BICKNELL RACING PRODUCTS

CHASSIS SETUP GUIDE

BICKNELL RACING PRODUCTS

FACTORY SUPPORT
Phone - **905-685-4291**
24 Hour Fax - 905-685-4472
sales@bicknellracingproducts.com

Chassis Sales Inquiries: randywilliamson@bicknellracingproducts.com

Body Inquiries: bodyshop@bicknellracingproducts.com

Machine Shop Inquiries: bobbyslack@me.com

Chassis Tech Inquiries: tech@bicknellracingproducts.com

CHASSIS / MACHINE SHOP DIVISION

E-MAIL ALL OTHER INQUIRIES TO:
administrator@bicknellracingproducts.com

PARTS SALES DIVISION

E-MAIL ORDERS TO:
cdnsales@bicknellracingproducts.com

PETES AUTOMOTIVE
117 CUSHMAN RD.
ST” CATHARINES, ONT
Phone - 905-685-RACE
24 Hour Fax - 905-685-1558

Hours of operation -
Monday - Thursday 8:00am to 5:30pm
Friday 8:00am to 5:00pm
Seasonal hours on Saturday 9:00am to Noon
(April - September)
We are closed on Sunday
and all major Holidays.

E-MAIL ORDERS TO:
usasales@bicknellracingproducts.com

BRP USA
1733 MARYLAND AVE.
NIAGARA FALLS, NY
Phone - 716-285-7502
24 Hour Fax - 1-800-285-1454

Hours of operation -
Monday, Tuesday, Thursday 8:30am to 5:30pm
Wednesday 8:30am to 6:30pm
Saturday 9:00am to Noon
Open Saturday Year Round
We are closed on Sunday
and all major Holidays

CAR OWNER / CHASSIS SERIAL

PLACE LABEL
HERE

Important Information

Congratulations on your purchase of a Bicknell race car. Before beginning the assembly of this vehicle, read and understand the following information. FAILURE TO READ AND UNDERSTAND THIS INFORMATION MAY LEAD TO AN OCCURRENCE OR MALFUNCTION WHICH WILL INCREASE THE RISK OF SERIOUS INJURY OR DEATH.

- **Use only fasteners supplied by Bicknell Racing Products or their exact equivalent, and use them in the manner and position detailed in these instructions and the parts list supplied with the manual.**
- **Tighten all fasteners to recommended or industry standard torque specifications.**
- **Replace any fastener which is damaged in any way or which may have been over-tightened**
- **Where nylon lock or other lock nuts are used, replace the nut each time it is removed**
- **Light-weight components may increase performance, but are more likely to fail under stress. DO NOT USE ANY COMPONENT NOT APPROVED BY BICKNELL RACING PRODUCTS IN THE ASSEMBLY AND OR OPERATION OF THIS RACE CAR**
- **Adjustments to the suspension will affect the driver's ability to control the race car. Do not operate this race car with any suspension settings not recommended by Bicknell Racing Products unless qualified**
- **DO NOT OPERATE VEHICLE WITH ANY SAFETY GUARD REMOVED**
- **DO NOT OPERATE MOTOR WITHOUT ADEQUATE VENTILATION. Running engines give off carbon monoxide. AN ODORLESS, COLOURLESS, POISON GAS. BREATHING CARBON MONOXIDE WILL CAUSE NAUSEA, FAINTING AND DEATH**
- **FUELS USED IN MOTORSPORTS ARE EXTREMELY FLAMABLE AND EXPLOSIVE. FIRE OR EXPLOSION CAN CAUSE SEVERE BURNS OR DEATH.**
- **This race car is NOT EQUIPPED with a parking brake. USE CAUTION TO PREVENT INJURY CAUSED BY A ROLLING CAR**
- **Do not work under or near a car which is raised on a jack. ALWAYS SUPPORT CAR WITH JACK STANDS OR WORK STANDS BEFORE WORKING NEAR OR UNDER IT.**
- **Tire mounting should only be performed by qualified personnel. Always tighten all fasteners to industry specified torque. CAREFULLY INSPECT TIRES FOR DAMAGE AFTER ANY CAR TO CAR OR CAR TO BARRIER CONTACT. REPLACE DAMAGED TIRES BEFORE RESUMING OPERATION OF RACE CAR. DO NOT OVER-INFLATE TIRE PRESSURES.**
- **Running engines produce heat. CONTACT WITH HOT AREAS OF THE ENGINE AND EXHAUST SYSTEM CAN CAUSE BURNS ON CONTACT**
- **Replace any component which is damaged or worn before resuming operation of race car. INSPECT ALL COMPONENTS ON RACE CAR AFTER ANY CAR TO CAR OR CAR TO BARRIER CONTACT.**
- **Read and understand all instructions supplied with components, parts or accessories not supplied by Bicknell Racing Products before installing them on this race car. In the event that any instruction conflicts with those contained in this manual, consult Bicknell Racing Products or a qualified expert BEFORE OPERATING RACE CAR.**
- **AUTO RACING IS A VERY DANGEROUS ACTIVITY WITH A HIGH RISK OF SERIOUS INJURY OR DEATH, WHICH CANNOT BE ELIMINATED. FAILURE TO OPERATE THIS RACE CAR IN CONFORMITY WITH THESE INSTRUCTIONS INCREASES THE RISK OF INJURY OR DEATH.**

THE FOLLOWING QUOTES ARE WHAT ANY SMART RACER MUST REMEMBER:

- The only stupid question is the one that is never asked.

- SMOOTH IS FAST.

- To finish first, first you must finish.

- Handling begins at the starters stand, then corner entry, then corner mid turn, and then finally corner exit.

REV. 002a

TABLE OF CONTENTS

CHASSIS TERMINOLOGY

Here are some common terms you will see in this book, and will most likely hear at the race track.

Left Side Percentage - This is the weight of the left side of the car. To calculate the left side percentage, add the left rear wheel weight and the left front wheel weight and divide by the total. In the below example, the left side percentage is 54%.
The more left side % the car has, the better it will steer into the corner. BRP recommends left side % between 54% and 54.2%.

LF 470	RF 310
LR 730	RR 710

LF WEIGHT + LR WEIGHT ÷ TOTAL WEIGHT = LEFT SIDE %
470 + 730 ÷ 2220 =.5405 or 54%

NOTE: BRP recommends the following left percentage:
54% - 54.2%

Rear Percentage - This is the weight of the rear of the race car. To calculate the rear percentage, add the left rear wheel weight to the right rear weight and divide by the total. In the example below, the rear percentage is 64.9%. The more rear percentage a race car has, the tighter on the throttle it tends to be. Too much rear percentage can also make the back of the car swing on corner entry, causing a loose on entry / lack of side bite condition. This is called 'pendulum loose'.

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RR WEIGHT ÷ TOTAL WEIGHT = REAR %
730 + 710 ÷ 2220 =.6486 or 64.9%

NOTE: BRP recommends the following rear percentage:
big block : 63.5 - 64%
small block / sportsman : 65 - 66%

Diagonal Percentage - This is the weight of the diagonal of the race car. To calculate the diagaonal percentage, add the left rear weight and the right front weight and divide by the total. In the below example, the diagaonal percentage is 46.8%. The greater the diagonal % in the race car, the tighter the car will be. Left rear weight or wedge greatly effect the diagonal % so the more wedge a car has, the more diagonal the car will have.

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RF WEIGHT ÷ TOTAL WEIGHT = DIAGONAL %
730 + 310 ÷ 2220 =.4684 or 46.8%

NOTE: BRP recommends the following diagonal percentage:
46.5% - 47.5% to start.

Left Rear Weight or Wedge - This is the amount that the left rear tire is heavier than the right rear tire. To calculate left rear weight, subtract the right rear weight from the left rear and you are left with your wedge or left rear weight. Left rear weight usually makes the car tighter on throttle, but can also make the the car loose on entry as it will take away side bite because of the phyiscal weight it takes off of the right rear tire.

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RR WEIGHT = LEFT REAR WEIGHT
730 - 710 = 20# LR WEIGHT

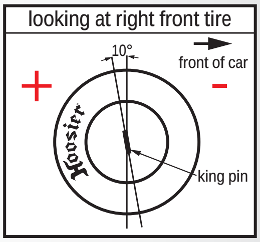
Ballast Weight - Any weight bolted to the chassis strictly to increase the total weight of the car. The placement of the ballast weight is very important, and has a drastic effect on a race car's handling. The added weight can alter race car balance and percentages.

Wheel Lead - The difference in wheel base from the left side to the right side. The longer the left side wheel base is, the tighter the car will be. The longer the right side, the looser the car will be.

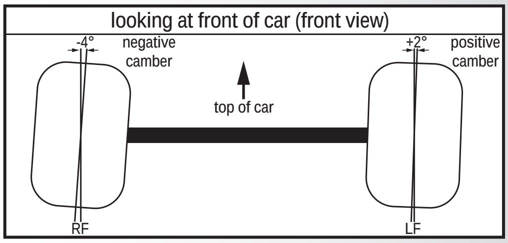
Chassis Tilt - Chassis tilt is difference in ride heights between the left and right of the chassis. Generally the lower the left side of the car is, the tighter the car will be on exit. It could also take away side bite from the car, making for a loose mid-turn condition.

Chassis Rake - The difference in ride height between the front and rear of the chassis. The higher the front ride heights are, the tighter the car will be on corner entry. The lower the front frame heights, the looser the car will be on corner entry. The higher the rear frame heights are, the looser the car will be on corner exit. The lower the rear frame heights, the tighter the car will be on corner exit. Higher ride heights = more chassis roll.

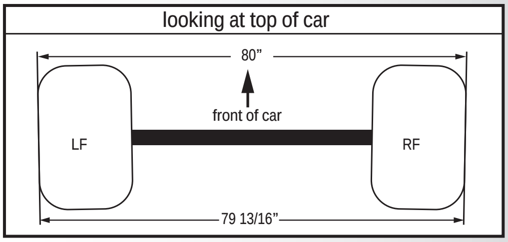
Caster - The angle to which the pivot or king pin is tilted forward or rearward from vertical as viewed from the side. If the kingpin is tilted back at the top, then the caster is positive. If it is tilted forward at the top, the caster is negative. The more caster a car has, the better the feel the driver will have but the stiffer the steering will be. The less caster a car has, the less feel the driver will have but the softer it will be. The general rule of thumb is run as much caster as you can handle. Bicknell recommends 10° of caster on the right front, and 6° of caster on the left front.



Camber - The angle of the tire relative to vertical as viewed from the front. If the top of the tire is leaning toward the center of the chassis, it has negative camber. If it is leaning toward the outside of the chassis, it has positive camber. Camber is built into the front axle so the only way to change the camber is to install a camber adjustable spindle on the front axle. Camber adjustable spindles have 2° of camber adjustment positive and negative. Bicknell recomends -4° of camber on the right front, and +1.5° to +2° camber on the left front.



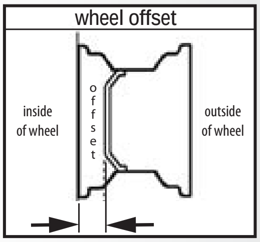
Toe In/Toe Out - The angle of the tires relative to each other as viewed from the top - much like looking down at your toes. Toe in is the front of the wheels pointing toward the centerline of the chassis. Toe out is the front of the wheels pointing away from the centerline of the chassis. Bicknell recommends 1/8" - 3/16" toe out.



Wheel Track - The measurement taken from a wheel on one side of the car to the wheel on the opposite side of the car (usually taken from the center of the wheel/tire).

Wheel Base - The measurement taken from the centerline of the front axle to the centerline of the rear axle. Also related to wheel lead (see page 3).

Wheel Offset - The measurement taken from the back edge of the rim where the tire seals, to the mounting flange of the wheel. The wheel offset has a great impact on the percentages of the race car and should always be checked. Bicknell recommends 3" offset rear wheels, with a 4" offset left front wheel and a 5" offset right front wheel. Wheel offset may also be refered to as wheel backset.



Frame Heights - The measurement from the bottom of the 2X4 frame rail to the ground. The front frame height is measured at the front of the 2X4 frame rail. The back is measured at the back of the 2X4 frame rail just in front of the rear tires. Frame heights can vary from track to track, but recommended starting frame heights are 5 1/4" on both left front and right front, and 6 1/2" on both left rear and right rear. Always use the flattest part of the floor when setting frame heights to ensure accurate measurements.

