure" at a dealer is a clear warning, that with two post or center post lifts it is critical the C8 is lifted in the correct places! As with the C6 and C7 there are oval Jack Pad locations and even if the lift arms have pads, IMO it would be safer to use Jack Pads in the recommended oval slots to assure the lift loads are 1) on the aluminum Frame and even if the lift arms bend slightly the car is not being lifted on the outside of the frame!**

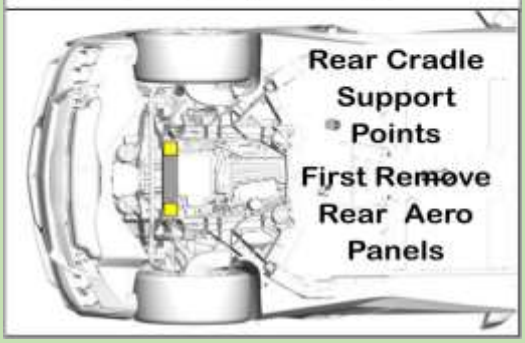
## GM Recommended Lift Locations






**IMO, it is safest to use a lift pad and NOPT rely on a pad at the end of a lift arm to assure the C8 is NOT being lifted other than on the frame, as intended.**




**As noted GM indiactes you can use several C8 frame members to support jack stands BUT You have to remove the aero panels. Not that diffcilt BUT from a safety standpoitt a bit of a "Catch 22." To access the screws that hold the panels you would have to only have the jack holding the car ….**

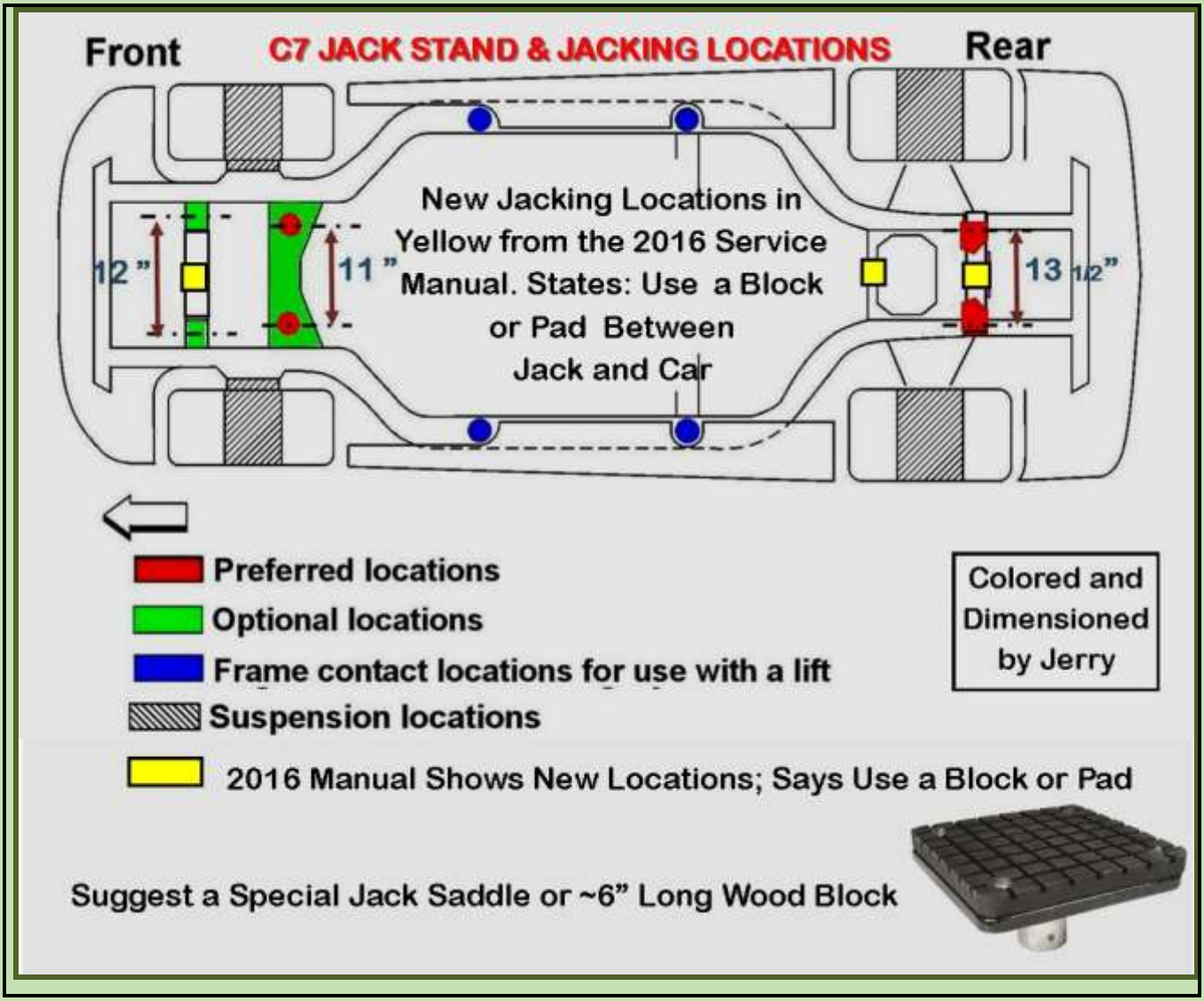
**OR COULD USE MY RECOMMENDATION AND INSTALL STANCHIONS UNDER THE WHEELS ON THAT END OF THE CAR!**

**Have jacked-up my C8 several times when I 1) changed to low dust Carbotech Brake pads, 2) added side skirts 3) added AC Condenser Mesh and Splitter.**

**Planned to use my lowest of several pairs of jack stands but would have meant jacking higher than needed. So, used one of my (*built for under ~$10 for two)* stanchions that usually go under a tire! Worked fine as a safety IF the jack were to fail.**

