



## MUFFLER DESIGN



There are as many different theories and designs of mufflers as there are companies making them. The science of muffler design revolves around three major areas: 1) sound, 2) flow, 3) and durability. For the team at Billy Boat Exhaust, we have taken our 25 years of experience, our racing background, and our practical approach to design a product that has a signature tone and provides a lifetime of driving enjoyment.



tube design. This tube design allows for more volume in the muffler tube and also allows for more perforated surface area inside the tube. More volume means better flow and less restriction, while the increased surface area means more perforated material to absorb sound waves. We also use perforated arrows inside the tubes to direct the exhaust flow in a lazy S pattern, helping to increase the efficiency of the absorption side of the muffler.



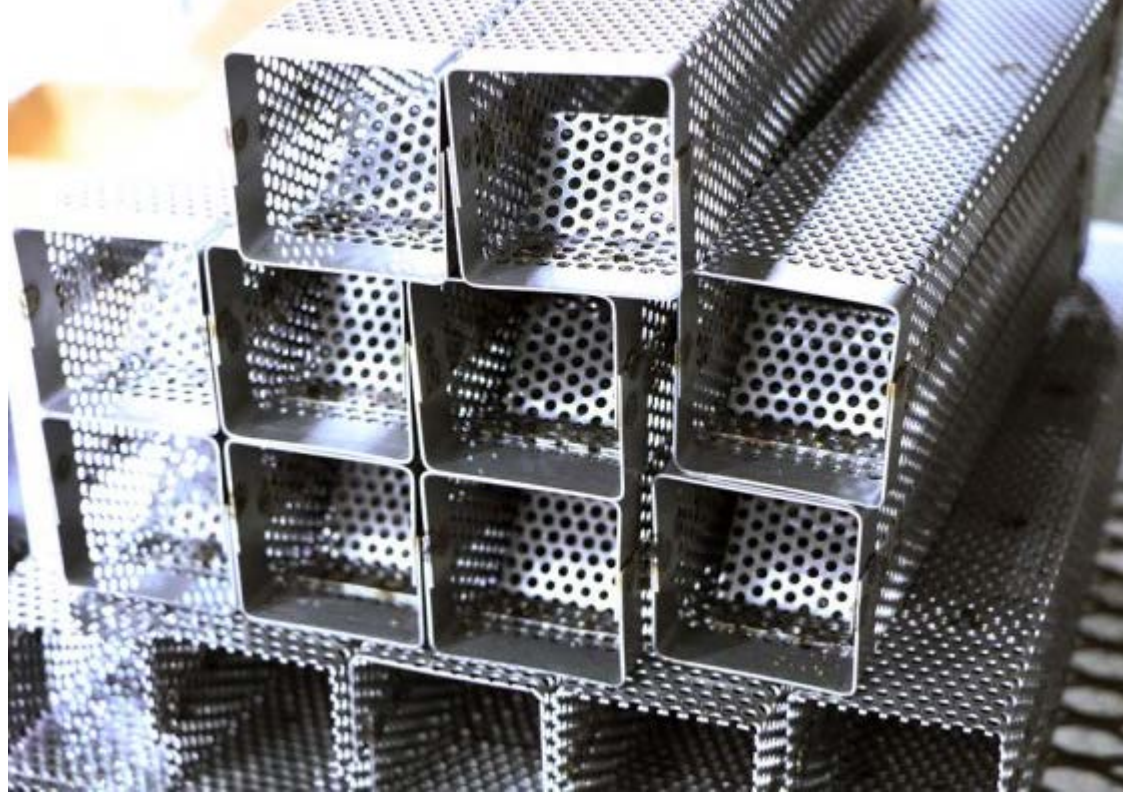
component to it. We use internal Helmholtz chambers in each muffler, which are dead-end tubes branched off of the main muffler core. The name comes from a device created in the 1850s by **Hermann von Helmholtz**, which he used to identify various **frequencies** and sound waves. As the exhaust flows by these tubes, pressure is reduced and the sound waves reflect back in the opposite direction. We use these internal tubes to reflect and cancel the high pitched sound waves which cause "drone" in the exhaust.