Chassis Bind - Refers to anything that restricts or limits the movement of the suspension. There are many items that commonly cause chassis bind such as bend or seized heim ends, bent or dented shocks, front radius rods bound up, torsion arms rubbing birdcages, improper shock height installation, torque arms, torsion rollers, torsion bearings or bushings, etc.

Brake Bias - The difference in brake pressure between the front and rear of the race car. Bicknell recommends a 1" front master cylinder mounted to the top of balance bar and a 7/8" rear master cylinder mounted to the bottom of the balance bar. This provides an equalized brake-pad-to-pressure ratio to allow the race car proper brake balance. Brake pad compound can also influence brake bias because you can also change the brake bias by changing the pad compound.

Sprung Weight - The portion of the car's mass that is supported above the suspension. This includes the chassis itself, the body, the fuel cell, ballas weight, etc.

Un Sprung Weight - The mass of the suspension and the components connected to it. This includes the axles, wheels, tires, hubs, etc. The heavier un sprung components are, the more difficult they are to control. Un sprung weight can also increase tire wear, and can be hard on shocks. When un sprung components are heavy, the shock has to work harder to control these components decreasng life of the shock.

Rotating Weight - The portion of the car's mass that accerlerates and decelerates. This includes axles, driveshaft, wheels, tires, etc. Four things determine the effect of rotating weight on the car.

1- How quickly and how often the mass or weight accelerates or decelerates.
2- How heavy the rotating mass is.
3- The rotating weights distance from the centerline.
4- How fast the weight spins.

Each one of the above factors effect the car in different ways, so lightening the appropriate items is the key.

Stagger - The measured difference between the left and right side tires. If a right rear tire is 92", and the left rear tire is 86"- the race car has 6" of stagger. Stagger has a huge effect on race car handling. More stagger makes the car looser on corner entry and corner apex, while less stagger makes the car tighter on corner entry and corner apex. Insufficient stagger can also cause the car to be loose in the apex because the car will not turn on entry, and the driver has to shear the car which puts the car in a 4 wheel slide.

Tight Car - A term used to classify a car that will not steer. This means the car will not turn as it attempts to negotiate the corner. The rear tires have more grip than the front tires. This condition is also known as understeer.

Loose Car - A term used to classify a car that wants to spin out or come around. This means the car turns too good or the front tires have more grip than the rear tires. This condition is also known as oversteer.

Side Bite - A term used to describe the amount of traction a car has as it slides across the track. There are many things that effect side bite including ballast weight placement, height and angle of panhard bars, ride heights, shocks, wheel offsets, etc.

Forward Bite - A term used to describe the amount of traction a car has as it accelerates forward. There are many things that effect forward bite including ballast weight placement, rear radius rod location, length of torque arm, left rear weight, shocks, tire preperation and compound, tire pressures, etc.

Shock Bump (or compression) - This is a term used to describe the force experienced when the shock is being compressed. A good example would be when you hit a bump on the track. If there was no compression in your shock, the tire would just move upward along with the car, and the tire would lose contact with the track. With compression, the tire will stay in contact with the track, and reduce the car's motion. The basic theory is it converts the upward travel of the wheel from track imperfections into heat, and controls the car's motion.

Shock Rebound (or extension) - This is a term used to describe the force experienced when the shock returns from its compressed state, to its original state. When a shock is in the process of rebounding, the spring or torsion bar is going from being compressed back to normal ride height and releases its stored energy. Basically, the shock is converting the energy from the compressed spring into heat, and dissippating the car's motion. We have all seen an old 70's Monte Carlo with bad shocks- it will just keep bouncing for days! But the shock no longer has control of the spring, hence why it bounces.
See page 45-48 for more information on shocks.

SCALING PROCEDURE

The following is the scaling procedure we use at Bicknell Racing Products. Please consult attached set-up sheet for accurate set-up. Set-ups are ever changing, and depend on track, engine combination, and tire selection etc. A more detailed set-up sheet can be obtained by e-mailing your serial #, division, engine combination, shock brand, track, and brand of tire you will be racing on to the following e-mail address:

tech@bicknellracingproducts.com

1- Set air pressure in tires. Measure stagger both front and rear.

2- Set frame heights using the procedure on page 10.

3- Place car on Scales.

4- Adjust front and rear panhard bars to obtain the proper left side percentage. (BRP recommends 54.0% - 54.2% left side percentage)

5- Install ballast weight (maintain left side percentage).

6- Recheck frame heights and adjust as necessary.

7- Check rear end squareness off keystocks using procedure on page 16.

8- Double check birdcage timing using procedure on page 17 - 20.

9- Set front caster using procedure on page 14 - 15.

10- Check front end for squareness off of front shock towers using procedure on page 14 - 15.

11- Recheck frame heights and adjust as necessary.

12- Set left rear weight using formula on page 12.

NOTE: You should always jack 1 rear tire off the scales to free wheel the rear tires. This will avoid the tires being bound up. Most often times, scale inconsistencies are caused by the tires being bound up. Another way to avoid this is to take 1 axle out while scaling.

13- Check for necessary shock stem heights. The left front should 3” of stem showing and the right front should have 4 1/2“ - 5” of stem showing.

14- Check car for binds using the procedure on page 27.

15- Set toe to 1/8” to 3/16” out at the tires.

16- Crack you favorite beer............

CHASSIS SPECIFICATIONS

The following are chassis specifications for all 2001-to-present Midrail dirt modified chassis. Under certain situations, different parts or specs may be required based on serial number. If you have any questions, all chassis are kept on record to verify components and specs. If you have any questions, please call our tech department @ 905-685-4291 or e-mail tech@bicknellracingproducts.com

Always keep torsion bushing and bearing lubed, and keep space between torsion stop and bushing. Always try to keep all unsprung weight as light as possible. This prevents tire wear and is easier on suspension components. Keep all turning weight such as hubs, driveshaft, etc. as light as possble becasue 1 pound of turning weight is like 10 pounds of static weight for the purposes of acceleration and deceleration.

PLEASE NOTE:

DO NOT USE ANY COMPONENTS NOT APPROVED BY BICKNELL RACING PRODUCTS. IF YOU ARE UNSURE, OF THE SUITABILITY OF A COMPONENT FOR USE ON YOUR BICKNELL RACE CAR, CALL, E-MAIL OR WRITE TO BICKNELL RACING PRODUCTS BEFORE OPERATING A THE RACE CAR WITH THE COMPONENT INSTALLED.

WARNING- CHECK ALL FLUID LEVELS AND DRAIN PLUG TIGHTNESS BEFORE RACING.
RECOMMENDED SETUP SPECS ARE GUIDELINES ONLY. CAR SHOULD BE SETUP TO THESE SPECS INITIALLY AND THEN FINE TUNED AT THE TRACK TO FIT EACH DRIVER OWN PERSONAL DRIVING STYLE. WHEN THE CAR IS WORKING WELL, MAKE YOUR OWN SETUP SPECS THAT YOU WILL BE ABLE TO REFER BACK TO.

PLEASE NOTE: below specs are generic - Please refer to particular race track setup sheet for more info.

POSITION	FRAME HEIGHT	SPRING	TORSION BAR	INTEGRA SHOCK	TIRE PRESSURE
LEFT FRONT	5 1/4”	225		LF STD +2R	9#
RIGHT FRONT	5 1/4”	150-175		RF STD +1C	9#
LEFT REAR	6 1/2”	200	950	LR MED	6#
RIGHT REAR	6 1/2”	200	925	LR MED	10#

SPRINGS: For a big block, we recommend starting with a 175 # spring on the right front and for a small block or sportsman 150# spring on the right front. Start with a 225# spring on the left front. If the car pushes on entry, sometimes it can be corrected by lowering the front panhard on the outboard side and inboard side - see front panhard bar location on page 8. If the car pushes on entry after lowering the front panhard bar, you may need to lower the right front spring rate, and/or raise the left front spring rate. This should also be done on tracks with long sweeping turns where there is not much weight transfer. If the opposite is happening, do the reverse to this.

TORSION BARS: We recommend for big block, small block, and sportsman to start with a 950 left rear bar and a 925 right rear bar with both rollers in the rear holes. If you race on a highly banked track, for example Lebenon Valley, or a very heavy/tacky race track you may have to stiffen up the right rear bar. In general, If the car rolls to the right rear too much, you can install a 950 right rear torsion bar. Always remember that moving the roller on the birdcages to the front holes will SOFTEN the spring rate while the roller in the back holes will be stiffer. The shorter the torsion arm, the stiffer the spring. The longer the torsion arm, the softer.

RIGHT REAR HELPER SPRING: Sometimes IF you are at the track and the car is rolling on the right rear too much and you don’t have time to change the torsion bar, a coil assist spring of 80# can be used on the right rear to limit the amount of chassis roll. Have the assist spring nut touching the coil at ride height to start. Sometimes a stiffer right rear shock can help as well as more gas pressure in the right rear shock.

WHEEL BASE: Square the rear end in the car 9” from the front of the rear end tube to the keystocks for -5° bird-cage timing cars, or 8 3/4” for 0° bidrcage timing cars. For more information on birdcage timing, please consult pages 17-20 of this manual. Square the rear end side to side -- see page 16 of this manual for info. Square the front end 1 1/2” between the front of the front axle to the back of te shock towers- See page 14-15 of this manual for more information. This should set the wheelbase to 105 1/2” - 105 3/4” on both sides. If the car is tight, lead the left rear ahead 3/8”, which also softens the LR spring rate.

FRONT AXLE AND PANHARD LOCATION: Install the front panhard bar as per instructions on page 14-15 of this manual. On setup blocks or at ride height, there should be aproximately 1/2” clearance between the left front shock tower and and the lower bolt holding the shock onto the axle bracket.

TOE OUT: 1/8” -3/16” toe out at the wheels, or 1/16” toe out at the rotors.

CASTER: The left front should be 6°, and the right front should be 10°. The caster split is built into the axle. Always make sure the right front is 3-4° more than the left front - see page 14-15 for more information. The more caster you run, the stiffer the steering will feel. Also it will not add as much left rear weight on corner entry (loose) and more left rear weight on corner exit (tight).

LEFT REAR WEIGHT: for more information, please see page 12 of this manual.
Dry slick track = 60 to 110 pounds more on left rear (start at 40#)
Wet or tacky track = 0 to 30 pounds more on left rear (start at 30#)
Very heavy track = you may need 30# right rear weight.

TIRE STAGGER: Front stagger = 1/2” to 1 1/2” - smaller tire on the left front.
Rear stagger = 7” to 8” on a heavy track, 6” to 7” on medium tracks, and 5-6” for slick tracks. Corner entry must be slow enough to prevent car from sliding out. Insufficient stagger will cause slow corner entry, and could cause a push when the throttle is applied. Too much stagger may slow down straight away speeds and make the car loose on exit. If a quick decision must be made, always keep stagger on the higher side than the lower side because its possible to drive a loose race car, but impossible for most drivers to drive a tight race car.

RADIUS ROD LENGTHS: Note: All lengths are rod lengths with no heim ends.

LEFT FRONT	-	QTY 2 - 25”	BRP 1250BK or BRP RR25BK or BRP RR25S
RIGHT FRONT	-	QTY 2 - 25”	BRP 1250BK or BRP RR25BK or BRP RR25S
FRONT PANHARD	-	QTY 1 - 21”	BRP 1210BK
LEFT REAR	-	QTY 1 - 27”	BRP RR27BK or BRP RR27S
RIGHT REAR	-	QTY 1 - 27 1/2”	BRP RR27 1/2BK or BRP RR 27 1/2S
DRAG LINK	-	QTY 1 - 64” to 66”	BRP RR64B or BRP RR66B
TIE ROD	-	QTY 1 - 48 1/2”	BRP RR48 1/2 for 52” AXLE

NOTE: If BERT or WINTERS spindles are used, a 47 1/2” TIE ROD (BRP RR 47 1/2) is used or BRP 9140 / 9087

REAR PANHARD	-	QTY 1 - 15”	BRP 1150BK

Start with rear radius rods in the middle holes at the chassis. See page 28 for more info on radius rod placement.

REAR SPRING ROD: BRP 1399-900-171/2BK (comes with 17 1/2” radius rod)
Compress spring to 3 3/4” for tacky track. 4” for normal track and 4 1/4” for slick track.

FRONT AXLE: BRP EC52BOC 4 bar cambered front axle. Use BRP 9200 spindles for small bearing and BRP 4588 splindles for large bearing hubs.