## Jacking a C7:

**This first issue in jacking a C7- *be sure to use only acceptable GM locations!* The picture below is from the 2014 Service Manual that I colored for clarity. The C7 front and rear suspension cross members are made of hollow aluminum castings, so GM in 2014 *only* designated one as a lifting location! However, in the 2016 Service Manual this limitation was removed, see next page for details. The Dark Blue round circles on the frame sides are the shipping slots where jacking pads can be inserted. That is important to avoid scratching the frame or cracking the fiberglass reinforced composite rocker panels extending over the frame. Either temporary or semi-permanent types can be purchased.**



**DETAILS:**

**several options are available for jacking a Vette. For my C6 I used an inexpensive method with an inexpensive hydraulic jack lifting one side and a very old but functional scissor jack lifting the other side. Both are lifting on jack pads. For the C6 these pads were a temporary type made of aluminum, 3-inch OD and 1 inch high (circled in green.) *Note the hydraulic jack is perpendicular to the side of the car so it can roll into the car as it is lifted!* The hydraulic jack should have a minimum lift height of about 3 ½ inches or less.**

**Semi-permanent jack pads (shown with a red border) are also available; they snap into the shipping lots and stay on the car.**

**Wheel chocks need to be used before jacking the car, I have used bricks in the past but the rubber one shown is only $7.**


**This side was lifted with an old but strong scissor jack. *It has the advantage of lifting straight up with no need for it to slide under the car as it lifts.* Be sure they have a minimum lift height of about 3½ inches. Home Depot had one that was 3¾ to 15½" for under $20. However, found it was difficult to lift car but safe and if using only infrequently purchasing two is a minimal investment. Harbor Freight often has low profile hydraulic jacks on sale for about ~$70 each but see upcoming WARNING.**

***DON'T* get under the car with just a jack! It could slip or the hydraulics fail. There are many quality jack stands available. Harbor Freight has them for about $25 a pair. They should be able to collapse to about 12 inches or less so they can fit under the front or rear suspension GM jacking locations. This pic is my C7 being lifted using a low-profile hydraulic jack and a jack stand being moved to the proper location. Note, I alternately lift each side several inches at a time, so the car remains level, then it is lowered on two stands.**

**There are times when it is desirable to have the car level when lifted. That means both the front and rear must be raised. This is useful when changing oil to assure all is drained from the pan, when checking the differential fluid level or installing side skirts etc. The pic left shows a safe approach. Fabricated wood stanchions support one end of the car while jack stands are used on the other. Details of fabricating are shown below.**

***I was somewhat surprised when a few forum posters said they would not trust the wood stations when getting under a car! For fun, I performed rough load and safety factor calculations! They are presented at the end of this PDF. You'll see they have a conservative Safety Factor of over 15!***

**With my added vertically contoured C7 side skirts, 2½-inch diameter x 2-inch-high jack pads by Katech were used.**

**There are many ~1-inch-high jack pads available if you have low profile or no side skirts (like my Grand Sport Stage 2 Aero side shirts). *ReverseLogic* (left in pic) has jack pads worth considering. I purchased since they can be temporarily bolted to the car for a visit to the dealer or tire shop. Don't have to worry IF they will be used! Also have a 1" Katech pad I'll use with my new long arm jack with a deep saddle pad I have fabricated. Details in the back!**

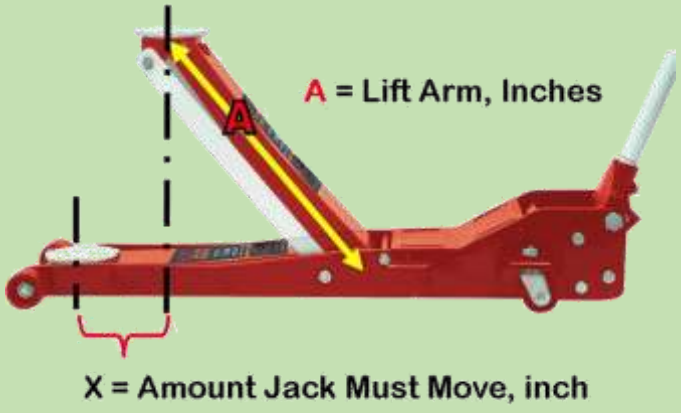

**The right-side rear is jacked up and the fabricated stanchion in place. May need to put both jacks under the jack pads before the first side is lifted so the other side doesn't lower to a point where it does not fit! *The two hydraulic jacks must be positioned so they can roll into the car as it's raised.* In addition, it's advisable to lift one side a few inches and do the same on the other, then alternate to keep the car relatively level.**

**With the rear lifted and the tires placed on stanchions, the jack pads were moved to the front slots. The front is raised enough to get quality jack stands under the front GM recommended lifting locations on the aluminum cradle. The jacking surface must be hard such as concrete or asphalt to allow the jack to easily roll into the car as it's lifted.**

***Remember, position the rear casters so they are ready to roll into the car and are not facing backward or sideways*.**

**Be very careful to place jack stands under the proper location as on the suggested ends of the hollow crossbeam on the cradle.**

**If the jack saddle is not centrally located on the jack pad start over before getting under the car to place the jack stands. Also never trust a jack, it could leak and fail.**


**A problem can occur on rough concreate exacerbated by the jack having a very short, 10-inch Lift Arm. At a high lift, it required the jack to move in considerably to keep the jack saddle directly under the Jack pad.**

**The longer the Jack Lift Arm the less it has to move. Using Trigonometry, I calculated the amount the jack had to move in (X in pic) for various size jacks.**