Durability is also an important component of each muffler. We use only 18 or 20 gauge 304 stainless steel for our muffler cases, and the muffler endplates are all 14 gauge 304 stainless steel. Each muffler is hand built according to exact design specifications for each application, and then either hand TIG welded or welded in our robotic welding cell. Our goal at Billy Boat Exhaust is to build the best performing, best sounding and highest quality exhaust systems on the market. Our manufacturing techniques and our signature tone is unique in the industry in order to provide our customers with a "moment of adrenaline and a lifetime of performance."

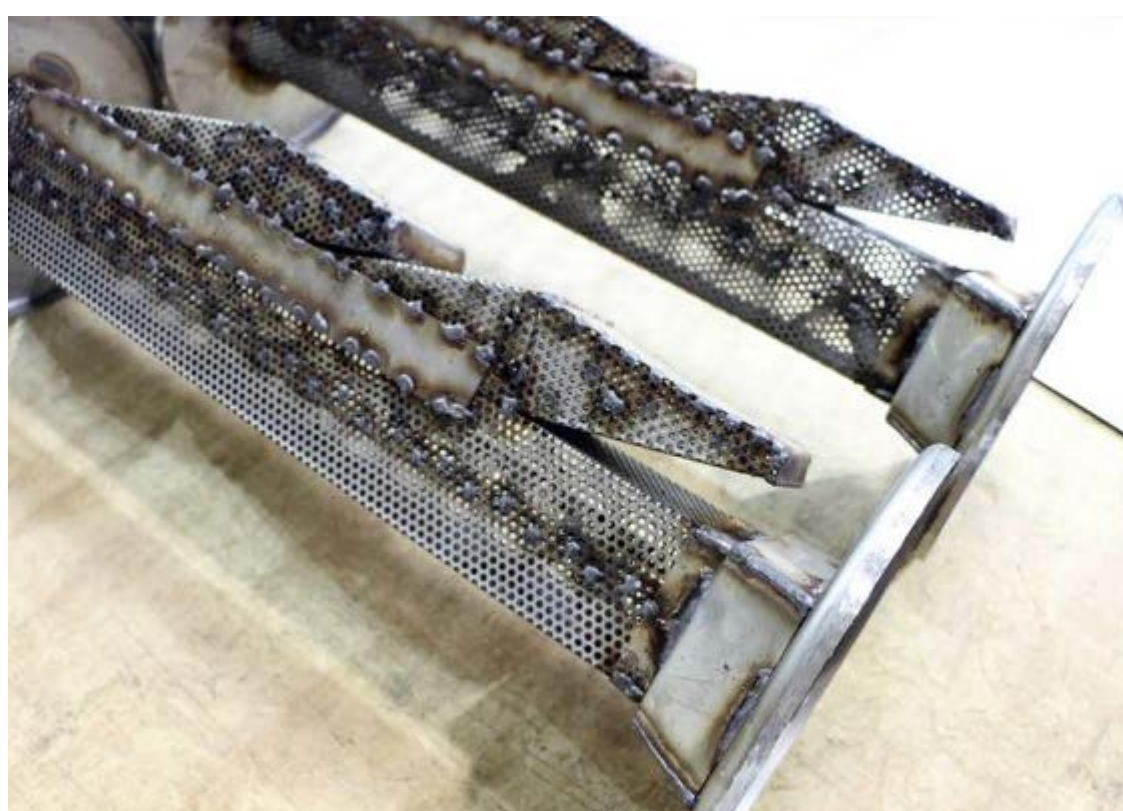
There are two basic ways to muffle an internal combustion engine. First, through absorption, in which the sounds waves are absorbed through a perforated core into some kind of packing material, and second, reflection, in which the sound waves are bounced off an internal baffle or back at each other in order to cancel the sound waves. We have built thousands of exhaust systems over the years and have found that each design theory has strengths and weaknesses. Our goal when we prototype a new exhaust is to create a deeper, throatier tone for the exhaust, increase the volume at idle and while under acceleration, but keep the interior volume quiet while at cruise and free of any "drone". In order to meet these criteria, we use a combination of each design style in our exhaust systems. We do not use "off the shelf" mufflers in our exhaust systems- each application is evaluated, and we build what is the optimal solution for each vehicle. This provides us with the opportunity to achieve the ultimate sound and performance.