FRONT HUBS: BRP 4570BK for small bearing spindles (BRP 9200) and BRP 9382 for large bearing spindles (BRP 4588)

BUMPERS: FRONT **:** BRP 464 or 464-1.5 - add “T” to end for tall.
REAR : BRP 7111
RIGHT SIDE : OUTER - BRP 7102 MIDDLE : BRP 447 REAR INNER : BRP 7100
LEFT SIDE : OUTER - BRP 7101 MIDDLE : BRP 447 REAR INNER : BRP 7100
DOUBLE RAIL SIDE BARS - RIGHT : BRP 7129 LEFT : BRP 7128
*****NOTE: FOR CHROME BUMPERS, ADD “C” TO END OF PART NUMBER*****

BODY MOUNTS: LEFT DOOR MOUNT - BRP 7105S for straight BRP 7105 for kick in doors
RIGHT DOOR MOUNT - BRP 7106S for straight BRP 7106 for kick in doors
REAR QUARTER MOUNTS - LEFT : BRP 7096 RIGHT : BRP 9592
OR 4 BRP 7096 and 2 BRP 7097 for spring steel rear quarter mounts
ROOF MOUNTS - FRONT : BRP 7108 REAR : BRP 7109 EXTENSIONS : BRP 7112
FOR MORE INFORMATION, PLEASE CONSULT CATALOG PAGE 184

REAR TORSION ARMS: LEFT : BRP 4400 or BRP 9360 RIGHT : BRP 4402 or BRP 9361

SHOCK SLIDERS: LEFT FRONT : BRP 9143LBK RIGHT FRONT : BRP 9143RBK
REAR : BRP 9060BK

FOR COIL OVER OPTIONS, PLEASE SEE PAGES 24-28 IN THIS SETUP MANUAL.

REAR END: DMI CT1-486 - SEE PAGE 47 - 48 of the BRP CATALOG FOR MORE OPTIONS

REAR END TUBE / AXLE LENGTHS:

	8 BOLT	SMART TUBE	QUAD LOCK	QUAD LOCK W/ RING
RIGHT REAR TUBE	BRP 3576	BRP 3800-60	BRP 4000-60	BRP 4050-60
LEFT REAR TUBE	BRP 3520	BRP 3800-05	BRP 4000-05	BRP 4050-05
RIGHT REAR AXLE	BRP 3076	BRP 3060	BRP 3060	BRP 3060
LEFT REAR AXLE	BRP 3020	BRP 3005	BRP 3005	BRP 3005

SEE PAGE 50 - 52 of the BRP CATALOG FOR MORE OPTIONS

TRANSMISSION: GEN 1 - BERT MOZ or WIN 60150
GEN II - BER 1200 NOTE: USE TORCO MTF FLUID AND CHANGE EVERY 10 RACES

TORQUE ARMS AND DRIVE LINE: 0° torque arm : BRP 426 -3° torque arm : BRP 432 or BRP 9295

BRP RECOMMENDS BRP 432 TORQUE ARMS (BRP 9295 same as BRP 432 with front hole missing)

Rubber Biscuit - BRP 424BL or BRP 9425 Driveshaft - BRP 4044 (20" long)
Driveshaft Cover - BRP 1645 for GEN 1 transmission or BRP 9020 for GEN II transmissions
Strange Complete driveshaft kit with yokes and u-joints - STG DKM203-20
Slip Yoke - BRP 509 U Joint - BRP 512
Slider Plate - BRP 417S Slider Collars - BRP 181-1A (2 or 4 required)
Slider Rods - stock floor : BRP 421 (2 required) Rubber floor : BRP 9115 (2 required)

BRAKES: NOTE: Bleed brakes every 1-2 weeks to keep fluid fresh. Never use silicon fluids. Never mix fluid types.
BRC Calipers 3/8" front rotor width : BRC 170-1526 or BRC 170-1526BK for black.
BRC Calipers .810" rear rotor width: BRC 170-4090 or BRC 170-4090BK for black.
BRC Radial Mount Calipers .810" rear rotor width: BRC 170-5810

REAR PANHARD MOUNT: Start with the panhard in the second hole down on the rear end and the 6th hole down on the outside BRP 4550 plates (non adjustable) or aprox 3" up on the adjustable outboard mount.
REAR PANHARD MOUNT KIT - BRP 4551 or Optional cockpit adjustable BRP 4549
INNER REAR PANHARD MOUNT - BRP 1626

REAR BIRDCAGES: NOTE *-indicates available in red or black. All other available in black only

	8 BOLT	SMART TUBE	-5° QUAD LOCK	0° QUAD LOCK	QUAD LOCK ADJUST.
RIGHT REAR	BRP 4293*	BRP 4257*	BRP 9033*	BRP 9466	BRP 9310
LEFT REAR	BRP 4292*	BRP 4255*	BRP 9032*	BRP 9465	BRP 9310

FOR COIL OVER OPTIONS, PLEASE SEE PAGES 32-36 IN THE CATALOG.

BRAKE BALANCE BAR: BRC 310-9070 (or BRC310-9085 with master cylinders installed) or BRP310-1000
WIL260-10375B = 1" front master cylinder WIL26010374B = 7/8" rear master cylinder
SEE PAGES 22-26 FOR MORE INFORMATION

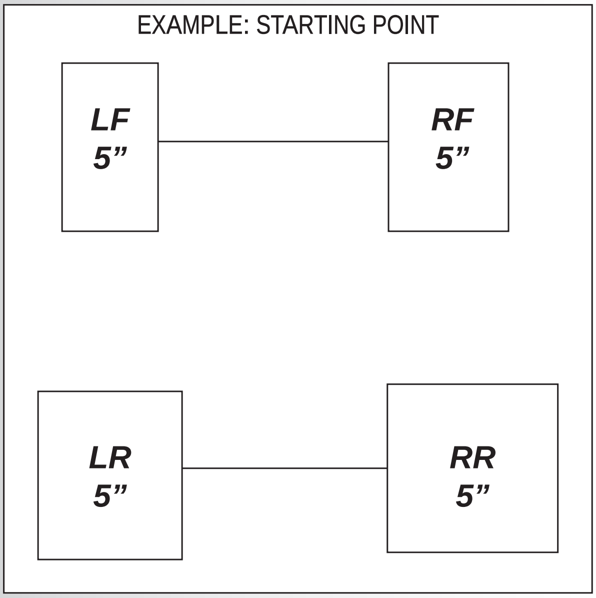
WHEELS: LF:10" X 4" RF: 12" X 5" LR: 13" X 3" RR14" X 3"

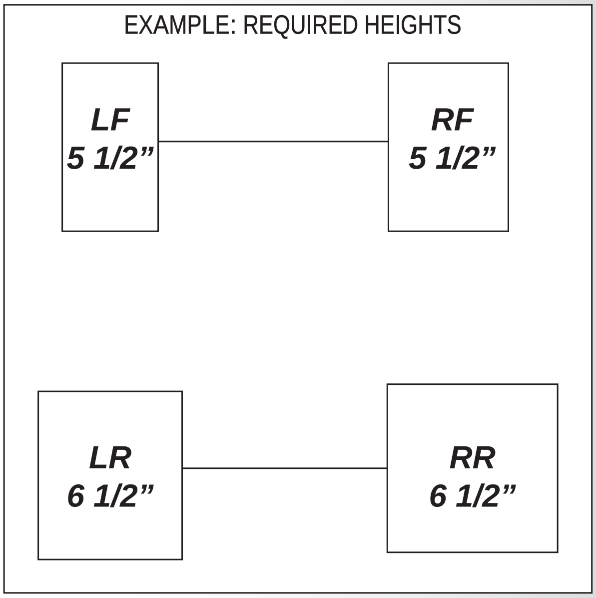
SETUP BLOCK HEIGHTS: LF - BRP 1553 (4 1/4") RF - BRP 1552 (3 3/4")
LR - BRP 1538 (4 1/2") RR - BRP 1539 (3 3/4")
LR DROP RAIL - BRP 1537 (6")

FOR MORE INFORMATION, PLEASE CONSULT OUR CATALOG FOR FULL PARTS LIST LOCATED ON PAGE 176-177.

SETTING FRAME HEIGHTS

***NOTE: The following examples are for coil over front and torsion bar rear suspension. ***





1 TURN ON A COIL NUT - 1/8” OR 6 POUNDS OF WEIGHT (AS LONG AS THE COIL SLEEVE IS 8 TPI)
1 TURN ON A TORSION BAR = 1/4” OR 12 POUNDS OF WEIGHT

By using the information that we have listed above, getting the required frame heights will be easy.

1- You will need to raise the front up 1/2” on both sides.

2- As noted in the above example, 4 turns will raise the front of the car 1/2”. Just wind the coil nuts down 4 turns on both sides.

3- Now, move to the rear and you will need to raise both sides by 1 1/2”.

4- As also noted above, you need to put 6 turns on each torsion stop bolt - 1 turn for every 1/4” you need to go up.

5- Recheck both front and rear and make final adjustments as needed before moving onto the next step.

Note: Once ride heights are achieved, make sure you have the proper shock stem showing.
Left Front - 3” showing   Right Front - 4 1/2”
If the right front shock only has 3 1/2” showing, you need to expose another inch of shock shaft.
The shock slider needs to be raised by 1”, and the coil nut needs to moved down 1”.

CALCULATING WEIGHTS AND PERCENTAGES

Most modern scale systems give you all this information, but here is the formulas for calculating percentages. The only way to change the percentages of a race car is to move the physical weight in the chassis (ballast weight), change the location of the rear end and front end, or by changing the frame heights or wheel offsets. Also the physical weight of the tires will have an effect on percentages.

NOTE:
If you have wireless scales, we have seen where the batteries have been weak and this makes the percentages of the car seem strange. If the percentages are different then what you had the previous week, double check and make sure each scale pad reads the same. If not, replace the batteries in that pad.

Left Side Percentage

LF 470	RF 310
LR 730	RR 710

LF WEIGHT + LR WEIGHT ÷ TOTAL WEIGHT = LEFT SIDE %

470 + 730 ÷ 2220 =.5405 or 54%

Rear Percentage

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RR WEIGHT ÷ TOTAL WEIGHT = REAR %

730 + 710 ÷ 2220 =.6486 or 64.9%

Diagonal or Cross Percentage

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RF WEIGHT ÷ TOTAL WEIGHT = DIAGONAL %

730 + 310 ÷ 2220 =.4684 or 46.8%

Left Rear Weight

LF 470	RF 310
LR 730	RR 710

LR WEIGHT + RR WEIGHT = LEFT REAR WEIGHT

730 - 710 = 20# LR WEIGHT

Adjusting Weight Percentages And Frame Heights

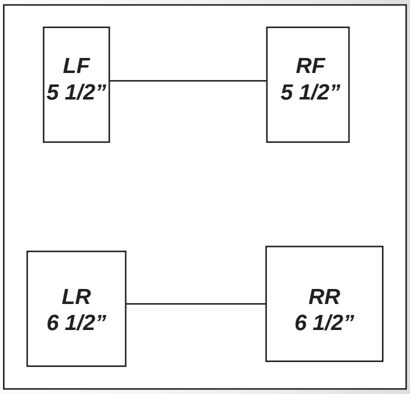
A few things should be noted before we start. All information is based on a 2050-2250 pound race car after ballast weight is added and WITHOUT DRIVER.

- 1 turn on a torsion stop bolt will change the weight on that tire aprox. 12 pounds. It will also change the frame height of that corner aprox. 1/4".
- 2 turns on a standard coil over front shock nut will have the same effect - 1/4" of ride height and 12 pounds of weight assuming the coil nut is 8 TPI (threads per inch). If they are not, see note.
- Left rear torsion bars should have 5-6 turns of pre-load with no rear shocks installed.
- Right rear torsion bars should have 6-7 turns of pre-load with no rear shocks installed
- Always never seize your torsion stop bolts.
- Always set your frame heights first.

Note:
a standard coil nut is 8 TPI (threads per inch), which means every turn is moving the nut 1/8". Some shocks have different threads per inch so you will need to figure out how many turns it takes to move your coil nut 1/8". If it is 12 threads per inch, it would take 3 turns to move the nut 1/8" or 6 turns to move the nut 1/4".

Formula For Adjusting Left Rear Weight - Torsion Bar

1- Put your car on scales and set left side percentage between 54% - 54.2% before adding any ballast weight to car. First, shorten the front panhard bar as much as possible until the lower mounting bolt of the left front shock is 1/4" away from the shock tower. If the left side percentage still is low, you can shorten the rear panhard bar until you acheive the necessary left side percentage.