**Measured several low-profile jacks at Harbor Freight. There is considerable difference in Lift Arm length. Bought a long reach, low profile jack requiring the least movement for a fixed 10-inch lift (less the min saddle height) to keep the saddle under the jack pad. It only has to move 1.2 inches. It has a 21-inch Lift Arm, 2 5/8 min, 23 ¾ max lift. It's heavy, weighing 93 pounds! It will be used when a high lift is needed.**

**The distance the jacks must move in while lifting 10 inches (less the min saddle height) is defined as X in pic right.**

**The medium 15-inch Arm Length jack requires moving in 1.8 inches.**

**However even the new jack with a 21-inch-long arm MUST move in. See pic left and Details, "INCREASING SADDLE DEPTH" at end of this PDF. It shows how I modified and fabricated the saddle to provide increased depth. This allows the sidewalls of the modified saddle to pull the jack in and keep in under the jack pad.**


**Note: X is the amount the jack must move into the car to match the Max lift of my short, 10-inch arm jack. Therefore, at its max lift the "short arm" jack must roll into the car 2.6 inches to keep the jack saddle under the lift pad. With the "long 21-inch arm" jack it only needs to move in 1.2 inches.**

**See the GM suggested jacking points in the figures provided. For the C7 two points are shown in Red and several locations shown in Green in the C7 jacking figure.**

**In the rear, only two are shown, both in Red, 13½ inches apart.**

**Place two quality jack stands under the proper points and carefully lower the jacks so the car rests on the jack stands.**

## Can't 4 Jack Stands Be Used?

**No- Not As Safely! Using 4 jack stands does not provide the desired stable support, IMO. Would be concerned to try my Dad's required shoulder test as defined in the introduction! Depending on what you're doing, a side load could cause a jack stand to slip off the lifting location.**

***Note the warning on this high quality and rugged pair of jack stands that I use. It states "USE ONLY TO SUPPORT ONE END OF A VEHICLE AT A TIME."***

**When getting under the car this is especially important. For example, when first removing the side drain plug from my C7 oil pan it required a great deal of force, more than expected or that I could achieve with my 3/8-inch ratchet wrench. I used my ½-inch breaker bar and quite a bit of force to break it loss, appeared to have Red Loctite! Of interest, had the same issue with the side drain plug in my Grand Sport. In fact, was prepared with a 6-point 15 mm socket, long extension and my ½ inch breaker bar. No help, the Grand Sport engine oil cooler is deeper and the socket with extension would not fit! Suggest getting a 6-point 15 mm box wrench (pic.) !**


**NOTE:**

**Really no need to lift the back of the car to change oil. Many use race ramps and only lift the front. In fact, using jacks and jack stands can lift somewhat less than ramps and you'll get more than sufficient old oil out to do the job perfectly fine.**

## Building the Stanchions

**A twelve-foot-long 2x6 was cut into 4 pieces 21 inches long and 4 pieces 9½ inch long. This makes two stanchions 12½ inches wide, sufficient to fit the rear tires. With the ¾-inch plywood top, it makes a 6 ¼ inch high "stand." Not bad for an $8 investment (had some left-over plywood!) Be sure to make the cuts square. *Note, had Lowes cut the 12-foot board into two 6-foot pieces to fit in our SUV! When I had my '93 Vette and no SUV, I would transport even 8 foot, 2X4's in the hatch a few miles to my home! I just put a blanket over the rear and used a bungee cord to hold the hatch down!***

**Assemble the cut pieces as shown in this picture. Note the corner clamp, which makes it easy to assure a 90-degree fit when drilling for the first screw but it's not essential.**

***Don't follow these suggestions unless you have the skills required to properly cut and screw the pieces together! Fabricate and use at your own risk!***


**Suggest using four 4 inch #8 screws to join each corner joint. That provides 1 ½ inches of gripping length. Pic shows the 4 screws on one joint.**

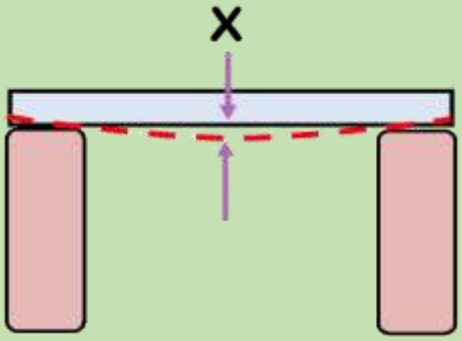
**It can be seen in the calculations of Safety Factor, that each screw in pine will have a "Pull Out" force of 790 lbs. *The information readily available on the Internet is amazing!***

***Use a pilot drill somewhat smaller than the root or minor screw diameter before inserting and screwing the parts together.***

**The top was made from ¾-inch plywood. It supports the tires and keeps the 2X6 side "columns" from tilting. Considering the strength of plywood and the loading, it has a Safety Factor of >4.3 based on its strength! However, their role in keeping the side 2X6 "columns" from tilting is more important as we'll see in the next item.**

**If the plywood deflects there will be a load pushing the 2X6 columns outward. Calculating that deflection, "X", for a 1000 lb load concentrated in the center would cause a deflection of only, 0.02 inches. That creates a side force of only 4 pounds! Even with 10,000 lbs. was the deflection "X" would only be 0.2 inches.**

**Calculated with a side load of 200 lbs (which would need very poor construction or some other defect.) As noted in the attached, the Safety Factor would still be 15! Could be less with poor construction!**




***Check Out the Safety Factor Assumptions and Calculations at the End of this Document***

## Why Not Use Ramps?

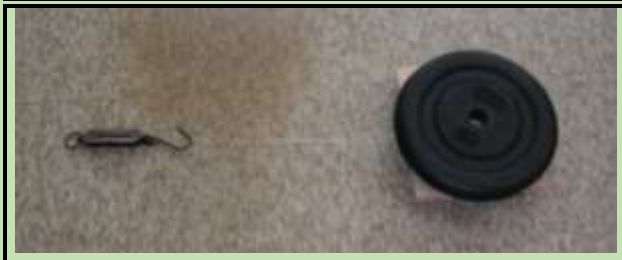
**Many folks do and are pleased with that approach; I tried and was not happy!**