While most muffler companies use a standard round tube design, Billy Boat Exhaust uses a square



The packing material around these perforated square tubes is equally as important as the design, as different materials have different acoustic properties. These materials must be durable and provide a lifetime of enjoyment, yet also emit the deep tones which create our signature tone. We use two different types of packing materials in our mufflers, a stainless steel mesh material and an extremely high temperature ceramic material. The stainless steel mesh is wrapped around all muffler cores to add a layer of durability to each muffler, while the ceramic material is used as a blanket around the core or as a void fill inside the muffler chamber. The combination of these two materials is unique in the exhaust industry and is the foundation for our deep, throaty muscle car tone.

Each of the mufflers in a Billy Boat Exhaust system also has a reflection

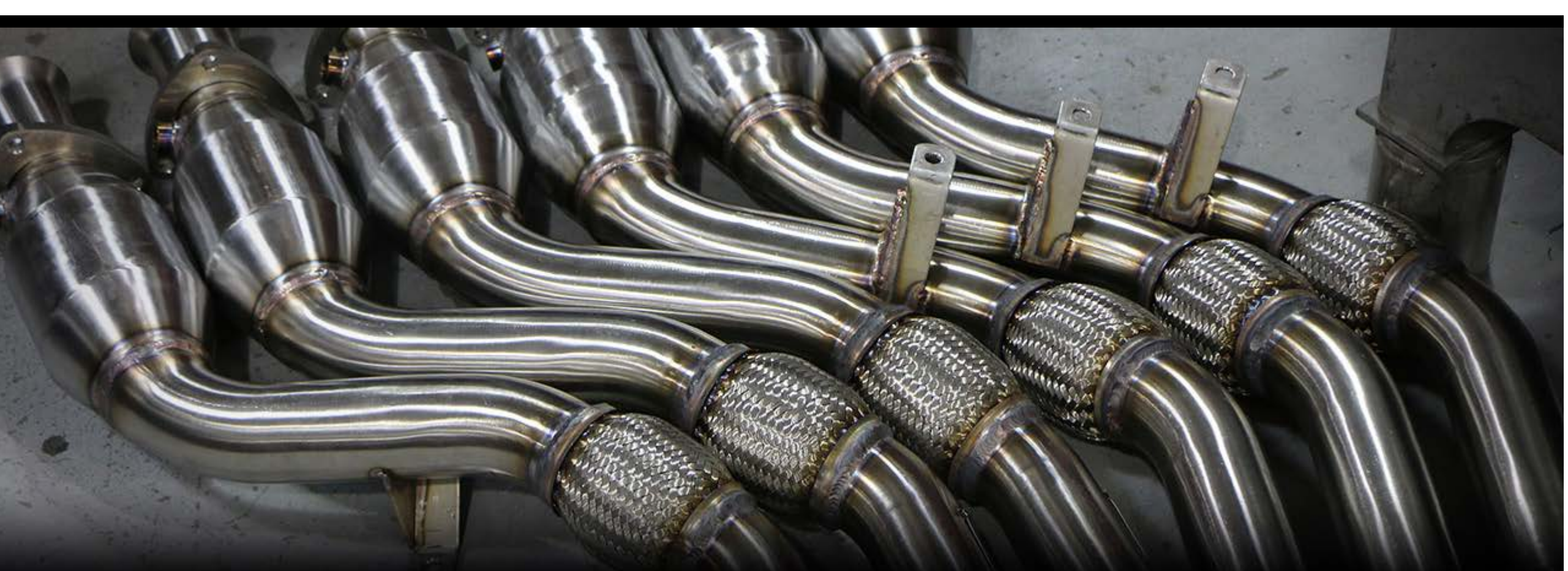


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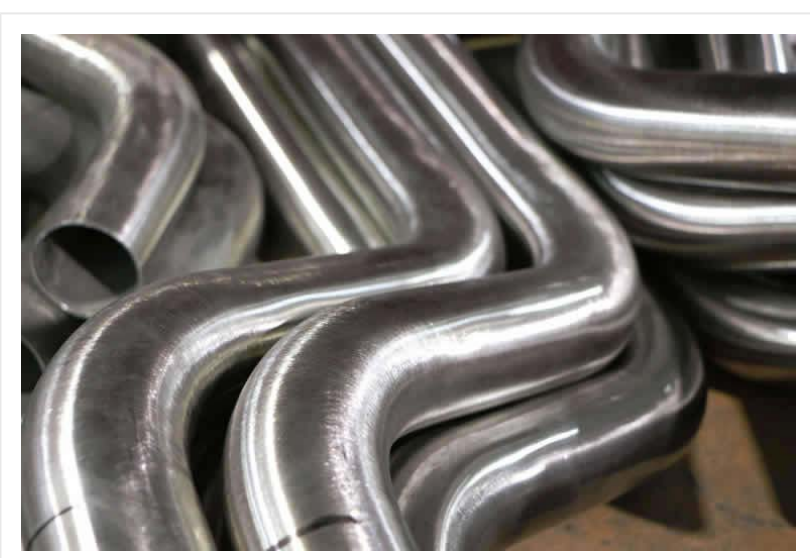
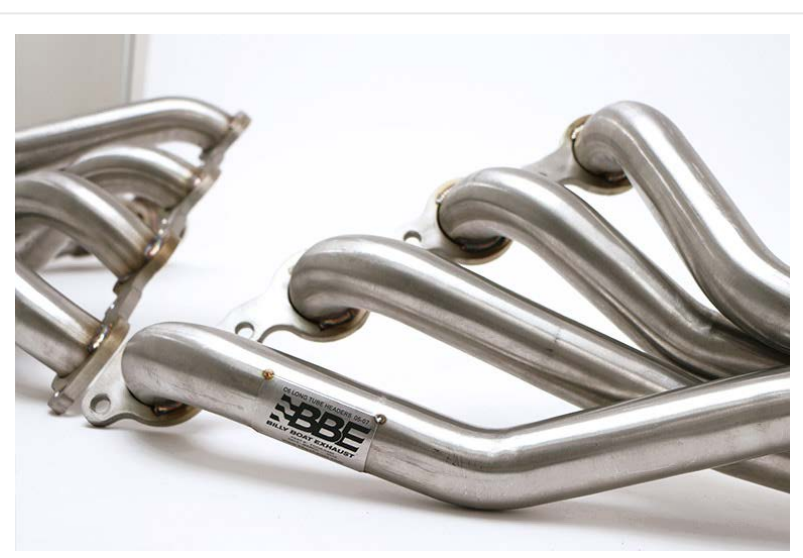
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## MANUFACTURING PROCESS



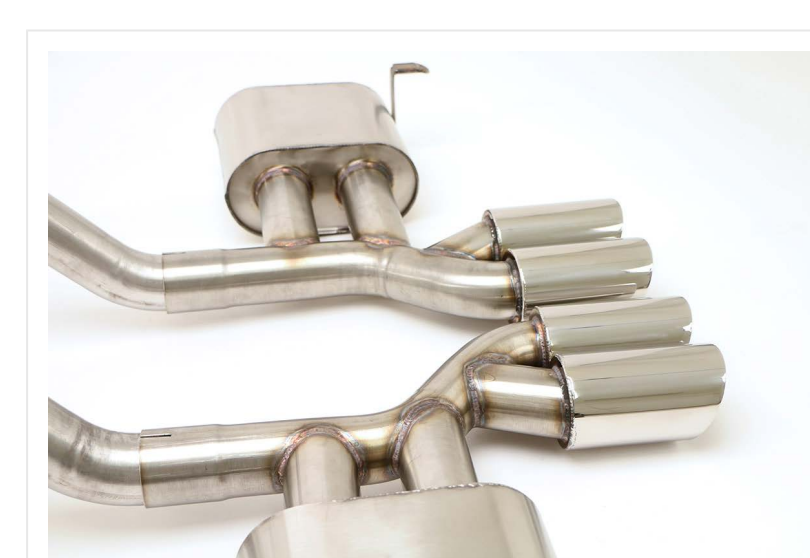
Each Billy Boat Performance Exhaust system incorporates 3-generations of fabrication skill and racing talent. Every system starts with T-304 stainless steel, known throughout the industry as the highest quality material practical for after-cat exhaust applications. All exhaust tubing is mandrel bent on sophisticated CNC machinery for a precise fit and uninterrupted exhaust flow. What's more, the use of T-304 stainless steel flanges offers high strength and complete resistance to harsh elements. All hangers, resonators, and tips are T-304 stainless steel as well.