2- Set your rear percentage to 63.5-64% for BB or 65-66% for SB/sports. Using ballast weight is okay toacheive this, but remember to maintain your left side percentage.

3- For example, if at this point the car has 100 pounds of left rear weight and we are trying to acheive 0 pounds left rear weight - here is the formula to achieve it.
(note- if you are going by cross weight percentage, 100 pounds of left rear weight will be aprox.50% cross)

The easy solution might be to just wind one corner and take all that weight out.... But we have our frame heights to worry about! What you need to do is take that 100 pounds of left rear weight and divide it by all 4 corners of the car. 100 divided by 4 = 25 pounds of weight per corner. Why 4 you ask? Because we are going to take out left rear weight by adjusting all 4 corners of the car to maintain our frame heights. Basically, we need to change all 4 corners of the car by 25 pounds of weight.

We already know from above that 1 turn on a torsion bar is equal to 12 pounds of weight adjustment on that corner, and 2 turns on a coil nut is also 12 pounds of weight adjustment on that corner.

Always remember that all weights are diagonal on a race car... If you increase weight on a corner, it will always put weight on the diagonal corner.

So, we need to take 2 turns out of the left rear torsion stop, and put 2 turns into the right rear torsion stop. We do diagonally the same we need to take 4 turns out of the right front coil nut and put 4 turns into the left front coil nut. Recheck your wheel weights and frame heights and you will see that you are very close... a few slight adjustments may be necessary.

Left Rear Weight Quick Checks (torsion bar) IF FRAME HEIGHTS ARE CORRECT

ADDING 25 # LEFT REAR

LF 1 turn out	RF 1 turn in
LR 1/2 turn in	RF 1/2 turn out

ADDING 50 # LEFT REAR

LF 2 turn out	RF 2 turn in
LR 1 turn in	RR 1 turn out

REMOVING 25 # LEFT REAR

LF 1 turn in	RF 1 turn out
LR 1/2 turn out	RF 1/2 turn in

REMOVING 50 # LEFT REAR

LF 2 turn in	RF 2 turn out
LR 1 turn out	RR 1 turn in

WARNING

ALL CHASSIS SETTING AND ADJUSTMENTS ARE INTENDED FOR USE BY PROFESSIONAL RACE TEAMS AND TO BE PERFORMED BY QUALIFIED TECHNICIANS. IF YOU ARE NOT QUALIFIED TO DO THE WORK, SEEK THE ASSISTANCE OF A QUALIFIED TECHNICIAN. IF YOUR DRIVER IS NOT EXPERIENCED IN THE OPERATION OF A RACE CAR OF THIS TYPE, SEEK THE ASSISTANCE OF A QUALIFIED RACE DRIVING INSTRUCTOR OR SCHOOL BEFORE OPERATING THIS RACE CAR.
SERIOUS INJURY OR DEATH CAN OCCUR IN AUTO RACING.

DO NOT WORK ON RACE CAR BEFORE SUPPORTING IT ON ADEQUATE JACK STANDS OR OTHER SUITABLE WORK STANDS. NEVER WORK NEAR OR UNDER A RACE CAR SUPPORTED ONLY ON A JACK. WORK ONLY ON A LEVEL, HARD SURFACE CAPABLE OF SUPPORTING STANDS.

TORSION BAR PRELOAD INSTRUCTIONS

These instructions are assuming that you already have the rear end installed, squared using setup blocks and that the torsion bars and torsion arms are slid into place and tightened down.

1- Make sure the rear shocks are unhooked.

2- Take the rear end off the setup stands and let it hang down. At this point, if you have a 1 1/2” left rear drop rail you must put a 1 1/2” block between the bottom of the left rear tube and top of the left rear frame connector. If car doesn’t have a drop left rear rail, the rear end will sit on the lower chassis rails.

3- Make sure the torsion stop adjuster bolt are never seized and installed in the stops. Back the stop adjuster bolts all the way out.

4- Slide the torsion stops into place. You may need to pry the left rear torsion bar out slightly to have enough room to slide the left rear stop into place. Use a pry bar on the left rear torsion arm to slide the torsion bar and arm out enough to slide torsion stop into place. If you need to, you can also lengthen the rear panhard bar to acheive this as well. Make sure the stop is rotated as close to the adjustment pad as possible.

5- Adjust the stop bolts until they just touch the adjustment pad and you feel a slight amount of tension starting.

6- Starting with the left rear bar, wind the required 5-6 turns into the stop bolt. Remember the stop on the right hand side of the car controls the left rear bar.

7- Next, do the same to the right rear bar, but put 6-7 turns into it. Now the car should be taken off the jack stands and set on the shop floor.

8- Torsion bars must now be seated. Bounce the back of the car by placing your knee on the rear bumper. Moderately bounce on the car for 3-5 minutes.

9- Re-install shocks. Make sure when you hook the shocks back up that the rear end tubes touch the frame rail on the left rear, and right rear is 1“-1.5” off the lower frame connector.

10- Scale car as necessary.

FRONT END SET-UP

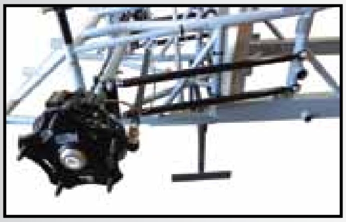


image 1A

1- First, ensure the brackets are properly installed on the axle. The brackets go to the grandstand side of the welded on slugs. The radius rods bolt on to the infield side of the axle brackets.
FRONT AXLE PART # BRP EC52BOC

image 1B

image 2A

2- Next, set the height of the panhard slider. BRP recommends to start the slider at 1" (see image2A)
On newer chassis with the welded on brackets, start in the second hole from the bottom (see image2B)

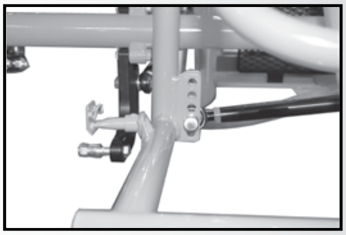


image 2B

image 3

3- The panhard drop bracket should be installed in the second hole down from the top. (see image 3)

DROP BRACKET PART # BRP 1503 (2 HOLES OFF AXLE CENTERLINE)
BRP 1622 (1 HOLE OFF AXLE CENTERLINE)

4- Place set-up blocks between axle and chassis. This will simulate ride height. Contact your chassis dealer to obtain a set. (see image 4)

RIGHT FRONT SET-UP BLOCK- BRP 1552
LEFT FRONT SET-UP BLOCK- BRP 1553

image 4

5- Next, set the front end left to right in the chassis. Between the 2 main rails, it should measure 12 7/8". Make a mark at 6 7/16". This is the center of the chassis. Next draw a line at 24" on the axle from the center-line of the left front king pin. Adjust panhard bar until the 2 marks line up. A 21" panhard bar should be very close to bottoming out. (see image 5)
Also note that there should be aproximately 1/4" - 1/2" of gap between the head of the shock bolt and left front shock tower (see image 6)

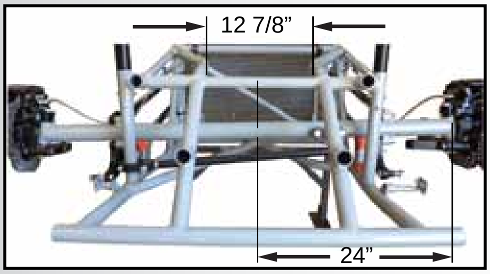


image 5

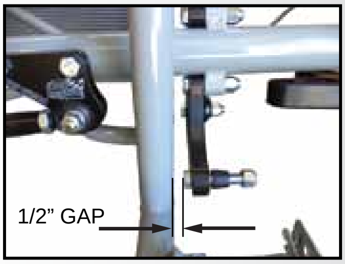


image 6

FRONT END SET-UP CONTINUED

image 7

6- Next, make sure the chassis is level with a digital protractor. This will make setting the caster easier. (see image 7)

7- With the chassis level, we can now set the caster. BRP recommends the caster to be set at 10.5° on the right front and 6.5° to 7° on the left front. However on the set-up blocks, we need to set the caster 1.5° more than actual to allow for the tilt in the chassis when we set the car at proper ride heights. In image 8, we have 12° of caster on the set-up blocks, but at ride height we will have 10.5°. On the left front (image 9) we have 8.2°, but when we set the chassis at proper ride heights the caster will be aprox. 6.7°. Adjust the caster using both top radius rods or both bottom radius rods. NOTE: While setting the front end, you could also take the upper right front radius rod off to make sure the the front end is neutral.


image 8

8- After the caster has been set, we can square the front end. Set the wheel base adjusting the radius rods so the axle is 1 1/2” away from the back of the shock towers. A piece of 1 1/2” tubing works well for this (figure 10). Adjust rods evenly so the caster does not change. Be sure to double check both sides as measurements may change as you adjust the opposite side.


image 9

9- Next, jam down all jam nuts except for the right front top radius rod. This rod must be free at all times. The left side is the load carrying side and will be slightly snug, but the right side radius rods should be free at all times. Once the car is set-up, go back and adjust the right front top radius rod until it is free. This will ensure a bind free front end.

10- Once car set on ground, set toe out to 1/8”-3/16 using toe plates.

Front end set-up is now complete!


image 10

REAR END SET-UP - TORSION BARS

NOTE: SEE PAGE 24-29 FOR COIL OVER, J BAR, AND LEFT SIDE PANHARD SETUPS


image 1


image 2

1- First, set the rear end on set-up stands with the torsion stops removed. (image 1 and 2)
Left Rear- BRP 1538 Right Rear- BRP 1539

2- Set the rear panhard bar height. BRP recommends to start the outer panhard at 3” on the adjustable, 6th hole from the top on the non-adjustable. (image 3) Set the inner panhard in the second hole from the top (image 4).

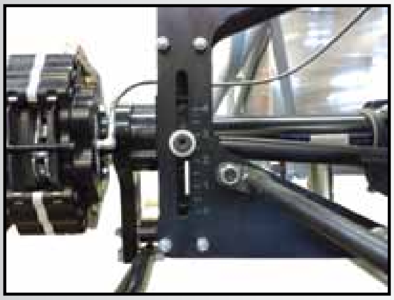


image 3


image 4

3- Once the panhad is set, center the rear end. Measure from the outside of the 2X4 frame rail to the outside of the torque arms 11 7/16”. This dimension should be the same on both sides. (images 5 and 6) The rear end can be offset to obtain proper left side percentage, just make the torsion arms do not hit the birdcages as the suspension moves.

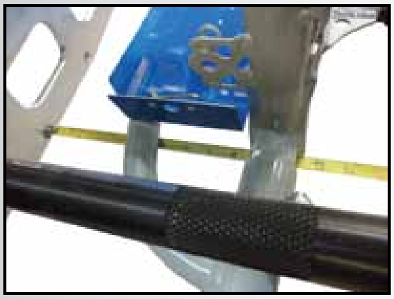


image 5


image 6

4- Now square the rear end. Measure 8 3/4” or 9“ (depending on birdcage timing - See page 17-20) from the back side of the keystock to the front side of the rear end tube. (images 7 and 8)

5- We recommend starting with both rear radius rods in the middle holes (image 9)
Set the spring rod to 3 3/4” for heavy tracks and adjust for track conditions.


image 7


image 8

6- Next, ensure birdcage timing is correct. The birdcage timing is important because this sets the spring rate of the torsion bars. See birdcage timing (page 17-20) for more information about this topic.

7- BRP recommends starting with both rollers in the bottom rear holes. (image10)


image 9


image 10

8- The torsion arms should line up aprox. in the center of the birdcages at this point. They can be offset to obtain left side percentage as long as the torsion arms don’t rub on the birdcages. If using quad lock tubes, you can also slide the birdcages on the tube to re-align the torsion arms in the center of the birdcages.

Note: If more left side percentage is required, you can shorten the rear panhard bar to achieve this. Always ensure there is at least 1/4” of clearence between torsion arms and birdcage plates.

BIRDCAGE TIMING

All the talk about birdcage timing... why is it so important anyways? It is important because it is what sets the spring rate of your rear torsion bars. Imagine having a coil spring on the right front of your car that was marked a 150 but actually measured 225. If your birdcage timing is incorrect, this is the exact same effect it will have on your race car. You should always use a digital angle finder (PT# BRP 9316) as the rotary style angle finders that are available at your local hardware store will not be able to measure the birdcage timing accurately enough. Also remember that if you are checking birdcage timing in the chassis, make sure the chassis is level.