**A friend used ramps to change oil on his C6. *When I asked if he had difficulty with the ramps slipping, he said "at times!"* When my C6 was new, built the cross brace for my large hydraulic jack but still needed to lift up the front and back to make room for the jack and cross brace. Decided to make my own very low-profile ramps! As noted, made four.**

**Used a 3-support rib design with ½-inch particleboard on top and bottom. They were sufficiently strong, even used on the wife's CTS she had at the time. In fact, with her automatic trans they seemed easier to use. However, with my standard shift C6 one or both ramps would slip when driving the Vette up on them.**

**Note the "rubber runner starting tabs" placed on the front of these finished home-fabricated ramps. Thought that would help avoid them sliding forward. Unfortunately, they were no help!**


**Having gone through the effort of building, the ramps thought of a possible way to improve them. Perhaps a higher friction material placed on the bottom might help eliminate the ramps moving when I tried to get the Vette up onto them. In fact, one would move and not the other, so I had to back off and start all over! This was particularly an issue when on my garage tiled floor but had even occurred when on my concrete driveway.**



**A fish scale and some weights provided repeatable data for static and sliding friction measurements! The result of these tests? *None of the materials tried, including rubber runner material was much different from the rough wood ramp bottoms were made from!***

# Final Outcome:

**Perhaps of interest, the ramps worked OK with the wife's CTS with an automatic trans (see pic below) then with my standard trans. The CTS could creep slowly up and did not have the same tendency to push one ramp forward. The C7 was susceptible to that occurring even when slipping the clutch. Since I like to work on my own and not ask my wife to see if the car was up properly on the ramps, or if one was moving, I gave them away! I wanted something I could safely and quickly do on my own; ramps did not appear to be what would work for me! I gave them to a person who needs to raise their vehicle on grass; something I would not do and can't do with jacks. They were very pleased to get the ramps! They worked fine for them!**

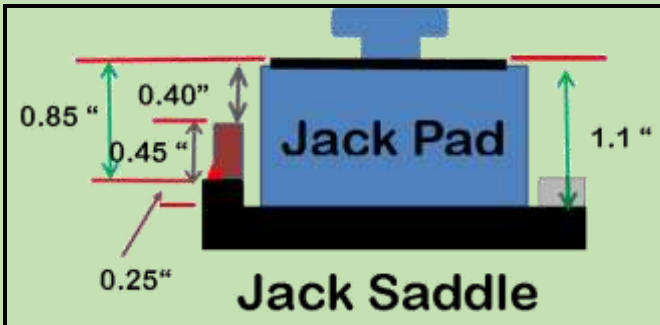
**Decided to use jacking pads and a three-jack approach defined above. *Just a reminder, to use the hydraulic jack and jack stand approach you must have a solid strong surface such as concreate or asphalt.* The two small jacks for the sides on the jacking pads and a large hydraulic jack on which the fabricated Cross Brace is employed to contact the preferred jacking points. Finally replaced my old scissor jack and cheap hydraulic jack with two low profile hydraulic jacks from Harbor Freight. For a C7 oil change the two jacks work great with the 2-inch-high jacking pads that are needed to provide the clearance for my side skirts. Safe, predictable and reasonably fast. I go a step further just to be sure all oil is drained and lift both front and rear employing the fabricated wooden stanchions. That keeps the car level and assures oil drains from the front drain plug.**

**There are many ways to jack-up a car. If you're using one and are pleased - fine. However, if you are looking for a way to do it for a reasonable cost, I hope this information was helpful in making your decision.**

**Several pages at the end, show calculations made to assure the home made "Wood Stanchions" were safe. I don't blame those who questioned their use, engineers can be wrong! *They said the Titanic Couldn't Sink!* However, they are light compared to what one forum poster who questioned their safety said he was going to do. He planned to stack five 2X12's to make "stanchions!" That would work but would weight about 50 lbs each versus the 12 lbs for these fabricated wood "stanchions"! Mine will also probably hold more weight than commercially available plastic stanchions that sell for over $50 each! The other issue is the 10-inch height of the commercial stanchions. In fact, I have 12-inch-high stanchions I used on my street rod when spending many hours underneath installing the exhaust, trans cooler, fuel lines, etc. (pic below.) However, that required a two-step jacking process to reach that height. The 6-inch-high, fabricated wooden stanchions are sufficient for the need and are easy to install with inexpensive jacks.**


## Increasing Jack Saddle Depth

**To obtain an "advertised Low Profile" the jack saddle on my new "long arm" jack is very shallow! No, help in moving the jack in toward the center of the car as it's lifted!**

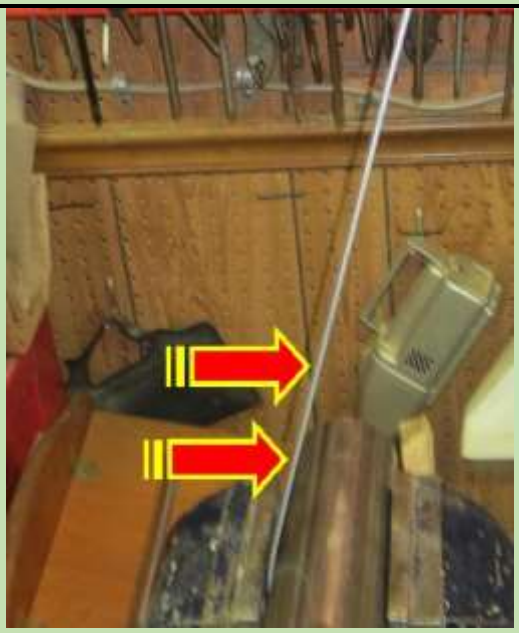



**Don't need the 2 5/8 minimum height inch spec, so why not increase the depth by ~1/2 inch!**

**Decided increasing the saddle edge height by 0.45 inches that would still allow enough clearance to put the large jack under a one-inch highjack pad.**