## PRT NO-DRONE TECHNOLOGY



The Billy Boat Performance Exhaust PRT after-cat system employs exhaust technology unique to the aftermarket So unique, in fact, it doesn't use a muffler at all. The Billy Boat Performance Exhaust PRT system is simple in design, though more complex in theory, which suggests that you can have a mellow sound at cruising speeds and a sport note when you're tearing up the streets. It allows true straight through exhaust passage under aggressive driving conditions.



**Construction:**  
ALL ALUMINUM TWIN PASS CORE – Billy Boat Exhaust oil coolers incorporate the highest aircraft-quality aluminum core that is available and is a two pass design.  
CAST ALUMINUM TANKS with drain plug. The tanks of the oil cooler are cast and feature –12 inlet and outlet fittings on the same end for high volume oil flow. They are positioned at a 45-degree angle from the core for easy line attachment. Also, cast into the tanks are mounting plates at the top of the cooler for easy installation and a drain plug at one end. The tanks are CNC machined and are then heliarc welded to the core and pressure tested.

**Performance:**  
Billy Boat Exhaust oil coolers provide a significant reduction in inlet versus outlet oil temperature. (250-degree inlet, 170-degree outlet at 85-degree ambient air at 45 mph). The addition of this cooler will increase the life of your engine and reduce the risk of engine failure.

**Installation:**  
SPOILER MOUNT- Billy Boat Exhaust spoiler mount coolers requires a factory 930 spoiler or after-market version for installation. Provisions for mounting are standard on the cooler. However, due to the numerous different spoiler and methods of mounting, no standard bracket is available. The product comes with –12 lines, aerogrip fittings, and adapter to connect directly to the lines in the right front fender.

FENDER MOUNT- The fender mount cooler replaces the stock "hoop" cooler, and bolts directly in its place. The horn may need re-locating and one hole must be drilled to mount the cooler. The product comes with lines that connect to the factory lines. The 87 930 horn bracket works great.

**Sizes:**  
The Billy Boat Exhaust oil cooler can be fabricated in any size for racing or endurance applications. Standard sizes are listed below:

**SPOILER MOUNT**  
2 1/2" Thick x 5 1/2" Tall x 15", 20", or 24" Wide  
**FENDER MOUNT**  
2 1/2" Thick x 12" Tall x 8" Wide  
(20" standard – total length including tanks is 23 1/2")

**Billy Boat Exhaust Safety**  
SAFETY: Appropriate disassembly, assembly methods and procedures are essential to ensure the personal safety of the installer performing the kit installation. Improper installation due to the failure to correctly follow these instructions could cause personal injury or death. Read each step of the installation manual carefully before starting the installation.

Always wear safety glasses for eye protection.  
Place the ignition switch in the OFF position.  
Always apply the parking brake when working on the vehicle.  
Block the front and rear tire surfaces to prevent unexpected vehicle movement.  
Operate the engine only in well-ventilated areas to avoid exposure to carbon monoxide.  
Do not smoke or use flammable items near or around the fuel system.  
Use chemicals and cleaners only in well-ventilated areas.  
Batteries can produce explosive hydrogen gas which can cause personal injury. Do not allow flames, sparks or flammable sources to come near the battery.  
Keep hands and any other objects away from the radiator fan blades.  
Keep yourself and your clothing away from moving parts when the engine is running.  
Do not wear loose clothing or jewelry that can be caught in rotating or moving parts.  
VEHICLE SUPPORT WARNING: Should the purchaser decide to install this exhaust product at home, be warned that car or light duty truck/van "bumper" jacks are intended for emergency use only. The use of frame contact jack stands in conjunction with a floor jack as main support is highly recommended to minimize accidental dropping of a vehicle while the installation proceeds. We recommend the use of a shop hoist if possible. Please use caution!

Check out an excellent selection of performance exhaust systems on our website.