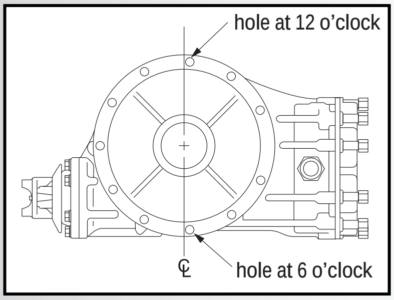


image 1

image 2

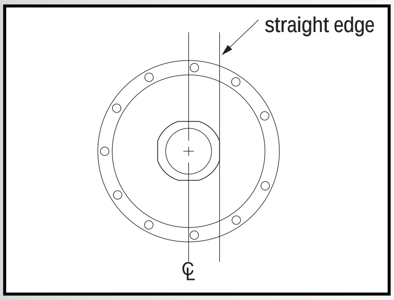


image 3

image 4

QUAD LOCK BIRDCAGE TIMING OPTION A + 5°

Birdcage timing option A: +2° in front of rear end center line with -3° torque arms (birdcage timing +5° in relation to rear end cover)
This option helps corner entry but makes a looser race car. It loads the torque arms down on deceleration. This option is better suited to limited horsepower applications or tracks that need a loose race car.

Step 1- Installing the tube in the rear end bell-

The tube is designed to be installed in the bell at 0°. So the flats on the tube need to be parallel with the mounting holes in the bell that are located at 12 o'clock and 6 o'clock (see image 1). The easiest way to acheive this is to put a piece of angle iron on the rear flat of the tube(see image 2). As the tube is installed, you can look down the angle iron and align it to the holes on the bell (see figure 3). This option uses BRP 9032 / BRP 9033 birdcages.

Step 2- Installing the birdcage-

The rear end tube sets the birdcage timing. If the timing of the tube is correct, then the timing of the birdcage will be correct. We aim for +2° forward (see page 28) with -3° torque arms. THERE IS +5° BUILT INTO A STANDARD QUAD LOCK BIRDCAGE. If you measure the birdcage timing in relation to the rear cover, it should be +5°. If you set the rear end in the car and use the setup blocks, the timing shoule be +2° (or 2° forward at the bottom see page 28)

An adjustable birdcage is also available if the tube is installed incorrectly, or if you would like to experiment with birdcage timing.

To locate the birdcage on the tube left to right, measure from the outside of the rear end tube (where the threads are) to the outside birdcage plate. It should measure aprox. 6 3/4" for both sides. If you have offset the rear end to gain left side percentage, then these measurements may different.

As a reference, if you set the rear cover of the rear end on the ground to measure birdcage timing, the birdcages will actually be at +5° forward at the bottom.

BIRDCAGE TIMING

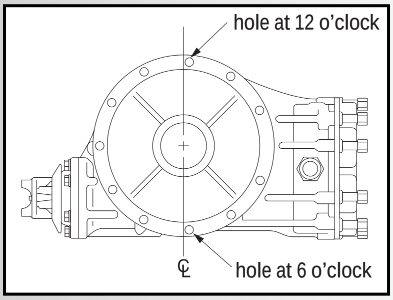


image 1


image 2

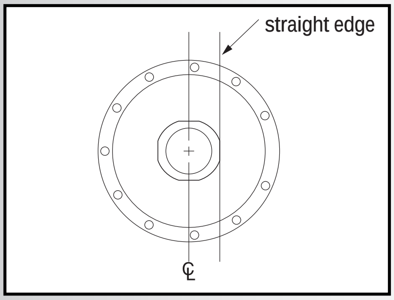


image 3

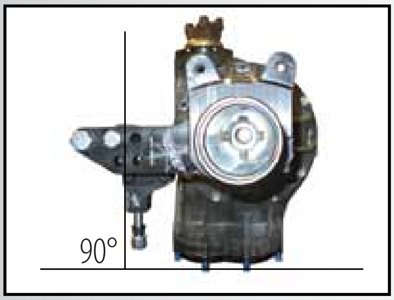


image 4


image 5

QUAD LOCK BIRDCAGE TIMING OPTION B 0°

Birdcage timing option B- 3° behind rear end center line with -3° torque arms (birdcage timing 0° in relation to rear end cover)
This option makes the rear end load more because the roller is behind rear end center line which will pre-lolad the torque arm.
This option will make the car tighter on corner entry, and tighter on acceleration.
This option is better suited to high horsepower applications and race tracks that are typically dry.

NOTE: For option B you must use BRP 9310 adjustable birdcages or BRP 9465/9466.

Step 1- Installing the tube in the rear end bell-

The tube is designed to be installed in the bell at 0°. So the flats on the tube need to be parallel with the mounting holes in the bell that are located at 12 o'clock and 6 o'clock (see image 1). The easiest way to acheive this is to put a piece of angle iron on the rear flat of the tube(see image 2). As the tube is installed, you can look down the angle iron and align it to the holes on the bell (see figure 3).

Step 2- Installing the birdcage-

Install the adjustable birdcages on the rear end tubes as normal. If the rear end is NOT installed in the race car, then rotate the rear end so it is on the back cover. Install the proper pills in the BRP 9310 birdcages so the bottom of the birdcage is 90° to the rear end center line (see image 4). If the tube is installed correctly, then the 5° pills should be installed in the birdcages.

As a reference, if you set the rear cover of the rear end on the ground to measure birdcage timing, the birdcages will actually be at 0°.

If the rear end is installed in the race car, set the rear end on the set-up blocks. Make sure the chassis is level. Install the proper pills in the birdcage so the birdcage measures -3°. The birdcages should be -3° behind the rear end center line (see image 5).

BIRDCAGE TIMING CONTINUED

image 5

SMART TUBE REAR END

Step 1- Installing the tube in the rear end bell-

When installing a smart tube into the bell, the tube does not need to be timed. All the timing is done on the birdcage, so the tube can be installed in any position.

Step 2- Installing the birdcage-

2A- To time the birdcages on a smart tube rear end, the rear radius rods and rear panhard bar should all be installed.
2B- Place rear end on setup stands.
2C- If you are using the brake brackets that came with the birdcages, install hubs and calipers. This will align the birdcages left to right. If using bolt on brake brackets, install hubs and calipers after birdcages have been timed.
2D- Square the rear end left to right off the torque arms.
2E- Ensure the torsion arms are centered in the birdcages.
2F- MAKE SURE CHASSIS IS LEVEL AT THIS POINT.
2G- Put the angle finder on the top of the birdcage (see image5) and set birdcage timing. See page 17-18 for birdcage timing options. (Option A: +2° forward, Option B: -3° backward)
2H- Drill and tap the birdcage into the tube, and tighten pinch bolt.

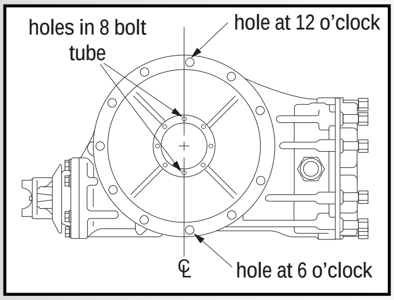


image 6

8 BOLT REAR END

Step 1- Installing the tube in the rear end bell-

The tube is designed to be installed in the bell at 0°. The holes in the end of the tube need to line up with the mounting holes at 12 o'clock and 6 o'clock in the bell (see image 6). The rear end tube sets the birdcage timing, so if the tube is installed correctly then the birdcage timing will also be correct.

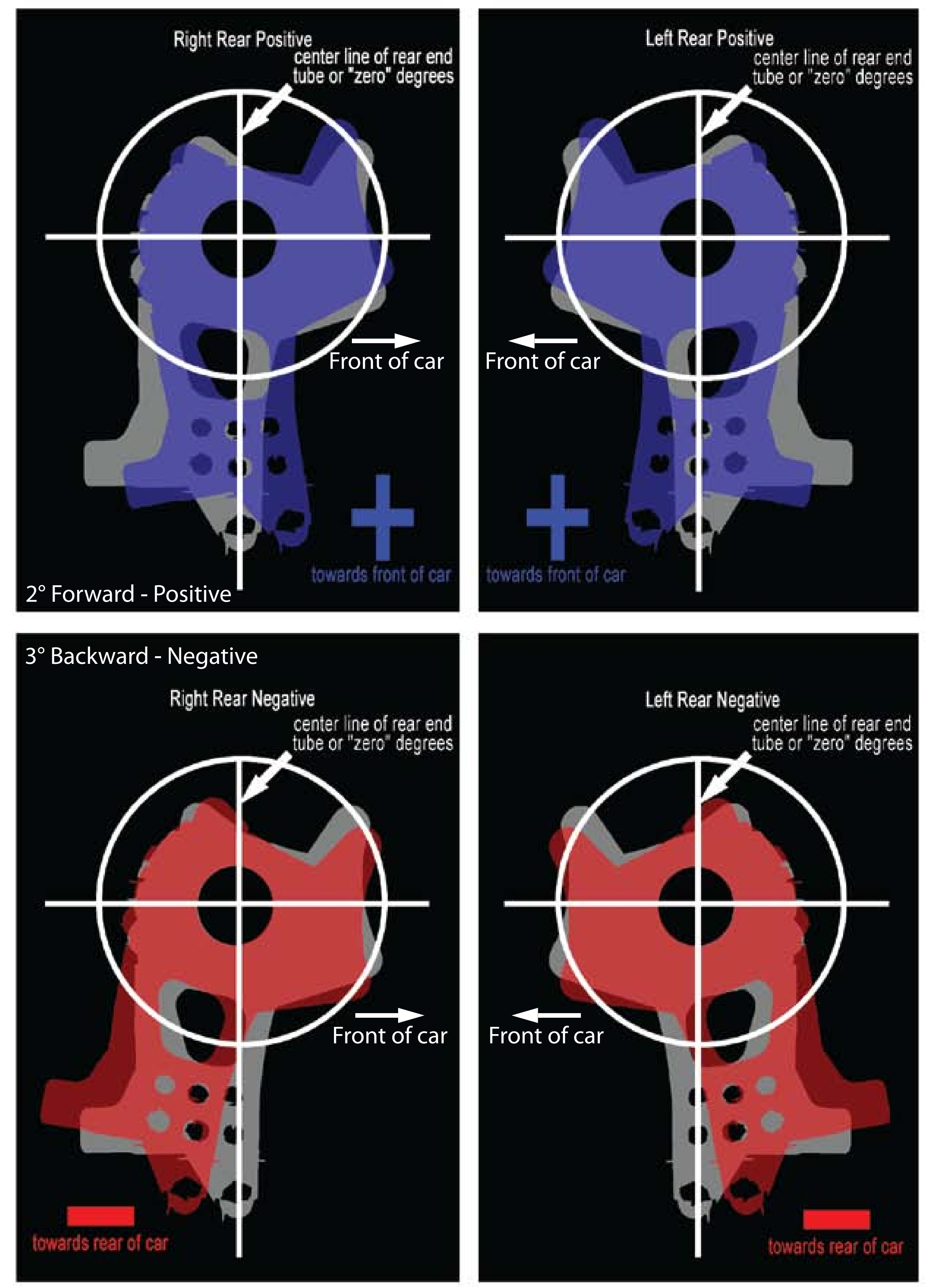

image 7

Step 2- Installing the birdcage-

2A- Install birdcages and spindles as per normal.
2B- MAKE SURE CHASSIS IS LEVEL.
2C- Place setup blocks under rear end tubes.
2D- Place the angle finder at the bottom of the shock mount and check the birdcage timing. The birdcage/tube timing should be aprox. 2.75°. If the birdcage timing is incorrect, a blank cup (PT # BRP 4308B) will need to be purchased and re-drilled to obtain the proper timing.