**Bought a ¾-inch wide X 1/8-inch-thick steel strip to make the saddle height increase. Used a scrape piece of 3-inch stainless exhaust pipe (used to make the exhaust for my ProStreet Rod.) Clamped the metal strip and pipe section in a vise as shown. bent the metal strip around the pipe.**

**Slight pressure by hand was enough to make most of the bend for the half circle pieces needed. A hammer was used at the very end.**



**This is what was achieved with just pushing on the steel strip. A few hammer blows were used at the very end. The curved section was moved under the 3-inch tube and the bend continued**

**The result is a full half circle achieved.**

**It was cut with a hacksaw and another similar half section made.**

**These are the two halves' ready to weld to the saddle base.**

**First, be sure to grind all paint from the surfaces to be joined. Paint has hydrocarbons that will cause porosity and inferior weld quality.**

**A small 110-volt input MIG welder is all that is needed to join these saddle sidepieces to the original base. I use an Argon, $CO_2$, Oxygen shielding gas mix. Argon, 25% $CO_2$ also would work fine.**

**Made a short weld on scrape to fine tune the wire feed speed and voltage.**

**The parts were held in a gloved hand and tack welded in place. A number of tack welds and fillet welds were made along the shelf that remained when the 1/8-inch-thick steel half circles were placed on the 1/4-inch-wide flats on the saddle. It was positioned flush with the inside of the saddle.**

**A grinder is used to remove excess weld deposit**

**Then the ¾ inch height was reduced to just under ½ inch above the old surface saddle surface with a 4-inch grinder. It made quick work of the excess material. Pic left shows it half completed.**

**This is a pic of the saddle, painted and screwed back in the jack. It used a treaded insert that still allows the saddle to rotate on the jack arm.**

**A one-inch-high aluminum Katech jack pad fits perfectly, as noted in the pic. Now when lifting the added saddle depth will help pull the jack into the center of the car keeping it from slipping off of the Katech jack pad**

# WA Technology

## Summary of Stanchion Safety Factors:

**Based on Compressive Strength of 2x6 pine columns:** ***SF = >400***

**Based on Yield Strength of top Plywood:** ***SF= >4.3***

**Based on Failure Mode Being the Tilting of the Side 2X6 Columns:**

- **Scenario 1) Assume only Top two screws, one on each end, are preventing tilting based on the angle caused by plywood deflection from a 1000 lb load:** ***SF=>350***
- **Scenario 2) Scenario 1 but side load raised to 100 lbs due misalignment of parts:** ***SF=>15***
- **Scenario 3) Scenario 2 with added safety factor from plywood screws also holding:** ***SF = >30***
- **Scenario 4) Scenario 3 but side load raised to 200 lbs due misalignment of parts:** ***SF=>15***

## Conclusion:

**Therefore with conservative assumptions and due to poor construction and other material misalignment, if 20% of the car weight per wheel is applied sideways on the vertical 2X6 columns, the minimum Safety Factor is greater than 4.3. This is well above the typical structural design safety factor of 3.**

**I recall one exception to the typical 3 Safety Factor was noted in a structural design course. That was for playground equipment where a Safety Factor of 4 or 5 was recommended! It was indicated you could not be sure how the structure would be stressed.**


## *!! CAUTION !!*

**Use this information at your own risk! Remember** ***"Engineers said the Titanic Couldn't Sink!"***

# WA Technology

## Calculations for Safety Factors *(SF)* :

**A)-Based on Compressive Strength of 2x6 pine columns:** ***SF = >400***

**Maximum compressive Strength of pine = 5000 lbs/in$^2$**
**Area = 1.5 in * (21*2 +9.5*2) = 92 in$^2$**
**Max Possible Load = 5000 lbs/in$^2$ * 92 in$^2$ = 450,000 lbs**
**Load on each wheel ~1000 lbs**
**SF = 450,000 lbs/1000lbs = 450**

**B)-Based on Yield Strength of top Plywood:** ***SF= >35***

***Max Stress= y F L / (4 I); where***
***Max Stress (psi)***
***y = Perpendicular distance from to neutral axis (in) = 0.75 in/2***
***F = load (lb) (1000 lb.)***
***L = length of beam (in) 9.5 in***
***I = moment of Inertia (in$^4$) see below = 0.7 in$^4$***

**Moment of inertia of a rectangular area about its centroid axis is:**
**$I = (1/12) * bh^3$**
**Where b = base of width of the rectangle**
**H = height of rectangle**
**For plywood 0.75 inched thick (h) and 20 inches wide (b)**
**I= 0.83*20*0.42 =0.7**

**Then:**
**Max Stress = (0.75/2*1000*9.5)/4*0.7) = 1500 psi**
**Tensile strength of Plywood = 5000 psi**
**SF = 5000 psi/1500 psi = 4.3**

**C)-Based on Failure Mode Being Tilting of Side 2X6 Columns:**


**Note 4 screws were used per side**

**But top screws have max stress.**

**Assumes top screw loaded because loaded plywood deflected.**

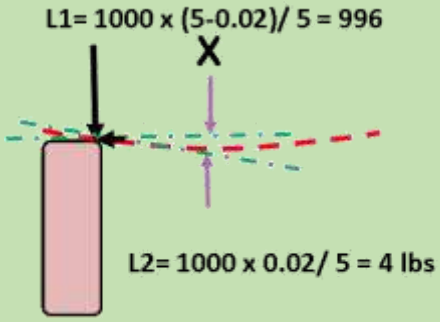
**Could have indicated bottom moved outward then it has max stress**

1. **Scenario 1) Assume only the Top two screws on each end are preventing tilting based on angle caused by plywood deflection from 1000 lb. load:** ***SF=>350***
   a. **Strength of 3 inch screw into pine: Two formula yields about the same result. One from the US Forestry service and a simpler one. The simpler one is:**
   **Pull Force = 3.14*Screw Diameter D*Length in Wood L*Shear Strength**
   **For a 3 inch #8 screw D = 0.12; L- 1.5 in wood; Pine Shear Strength =1400 psi**
   **Then Pull Force = 3.14*0.12*1.5*1400= 790 lbs**

b. **Deflection of plywood based on 1000 lb load:**
**Could have calculated based on the Modulus of Elasticity and beam bending equations but found this calculator on the Internet for calculating the deflection of wood shelves:**

http://www.woodbin.com/calcs/sagulator.htm

**If is useful and has about 200 different woods, plywood etc. Just put in the span, shelf load, distributed of center load, thickness, and depth and out comes the deflection in inches!**
**As expected the deflection for 1000 lbs with a 9.5 inch board width 20 inches deep is only 0.02 inches.**
**Then the small angle it produces would yield a very small force sideways on the column of only 4 pounds!**




**Considering only the top screw of the four used and since there is one on each end the 790 ponds max pull force X 2 = ~1500 lbs holding force so 1500/4 is a SF = 375**

2. **Scenario 2) Scenario 1 but side load raised to 100 lbs. due misalignment of parts: *SF=>15***
**For this Scenario it was assume misalignment of the parts could cause 100 pound side force so the holding force of 1500 pounds was resisting 100 pounds of a safety factor of 1500/100: SF=15**
3. **Scenario 3) Scenario 2 with added safety factor from plywood screws also holding: *SF = >30***
**However the plywood top adds to the rigidity and stability of the assembly. Just using the 7 smaller screws that hold the plywood to the 2X6 increased the holding strength. Using the shear strength of the screws can estimate that added holding force. These screws are 0.1 inch diameter providing an area of 0.008 $in^2$. The shear strength of the screw can be estimated at 605 of the screw tensile strength conservatively estimated at 50,000 psi.**
**Therefore 0.008 $in^2$ * 50,000 psi = 235 lbs per screw * 7 screws = ~1600 lbs**
**Therefore total holding force with just the two top 3 inch screws adding the 7 top screws = ~3000 lbs so the SF =3000/100 = 30**
4. **Scenario 4) Scenario 3 with but side load raised to 200 lbs. due misalignment of parts: *SF=>15***
**Using the same logic, if the side force was increased to 20% of the car weight, which would require considerably more misalignment, the safety factor would be reduced to 300/200 = 15**

## Conclusion:

**Therefore with very conservative assumptions and due to poor construction and other material misalignment, if 20% of the car weight per wheel is applied sideways on vertical 2X6 columns the minimum Safety Factor is 15. This is well above the typical structural design of 3.**

# *W A Technology*

## Forum Questions re Stanchion Design.

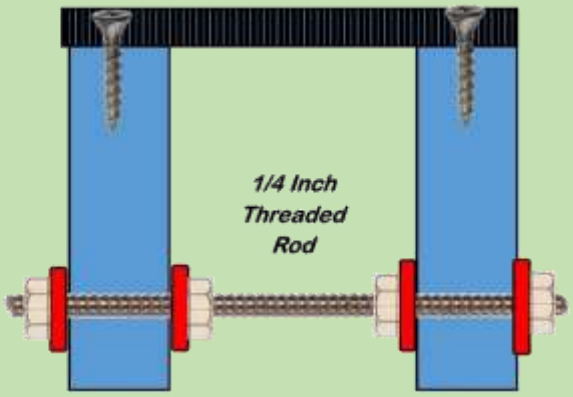
**Having 7 years of use and presenting the Safety Factor Calculations thought issues with the safety of this deign were past. BUT in 2021 several Forum Members questioned the strength of the design. With subjective opinions they were overly concerned because plywood (*as one said*) had only air underneath! Hmm a bridge with a lower typical Safety Factor in the design of 3, (i.e., the maximum design stress is 1/3 the minimum of the materials being used.) Lots of air under the center span beams holding up the roadway!**

**He suggested using a 2X4 under the plywood. Another thought an additional 2X6 was needed under the plywood!**

**Fact is the maximum stress on the ¾ plywood used IS NOT THE LIMINTING DESIGN ISSUE. In fact, it no doubt has a higher Safety Factor than the plastic Stanchions sold for $195 or Ramps folks use!**

**The *"Design Limitation"* is having the sides perpendicular to the ground AND MOST IMPORTANT staying that way. The 9 ½ inch end pieces and the four, 4 inch #8 screws recommended to attach the ends to the longer side members are holding in from allowing the sides to deviate from that perpendicular parallel position. Would not want another 2X6 that would be on the floor as small deviations would prevent both sides from resting on the floor and possibly causing uneven loads on the Stanchions. In addition, a 2X4 or 2X6 IS NOT NEEDED TO SUPPORT THE PLYWOOD! Plywood ¾ inch THICK this is very strong. The Safety Factor is 4.3. For example, in home construction it is 3 times stronger that the typical 7/16 plywood used for flooring on 16- or 24-inch-wide floor joints! The ¾ inch Thick Plywood on essential a 9 ½ inch wide "floor joists" is far stronger than the flooring in your home supporting a refrigerator! Perhaps that will be proof since "horse sense" was said by one member to be better than my engineering calculations!**

***NOW if the constructions techniques are a bit sloppy and you want extra assurance, you can use this light weight, strong method for the possible design weakness, IF you can't make square cuts!***


*After 7 years of successful use and Safety Factor calculations there is no need for improving the design. But if construction is not perfect, this is a way to improve the weakest link– keeping the sides perpendicular to the ground and remaining parallel.*

A light weight strong method would be the use of a ~1/4 inch threaded rod, washers and nuts.