Please e-mail the tech department if you have any questions regarding birdcage timing.
tech@bicknellracingproducts.com

BIRDCAGE TIMING



STOCK FLOOR TORQUE ARM SLIDER SETUP

1- First, ensure the slider heim (BRP 425) is the proper length. It should measure 2 1/4" from the center of the heim to the end of the threads (as seen in image1). This is very critical as this determines the pinion angle. If the heim was purchased from Bicknell Racing Products, (BRP 425) it will already be cut to the proper length of 2 1/4".

image 1

2- Next, be sure the torque arm rubbers are the correct length. For dry, slick tracks the torque arm rubbers can be cut down to as much as 1 1/8" high. For heavier tracks, it is better to leave rubbers at their shipped length. Be sure the rubbers are cut no less than 1 1/8" as they will have no compression if they are cut too short. (see image 2)

image 2

SEE RUBBER BUSHING CHART ON PAGE 23
FOR MORE BUSHING OPTIONS

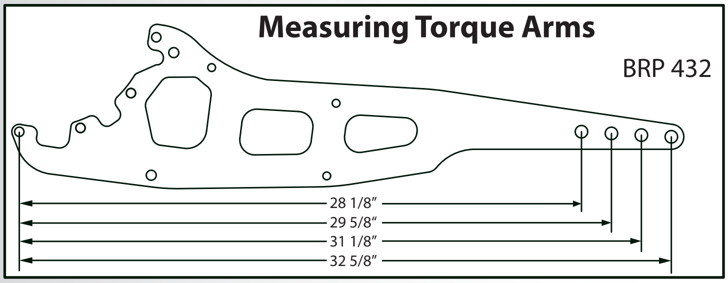
3- Prior to installation, ensure the slider rods (BRP 421 for standard floors, see page 22-23 for rubber floors) will slide into the chassis with ease. If they do not go in easy, clean them out with a drill or die grinder.

4- Install the rods and the safety collars and the slider plate (BRP 417S or 418). Make sure the slider plate travels the entire length of the slider. Make sure the grease fittings point towards the bottom on BRP 418, the 417S is marked "top".

5- Next install the heim. Be sure the steel sleeve goes in the center of the rubbers. The steel washers should go on the top and bottom of the rubbers (see image 3). Also ensure the bolt tightens all the way up. Red Loctite can be also be used.


COMPLETE - BRP 424BL
image 3

Note: Stock floor cars must use 2 BRP 421 slider rods and BRP 417S or 418 slider. It also requires 2 BRP 181-1A lock collars. The following biscuits can be used: BRP 9425, BRP 424, or BRP 424BL.



TORQUE ARM PART NUMBERS:

BRP 426: 0° STD quick change
BRP 432: -3° STD quick change
BRP 430: 0° NON quick change
BRP 433: 0° V8 quick change
BRP 439: -3° V8 quick change
BRP 9295: -3° quick change for engine back cars

TRIPLE BISCUIT SETUP - BRP 9425

The triple biscuit (BRP 9425) enhances traction by giving the tires more time to hook up. It has a more negative pinion angle, and also has more rubbers to allow more upward movement of the torque arms. This assembly uses an 1 7/8" heim (see image 4).

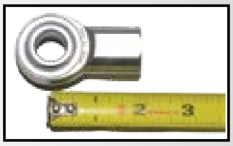
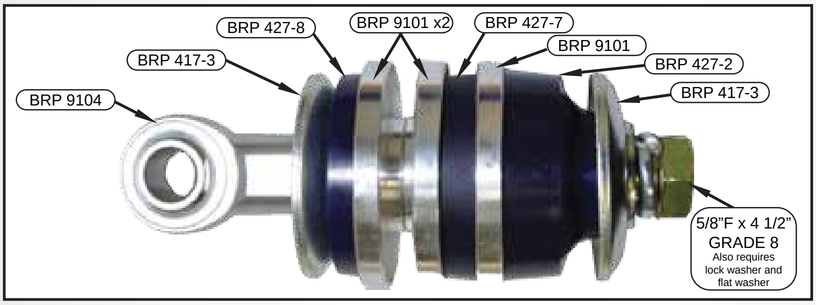


image 4



Note: You can either use the 2 BRP 9104's that come with the BRP 9425, or the steel slider (BRP 417S) comes with 2 with a snap ring. If you use these, then take out the 2 BRP 9101's

VER. 2 RUBBER FLOOR SETUP

1- First, install tie rod between floor members. This tie rod is used to space the frame rails to the appropriate width (see image1)

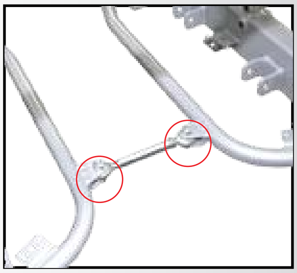


image 1

2- Next, install the engine plate (BRP 292). Use the tie rod to adjust the chassis in or out so the engine plate bolts install without the use of a hammer. The bolts should slide in place without any resistance.

NOTE: DO NOT DRILL OUT ENGINE PLATE OR FRAME FOR ALIGNMENT.

3- Once the engine plate is bolted in place, the floor cross beams can be installed. Take off the bottom cross beam plate (6 X 1/4" bolts). Place the front cross brace into the 2 X 4 floor saddle, and install the 1/2" shoulder bolts. Again, the shoulder bolts should install without any resistance. (see image 2) NOTE: There should be an even gap all the way around the half moon shaped notch in the cross brace. If the gap is not even, repeat step 2.

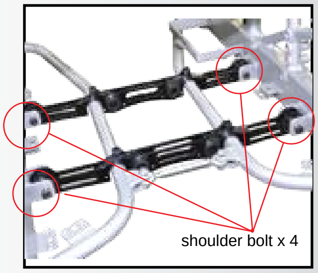


image 2

4- After the front cross brace is installed, the rear cross brace can be installed. Again, the shoulder bolts should install with no resistance. The shoulder bolts are longer than the saddles. This is necessary to ensure the saddles don't restrict the movement of the cross braces. (see image 3). They may appear to be too long, but they are correct.

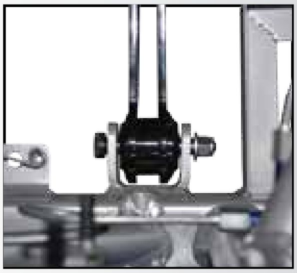


image 3

5- Now that the braces are installed, the bottom cross beam plates can be installed. They are installed with 1/4"C X 3/4" long bolts. (see image 4). Again they should install with no resistance. There may be a gap between the cross beam and the lower cross beam plates. This is built by design and the gap will close once all the bolts are tight. At this point, both cross braces should move freely. Move them back and forth, and up and down to ensure they are not obstructed in any way.

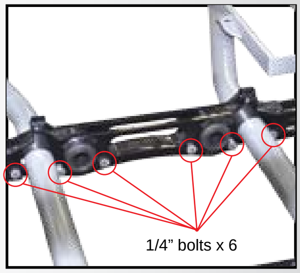


image 4

6- At this point, the slider rods (BRP 9115) can be installed. (see image 5) The slider rods install directly into the rubber, so some grease will aid in this process. Also make sure there is a lock collar in place on either side of the slider box itself as it may be a little difficult to remove the slider rods once they are installed. Make sure the slider is installed the correct way- there will be a 'T' marked on the top (see image 6 and 7.)

7- Once the slider box (BRP 417S) is installed, the lock collars can be tightened up. They should just touch the rubber bushings so they won't restrict the movement of the cross braces. Move the slider from front to back to ensure it moves free. It is designed to be sloppy. Install biscuit assembly.


You can also remove the link after installing the engine, and race with it removed.

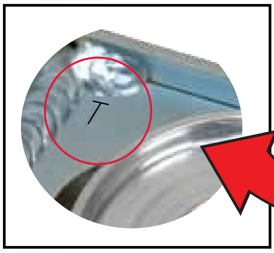


image 7

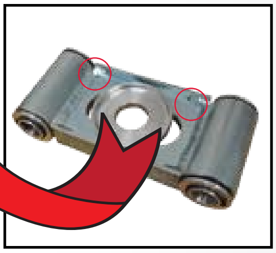


image 6


image 5

Note: Ver. 2 Rubber floor cars must use 2 BRP 9115 slider rods and BRP 417S slider. It also requires 4 BRP 181-1A lock collars. The following biscuits can be used: BRP 9425, BRP 424, or BRP 424BL.

VER. 3 RUBBER FLOOR SETUP

1- First, install the rubber bushings (BRP 2208G) in the floor. The sleeves welded to the floor have a tapered side, and a non-tapered side (see image 1). The bushings must be installed from the tapered side. Install the bushing by inserting it into the mounting sleeve, and striking the bushing with a hammer. A large flat hammer works well, or a flat object can be place between the bushing and the hammer. You will have to strike the bushing quite hard, so safety glasses is a must! When you hit the bushing, ensure you hit it square so the bushing doesn't cock in the sleeve. The bushing should slide into place with 1 swift hit.
NOTE: it is easier to install the floor bushings before the engine plate and transmission.

image 1

2- Next, install the slider rods (BRP 421). They install directly into the rubber bushing, so a little grease will aid in the rod sliding into the rubber (see image 2). Ensure the lock collars are inserted on the rods as well as the slider plate (BRP 417S). There will be a "T" on the slider to mark the top (see image 4 & 5).

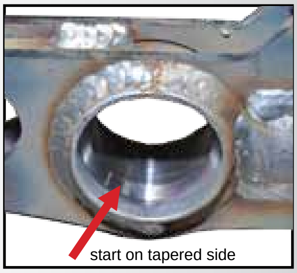


image 2

3- Once the slider box (BRP 417S) is installed, the lock collars can be tightened up. They should just touch the rubber bushings so they won't restrict the movement. Move the slider from front to back to ensure it moves free. It is designed to be sloppy. You can then install the biscuit assembly.

image 3

Note: Ver. 3 Rubber floor cars must use 2 BRP 9115 slider rods and BRP 417S slider. It also requires 4 BRP 181-1A lock collars. The following biscuits can be used: BRP 9425, BRP 424, or BRP 424BL.

image 6

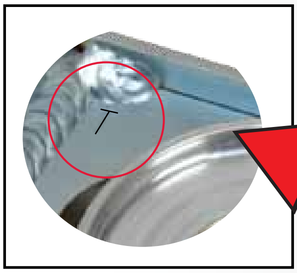


image 5

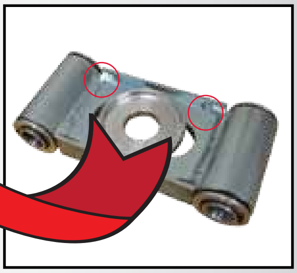


image 4

RUBBER BUSHING CHART

PART NUMBER	MATERIAL	HEIGHT	DUROMETER
BRP 427-1	black urethane	1 3/8"	70
BRP 427-2	red urethane	1 3/8"	50
BRP 427-5	blue urethane	1 3/8"	60
BRP 427-6	blue urethane	1 1/8"	60
BRP 427-7	blue urethane	3/4"	60
BRP 427-8	blue urethane	1/2"	60
BRP 9596	red natural rubber	1 3/8"	50

REAR COIL-OVER SETUP (NON SHORT LINK)


image 1


image 2


image 3


image 4


image 5

Most of these procedures are the same as a torsion bar car with the exception of coil over birdcages instead of torsion. This procedure uses BRP 9469 trailing arm brackets, with BRP 9595 upper shock mounts.

1- Install trailing arm brackets (birdcages) on tubes. Set the LR 6 3/4” from the end of the rear end bell to the inside of the trailing arm (see image 1). Set the RR 14 3/4“ from the end of the bell to the inside of the trailing arm (see image 2)

1- First, set the rear end on set-up stands with no springs or shocks.
(See image 3).
Use the following setup stands:
Left Rear std rail- BRP 1538   Left rear Drop Rail- BRP 9570
Right Rear- BRP 1539

2- Set the rear panhard bar height. If using right side panhard, start the outer panhard mount at 3” on the adjustable mount and 6th hole down on the non adjustable mount. Start the inner panhard at the second hole from the top (see image 4) NOTE: If using a left side panhard bar, go to page 28 of this manual for setup info. If using a left side J-Bar, go to page 29 of this manual for setup info.

3- Once the panhard bar or J-Bar has been set, center the rear end. Measure from the outisde of the 2 X 4 frame rails to the outside of the torque arms at 11 3/8” or 11 7/16”. This dimension should the same on both sides. The rear end can be offset to achieve proper left side percentage as well. To increase the left side percentage, move the left side of the rear end closer to the center of the race car (see image 5).

4- Now square the rear end. BRP recommends 9” on the right rear, and 8 3/4” on the left rear. The birdcage timing is less important on coil over cars as the spring rate is not dependant on the torsion arm length- the spring rate is built into the coils so the angle of the birdcages isn’t as important as a torsion bar car. To square the rear end, measure from the front of the rear end tube to the back side of the key stocks on the chassis. For a square rear end, make both measurements the same. With the right rear at 9” and the left rear at 8 3/4”, the rear will have 1/4” of lead (see image 6).