# WA Technology

## "52" C8, 2017 Grand Sport & 2014 Z51 Stingray Mods, Info Available As PDFs:

***53 PDFs discuss improvements or info about a C8, 2017 Grand Sport, 2014 Z51 Stingray function and/or esthetics. Some are minor and others, like the installing "Low Dust Brake Pads" on C8 & C7s, have detailed information.***

***Below are the PDF's available. Click on picture or Blue PDF link or copy and paste the PDF link (Blue type) into your browser. Or email me at*** GUttrachi@aol.com **and state the title desired, shown in Yellow:**

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|---|---|
| **C8 Install High Wing**<br>***How To Remove Rear Bumper- Install Wing***<br>**http://netwelding.com/C8_High_Wing.pdf** |  |
| **C8 FWD Hybrid**<br>***WFWD Hybrid Provides More Power & MPG***<br>**http://netwelding.com/C8_FWD_Hybrid.pdf** |  |
| **C8 Edge Red Engine Cover**<br>***Engine Cover Matches Valve Covers***<br>**http://netwelding.com/Engine_Cover.pdf** |  |
| **C8 Engine Compartment Lights**<br>***Multicolor Lights Remote operated***<br>**http://netwelding.com/Engine_Lights.pdf** |  |
| **C8 Side Skirts & Splitter**<br>***Install C7 Carbon side skirts & splitter on C8***<br>**http://netwelding.com/Side_Skirts.pdf** |  |
| **C8 Z51, GS/C7 Z51Ceramic Brake Pads**<br>***Performance Vettes have dusty brakes. These US made pads help!***<br>**http://netwelding.com/Ceramic_Pads.pdf** |  |

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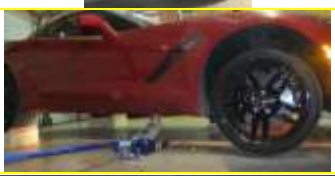
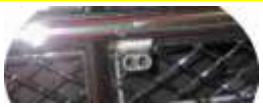
| **C8/GS/C7 Splash Guards**<br>***GM splash guards. ACS Best Front Guards for GS.***<br>***http://netwelding.com/Splash_Guard.pdf*** |  |
| **Jacking a C8/GS/C7 Vette**<br>***Safely jacking either front only or back & front***<br>***http://netwelding.com/Jacking_A_C7.pdf*** |  |
| **C8 & C7 Plates & Frame;**<br>**Must Meet South Carolina Law**<br>**http://netwelding.com/License_Plate_Frame.pdf** |  |
| **Change GS/C7 Oil**<br>***WHY change your own oil and C7 Lifting Methods***<br>**http://netwelding.com/Changing_Oil.pdf** |  |
| **C8/GS/C7 Mirror Proximity Alarm**<br>***Limit switch alarm warns when close to door frame***<br>**http://netwelding.com/Mirror_Proximity_Alarm.pdf** |  |
| **Jacking Pads for C8/GS/C7**<br>***Manual says Jacking Pads 2 1/2 inch max OD..***<br>**http://netwelding.com/Jacking_pads.pdf** |  |
| **C8/GS/C7 Radar Power**<br>***For C7 tapped rear fuse panel. For GS tapped mirror***<br>**http://netwelding.com/Radar_Detector_Power.pdf** |  |
| **C8 & C7 Wheel Chatter/Hop**<br>***Why sharp, low speed turns with cold tires causes the front tires to chatter/hop.***<br>***http://netwelding.com/Wheel_Chatter.pdf*** |  |
| **C8/GS/C7 Wheel Locks**<br>***Wheel locks, help protect your expensive wheels.***<br>**http://netwelding.com/Wheel_Locks.pdf** |  |
| **Deer Whistle Installed on C8/GS/C7**<br>***Do they work? Plus Install Info***<br>***http://netwelding.com/Deer_Whistle.pdf*** |  |
| **C8 & C7 Splitter Protector**<br>***Scrape Armor Protection for Splitter***<br>**http://netwelding.com/Splitter_Protectors.pdf** |  |
| **C8 & C7 Cargo Area**<br>***Rear cargo area storage device and rear protector***<br>**http://netwelding.com/Rear_Cargo_Area.pdf** |  |
| **C8 Coilover Tower Covers**<br>***Prevent water from filling cast aluminum cavities***<br>**http://netwelding.com/Tower_Covers.pdf** |  |
| **GS/C7 Belt Rattle**<br>***Passenger seat belt rattles against the seat back.***<br>**http://netwelding.com/Eliminate_Rattle.pdf** |  |