5- BRP recommends starting with both radius rods in the middle holes on the stock mounts. This setup will use the following radius rod lengths:
Left Rear - 27 1/2” rod length
Right Rear - 28” rod length (see catalog for spring rod lengths)
If you think you need more roll steer, you can always shorten the left rear radius rod length. BRP offers a 2” shorter adaptor bracket (BRP 9099L) and a 4” shorter adaptor bracket (BRP 9099L-4). These setups will use the following radius rod lengths:
Left Rear 2” shorter adaptor: 25 1/2” rod length
Left Rear 4” shorter adaptor: 23 1/2” rod length

Note: You can also use a regular birdcage with a coil over adaptor (BRP 9485) and BRP 9060BK upper shock mounts.

REAR COIL-OVER SETUP (NON SHORT LINK) CONT'D

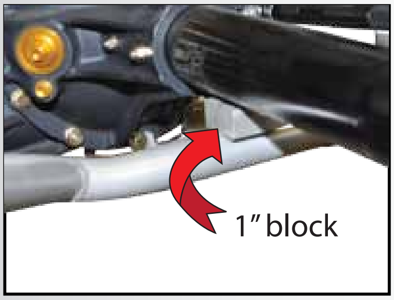


image 6

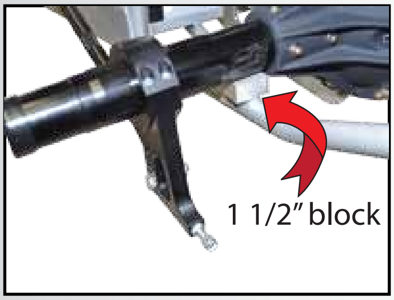


image 7

image 8

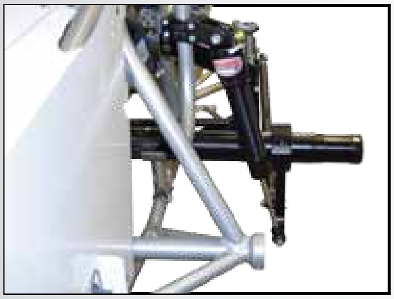


image 9

6- Once the rear end is centered and squared, the setup blocks can be removed. Again, this setup procedure is for BRP 9469 trailing arm brackets (birdcages) and BRP 9595 upper shock mounts.

7- Hang the rear end on the chassis. Put a 1" spacer under the rear end tube on the right side. For a regular left rear rail, hang the rear end directly on the chassis. If the chassis has a 1 1/2" drop rail, put a 1 1/2" block between the rear end and the chassis (See image 7).
NOTE: If you want more droop (more LR extension), the on the drop rail don't use the spacer.

8- Install upper shock mounts - THE SHOCKS SHOULD BE FULLY EXTENDED. It is easier to have the shocks with NO coils on them at this point (see image 8). You may need to rotate the mounts forward or backward once the car is at ride height, so snug up the upper shock mounts but don't tighten them fully. Also, you draw a line on the chassis to ensure the mounts don't move in the next step.

9- Next, you can install the setup blocks again and square the shocks. Again, the shocks should have NO coils on them. On the setup blocks the shocks should be as straight up and down as possible. The left rear should have an inward angle of 10°, and the right rear should have an inward angle of 15°. You can also do this step at ride height, but is is easier to do with no coils on the shocks and the setup blocks back under the rear end (see images 9 - 12).

10- Once step 9 is completed, ensure the upper shock mounts are tight. Remove the setup blocks and install the coils on the shocks. The right rear spring will need to be pre-loaded. A good starting point is to compress the right rear spring until the spring compresses to aprox. 13". The left rear spring will be off the cup by aprox. 1 1/2".

Recommended starting points for coils are the following:

Right Rear:	14" X 200# spring
Left Rear:	14" X 200# spring

image 10

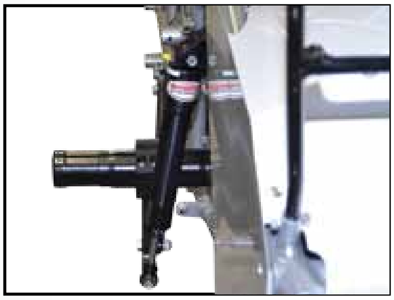


image 11

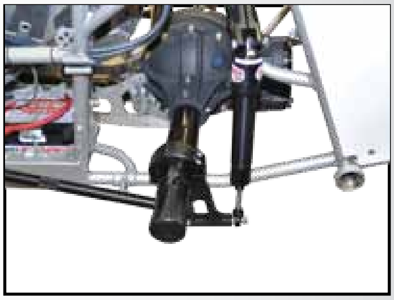


image 12

REAR SHORT LINK SETUP


image 1


image 2


image 3


image 4

image 5

Note: The rear brake calipers MUST be mounted on top of the rear end., especially on the left side. Make sure there is clearanace between the rotor and the left side panhard mount.

The procedures for squaring and centering the rear end are the same for short link cars as they are with torsion bar cars. The components are different, but the measurements for both are the same. This procedure will focus more on the component intstallation, will assume some procedures.

1- Install the front radius rod shortening brackets. The left rear (BRP 9099L-1)will bolt to the existing radius rod post and the threaded slug in the 2X4 frame rail (see image1). The right rear (BRP 9099R-1) bracket will bolt directly to the existing radius rod tree. Also required is the support bracket (BRP 9099R-1B) to complete the istallation (see image2).

Note: On short link only cars, the stock location is the 3rd hole from the bottom. The bottom slug is used to mount to the chassis and makes it not usable (see image 12)

2- Install the BRP 9469 trailing arms (birdcages) on the rear end quad lock tubes. The birdcages should be installed with the following dimensions from the end of the rear end bell to the inside of the birdcage.

LEFT REAR - 6 3/4”
RIGHT REAR - 14 3/4” (see image 3)

3- Next, install the birdcage adaptor brackets (BRP 9549). This bracket lowers the shock mount as well as shortens the radius rod mounting location (see image 4). This is required for both sides.

4- This setup generally uses the left side panhard (see image 5). For further information on the left side panhard bar, please see page 28 of this manual. Install the panhard bar in the top hole on the rear end, and the 3rd hole from the bottom on the frame brackets.

5-Install the rear radius rods. The left rear radius rod should be installed the 4th hole from the bottom on the chassis if using the bolt on mount (BRP 9099L-1) or the 3rd hole from the bottom on short link only chassis (see image 12) and the bottom hole on the birdcage. The right rear should be installed in the bottom hole on the chassis mount, and the bottom hole on the birdcage.

6- Once all the components are installed, then you can square and center the rear end. These procedures are again the same as any other car. Install the setup blocks in the normal fashion between the rear end tube and the chassis. Also at this point no shocks or springs should be installed. Use the following setup stands:

Left Rear std rail- BRP 1538 Left rear Drop Rail- BRP 9570
Right Rear- BRP 1539

7- Square the rear end on the setup blocks at 9” for both sides. Center the rear end in the chasssis at 11 3/8” both sides from the outside of the 2X4 frame rail to the outside of the torque arms. This dimension should be the same for both sides. To gain left side percentage, you can lengthen the left side panhard bar to move the left rear tire closer to the center of the chassis. Remember the left side panhard is OPPOSITE to the right side panhard bar.

REAR SHORT LINK SETUP CONT'D

image 6

image 7


image 8


image 9


image 10

8- Next, remove the setup blocks from under the rear end. Install the upper shock mounts next. Place a 1 1/2" spacer block under the right side and left side of the rear end to space the rear end tubes off the chassis. If more LR droop is desired, then drop the rear end tube all the down onto the drop rail.

9- Install upper shock mounts - THE SHOCKS SHOULD BE FULLY EXTENDED. It is easier to have the shocks with NO coils on them at this point. You may need to rotate the mounts forward or backward once the car is at ride height, so snug up the upper shock mounts but don't tighten them fully. Also, you draw a line on the chassis to ensure the mounts don't move in the next step. The upper shock mounts can either be BRP 9560 (image 6) or BRP 9574 (see image 7). The BRP 9574 has exhaust clearance, so is better suited to the right rear.

9- Next, you can install the setup blocks again and square the shocks. Again, the shocks should have NO coils on them. On the setup blocks the shocks should be as straight up and down as possible. The left rear should have an inward angle of 10°, and the right rear should have an inward angle of 15°. You can also do this step at ride height, but is is easier to do with no coils on the shocks and the setup blocks back under the rear end.

10- Once step 9 is completed, ensure the upper shock mounts are tight. Remove the setup blocks and install the coils on the shocks. The right rear spring will need to be pre-loaded. A good starting point is to compress the right rear spring until the spring compresses to aprox. 13" (see image 9). The left rear spring will be off the cup aprox. 2" (see image 10).

Recommended starting points for coils are the following:

Right Rear:	14" X 200# spring
Left Rear:	14" X 200# spring

11- Image 8 shows the completed right rear installation, while image 9 shows the completed left rear.


image 11

Short Link Only Left Rear

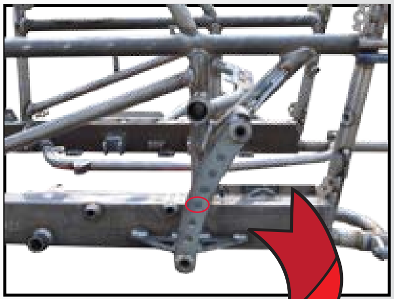


image 12

NOTE: On short link only chassis, the standard hole location is the 3rd hole up.

LEFT SIDE PANHARD BAR SETUP


image 1


image 2

image 3

image 4


image 5

Note: The rear brake calipers MUST be mounted on top of the rear end, especially on the left side. Make sure there is clearanace between the rotor and the left side panhard mount.

PART NUMBERS

Inner non-adjustable mount	BRP 1626L
Inner adjustable mount	BRP 9598
Outer non-adjustable mount (for left side panhard or J-Bar	BRP 9594
Outer non-adjustable mount (for left side panhard only)	BRP 9675
Outer adjustable mount	BRP 9588
Left side panhard bar (12” rod length)	BRP 1120BK

The left side panhard is usually installed on rear coil spring cars, but can be installed on torsion bar cars as long as the birdcages are widened, and wider rollers are used. The wide roller kits are available for the following birdcages:

BRP 9582 (fits BRP 9032,9033, 9465,9466,4255, 4257,4292,4293)
BRP 9583 (fits BRP 9310 birdcages only)

Start with the inboard left side panhard mount (BRP 1626L) in the top hole (see image1). For more side bite, lower the inner panhard to 2nd hole from the top. BRP also offers a cockpit adjustable inner panhard mount (BRP 9598) see image2

Start with the outboard side in the 3rd hole from the bottom. The adjustment for the left side panhard is the opposite of the right side panhard. To gain side bite or to tighten the car up, you raise the chassis side (or the left side). Also to gain side bite, you could lower the panhard bar at the rear end (left side). To free the car up, the opposite is true. Raising the panhard bar at the rear end, or lowering it on the chassis will reduce side bite.

The BRP 9594 outer panhard plates have 2 sets of holes. The bottom 4 holes are designed for the left side panhard, while the top 5 holes are designed for the left side J-bar. The holes appear to be different because the length of the J-bar and the panhard bar are different. This makes the arc they travel on different. You can still use the other holes, just be sure to check the rear end side to side to ensure the measurements from the side of the 2X4 to the side of the torque arms are where you had them.

Another good idea is to install both left and right inner panhard mounts. You can dual mount the inner panhard mounts with the BRP 9563 bolt kit. This way, you can run left side panhard, right side panhard or left side J-bar (see image 5).

LEFT SIDE J-BAR SETUP

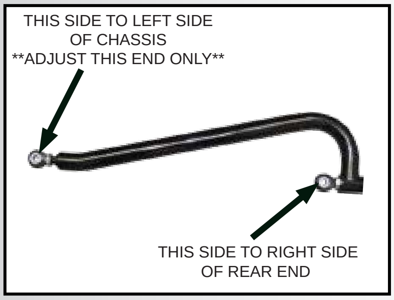


image 1

image 2

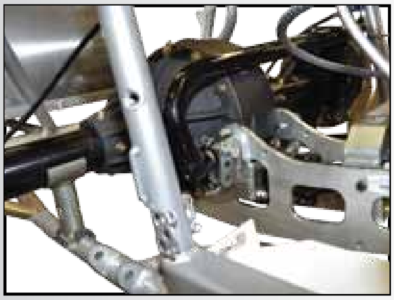


image 3

image 4

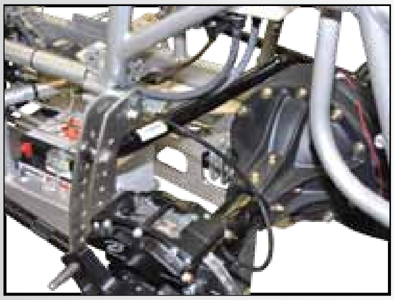


image 5

Note: The rear brake calipers MUST be mounted on top of the rear end, especially on the left side. Make sure there is clearanace between the rotor and the left side panhard mount.