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| **Aluminum C7 Chassis and Weld Repair**<br>*The C7 aluminum chassis. Includes weld repair info.*<br>http://netwelding.com/Aluminum_Chassis.pdf |  |
| **Manage GS/C7 Spilled Gas & Door Lock**<br>*Protect when filling gas. Preventing door lock failure.*<br>http://netwelding.com/Manage_Spilled_Gas.pdf |  |
| **GS/C7 License Plate & Cargo Lights**<br>*LED license plate light & cargo area bulbs*<br>http://netwelding.com/License_Plate_Light.pdf |  |
| **GS Rear Diffuser (Fits Any C7)**<br>*Rear Carbon Flash Composite Diffuser*<br>http://netwelding.com/Rear_Diffuser.pdf |  |
| **GS/C7 Door Panel Protector**<br>*Black plastic protector prevents scuffing of door*<br>http://netwelding.com/Door_Panel_Protector.pdf |  |
| **GS/C7 Improved Cup Holder**<br>*A solution to the cup holder spilling*<br>http://netwelding.com/Improved_cup_Holder.pdf |  |
| **C7 Carbon Fiber Grille Bar**<br>*Install genuine carbon fiber grille bar overlay*<br>*http://netwelding.com/CF_Grille_Bar.pdf* |  |
| **Replacing C7 Battery**<br>*Tricks for installing battery!*<br>http://netwelding.com/Battery_Issues.pdf |  |
| **GS/C7 Window Valet**<br>*Lower Windows With FOB Helps Latch Hatch*<br>http://netwelding.com/Hatch_Latch.pdf |  |
| **GS/C7 Blind Spot Mirror**<br>*Smaller rear and side windows cause C7 blind spots. Small "blind spot mirrors" help*<br>http://netwelding.com/Blind_Spot.pdf |  |
| **GS/C7 Skid Pad Protector**<br>*After the air dam, the aluminum "skid pad" hits*<br>http://netwelding.com/Skid_Pad_Protector.pdf |  |
| **GS/C7 OnStar Lights**<br>*Rear view mirror OnStar LED's, at a quick glance, look like a police car flashing light! This is a fix.*<br>http://netwelding.com/OnStar_Lights.pdf |  |

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| **GS/C7 Skip Shift Eliminator**<br>***Skip Shift Eliminator install with suggestions on jacking a C7.***<br>**http://netwelding.com/Skip_shift_Eliminator.pdf** |  |
| **GS/C7 Catch Can & Clean Oil Separator**<br>***What is Coking and how to reduce the potential***<br>**http://netwelding.com/Catch_Can.pdf** |  |
| **GS MGW Flat Stick Shifter**<br>***The MGW shifter shortens throw and is more precise***<br>**http://netwelding.com/MGW_Shifter.pdf** |  |
| **GS/C7 Round Shift Knob**<br>***A round shift knob shortens throw on OEM shifter***<br>**http://netwelding.com/Shift_Knob.pdf** |  |
| **GS/C7 Stingray Sill Plate**<br>***Stingray sill plate replaces original.***<br>**http://netwelding.com/Sill_Plate.pdf** |  |
| **GS/C7 Nylon Bra**<br>***Nylon Bra Stops Bugs. Fits with Stage 3 Winglets***<br>**http://netwelding.com/Nylon_Bra.pdf** |  |
| **GS/C7 Clutch Fluid Change**<br>***Clutch fluid after 3000 miles gets dirty***<br>**http://netwelding.com/Clutch_Fluid.pdf** |  |
| **C7 Carbon Fiber Hood Vent**<br>***Replaces Plastic Hood Vent***<br>**http://netwelding.com/Hood_Vent.pdf** |  |
| **GS/C7 Cold Air Intake**<br>***Low Restriction Air Filter & Duct***<br>**http://netwelding.com/Cold_Air_Intake.pdf** |  |
| **GS/C7 Soler Modified Throttle Body**<br>***For Improved Throttle Response***<br>**http://netwelding.com/Soler_Mod_TB.pdf** |  |
| **Garmin GPS for GS Cubby**<br>***Garmin Mounts in GS Cubby & Apple CARPLAY***<br>**http://netwelding.com/GPS_In_Cubby.pdf** |  |
| **GS Splitter Stage 3 Winglet**<br>***Stage 3 Winglets Integrate with Spats***<br>**http://netwelding.com/Stage_3_Winglets.pdf** |  |
| **C7 Removing GM Plastic Film**<br>***How To Remove The Rocker Panel Film***<br>**http://netwelding.com/Rocker_Panel_Film.pdf** |  |

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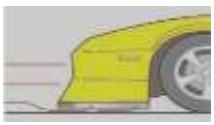
| **GS 2LT to 2.5 LT**<br>***Red Upper Dash Pad Like 3LT***<br>**http://netwelding.com/Red_Dash_Pad.pdf** |  |
| **Jake Emblem/Decals for GS**<br>***Jake Symbols Support GS Racing Image***<br>**http://netwelding.com/Jake_Emblems.pdf** |  |
| **Rusty GS/C7 Muffler**<br>***Why the C7 muffler rusts way to turn matte black.***<br>**http://netwelding.com/Muffler_Rust.pdf** |  |
| **GS Engine Compartment Mods**<br>***Cosmetic Additions in Engine Compartment***<br>**http://netwelding.com/Engine_Compartment.pdf** |  |
| **GS Vitesse Throttle Controller: Fits All C7s**<br>***Adjustable Throttle-by-Wire Control***<br>**http://netwelding.com/Throttle_Control.pdf** |  |
| **Splitter w/End Plates**<br>***How to install Splitter & Nylon bra fit***<br>**http://netwelding.com/CF_Splitter.pdf** |  |
| **Boomy Bass Solution**<br>***Use Presets to Adjust Bass etc Tone/Balance***<br>**http://netwelding.com/Boomy_Bass** |  |
| **GS/C7 Air Dam, Functions**<br>***Why Missing from Z51, Some GS & Z06***<br>**http://netwelding.com/Air_Dam.pdf** |  |
| **Rusty GS/C7 Muffler**<br>***Why the C7 muffler rusts way to turn matte black.***<br>**http://netwelding.com/Muffler_Rust.pdf** |  |
| **Engineering a ProStreet Rod**<br>***How Our '34 ProStreet Rod Was Designed and Built***<br>**http://netwelding.com/Engineering%20Street%20Rod%203-08.pdf** |  |
| **Motorsports Welding Article**<br>***Wrote a 5 Page Article for AWS March 2018 Journal***<br>***Covers NHRA and NASCAR Chassis Design***<br>**http://netwelding.com/Motorsports_Welding_2018.pdf** |  |

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