PART NUMBERS

Inner non-adjustable mount	BRP 1626
Outer non-adjustable mount	BRP 9594
Left side J-bar	BRP 9584

NOTE: Aprox. center to center is 24-1/4"

The left side J-bar is usually installed on rear coil spring cars, but can be installed on torsion bar cars as long as the birdcages are widened, and wider rollers are used. The wide roller kits are available for the following birdcages:

BRP 9582 (fits BRP 9032,9033, 9465,9466,4255, 4257,4292,4293)
BRP 9583 (fits BRP 9310 birdcages only)

The left side J-bar uses the left side outer panhard mount (BRP 9594) and attaches to the the right side of the rear end using the BRP 1626 panhard mount. This is the same inner panhard mount that is utilized for the right side panhard mount. Start with an approximate center to center of 24 1/4" (see image2). To start, bottom out the rod end on that attaches to the right side of the rear end. This end has no adjustment. To adjust the length, only use the rod end on the left side of the J-bar (see image1)

Start with the inboard right side panhard mount (BRP 1626) in the top hole (see image3) and the left side that attaches to the chassis (BRP 9594) in the 2nd hole from the top (see image 4,5). This will be a good starting point for a semi slick track. For a heavy track, you may need to start with the J-bar in the 3rd or 4th hole from the top.

The BRP 9594 outer panhard plates have 2 sets of holes. The bottom 4 holes are designed for the left side panhard, while the top 5 holes are designed for the left side J-bar. The holes appear to be different because the length of the J-bar and the panhard bar are different. This makes the arc they travel on different. You can still use the other holes, just be sure to check the rear end side to side to ensure the measurements from the side of the 2X4 to the side of the torque arms are where you had them.

The adjustment for the left side J-bar is the opposite of the right side panhard. To gain side bite or to tighten the car up, you raise the chassis side (or the left side). Also to gain side bite, you could lower the J-bar at the rear end (right side). To free the car up, the opposite is true. Raising the J-bar at the rear end, or lowering it on the chassis will reduce side bite.

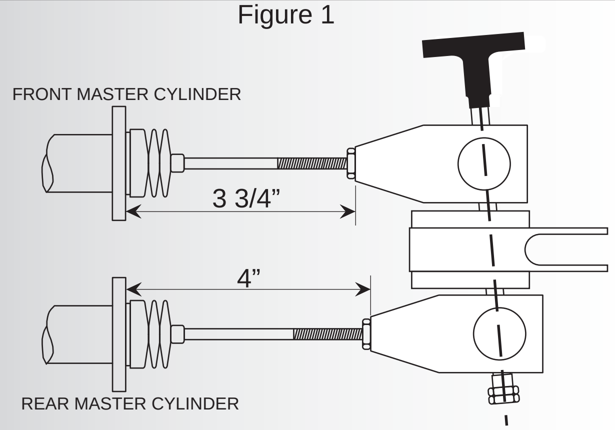
BALANCE BAR SET-UP

BRC 310-1000 Balance Bar Setup

Bicknell balance bar assemblies allow precise adjustment between front and rear brake bias. They have been specifically designed for racing purposes. When properly set-up, this unit will give you the proper amount of bias adjustment. Always remember to keep the bar well lubed and free of debris. The bar should have aproximately 1/4" of up and down movement. This means the bar can pivot freely without obstructions. It is also important to ensure the brake pedal returns to the relaxed position freely and that there is no pressure exerted on the master cylinder.

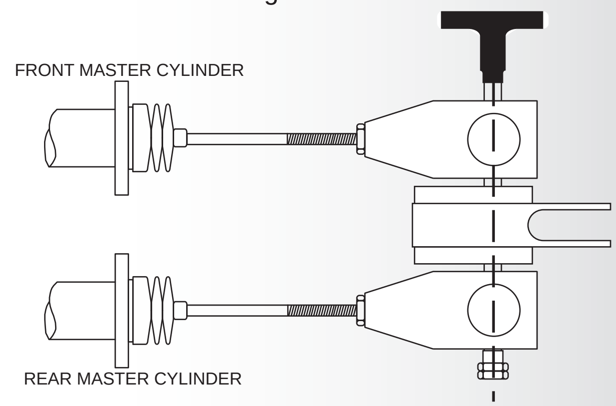
Thread the master cylinder pushrods into the clevises on the balance bar. A good starting point can be found in Figure 1. From the end of the clevis to the front side of the master cylinder mounting surface should be 3 3/4" for front and 4" for the rear in a typical dirt car set-up. The balance bar should be straight up and down under moderate pedal effort (Figure 2). This may lead to the balance bar being cocked under no pedal effort. This is perfectly fine as long as there is NO pressure on the master cylinder push rods when the pedal is in the relaxed position.

Figure 1



NO PEDAL EFFORT

Figure 2

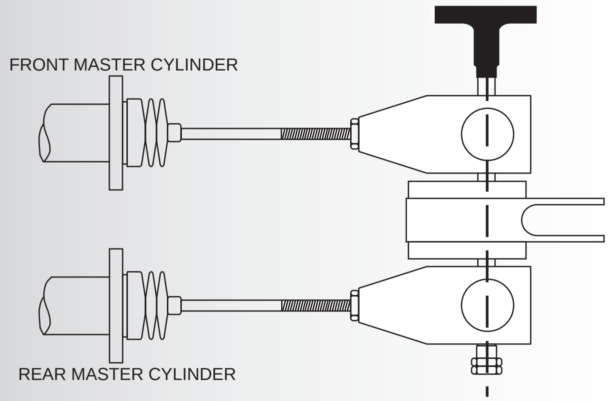


MODERATE PEDAL EFFORT

Please note: the above pushrod adjustment is for a typical dirt application with small front calipers and large rear calipers. Master cylinder size and caliper size have a large effect on the adjustment. If you have any questions, please call 905-685-4291.

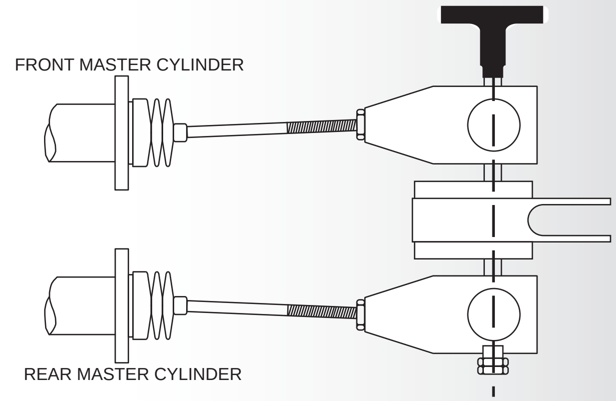
In the neutral position, the balance bar should have aproximately 1/4" of play between the clevises (figure 3). If there is too much play the master cylinder pushrods will be at the incorrect angle as shown in figure 4. The clevises should be set from the factory, but should be double checked to ensure they are in the correct location.

FIGURE 3



PROPER ALIGNMENT

FIGURE 4



INCORRECT ALIGNMENT

Please e-mail the tech department if you have any questions regarding balance bars: tech@bicknellracingproducts.com
Or call the tech department @ 905-685-4291

BALANCE BAR SET-UP

BRC 310-9070 Balance Bar Setup

1. REMOVE THE STANDARD JAM NUTS THAT COME ON THE MASTER CYLINDER RODS. SCREW THE LONG SLIDER BUSHINGS ONTO YOUR MASTER CYLINDERS PUSH RODS. THE FLATS FOR THE WRENCH NEED TO BE AT THE FARTHEST END AWAY FROM THE MASTER CYLINDER BODY. THE TOP MASTER IS FOR YOUR FRONT BRAKES, THE BOTTOM ONE IS FOR YOUR REAR BRAKES. SCREW THE TOP ONE ON SO THAT THERE IS ½" TO 5/8" OF THE MASTER CYLINDER PUSH ROD THREADS SHOWING. SCREW THE BOTTOM ONE ON SO THAT THERE IS 5/16" - 3/8" OF THE MASTER CYLINDER PUSH ROD THREADS SHOWING.

2. SLIDE BOTH MASTER CYLINDERS INTO PLACE AND TIGHTEN THE MOUNTING NUTS. BE SURE TO RECHECK THEM ONCE THE UNIT IS MOUNTED IN THE CAR. ***IF AT THIS POINT THE MASTERS RODS DO NOT MOVE IN AND OUT FREELY, LOOSEN NUTS, RE POSITION AND TRY AGAIN, RE TIGHTEN. SOME MASTERS MIGHT BE NOT BE 100% PERPENDICULAR BETWEEN THE FACE AND THE BORE. IF THEY ARE NOT, IT CAN CAUSE A BIND. YOU WILL HAVE TO FILE OUT THE BRONZE BUSHING TO MAKE THEM SLIDE EASILY. DO NOT BE ALARMED IF YOU HAVE TO DO THIS . BUT DO NOT CONTINUE IF IT SEEMS IMPOSSIBLE FOR THESE TO MOVE FREELY IN AND OUT. CALL BICKNELL RACING FOR HELP***.

3. TAKE THE PIVOT BLOCK ASSEMBLY WITH THE BRAKE ROD CLEVIS POINTING FORWARDS AND THE ADJUSTER KNOB POINTING UP AND WIND THE TOP ROD END ONTO THE MASTER CYLINDER ROD. BE SURE THAT THE ROD AND THE BUSHING ARE NOT TURNING. YOU NEED TO MAINTAIN THAT ½ TO 5/8 OF THREAD TO SCREW INTO THE ROD END. **FAILURE TO DO SO CAN RESULT IN BRAKE FAILURE.** ONCE YOU HAVE WOUND THE HEIM UP TO THE LONG SLIDER BUSHING, TAKE TWO 7/16 WRENCHES AND LOCK THEM TOGETHER BY TURNING THEM OPPOSITE DIRECTIONS.

4. REMOVE THE CLEVIS PIN THAT HOLDS THE BOTTOM ROD END IN PLACE AND REMOVE THE ROD END. SCREW THAT ROD END ONTO THE LOWER MASTER CYLINDER ROD AND AGAIN MAKE SURE THAT THE RODS AND BUSHINGS ARE NOT TURNING. YOU NEED TO MAINTAIN 5/16" TO 3/8" OF THREAD TO SCREW INTO THE HEIM. **FAILURE TO DO SO CAN RESULT IN BRAKE FAILURE.** ONCE YOU HAVE WOUND THE ROD END UP TO THE LONG SLIDER BUSHING, TAKE TWO 7/16" WRENCHES AND LOCK THEM TOGETHER BY TURNING THEM OPPOSITE DIRECTIONS.

STEP 5

5. NOW SLIDE THE LOWER ROD END BACK INTO ITS SLOT IN THE PIVOT BLOCK. THE PIN GOES IN FROM THE TOP SIDE WITH TWO WASHERS ON THE TOP AND ONE WASHER AND A COTTER PIN ON THE BOTTOM. BEND THE COTTER PIN ALL THE WAY AROUND SO THAT IT WILL NOT FALL OUT OR INTERFERE WITH ANY MOUNTING BOLTS, STRAPS, LOOSE CLOTHING ETC. HOLD THE TOP OF THE PIN WITH A PAIR OF PLIERS IF NEEDED TO ASSIST IN PROPER BENDING OF THE COTTER PIN.

NOTE 2 WASHERS ON TOP

6. NOW THAT THE UNIT IS ASSEMBLED, MAKE SURE TO LIGHTLY LUBRICATE THE ADJUSTER ROD AND THE SLIDER BUSHINGS AND BRONZE BUSHINGS. DO NOT SATURATE IN OIL AS THIS WILL DO NOTHING MORE THAN COLLECT DUST AND DIRT. TOO MUCH OF A LUBRICANT WILL NOT MAKE IT BETTER!!!

7. BEFORE INSTALLING THE COMPLETE UNIT IN THE CAR, **DOUBLE CHECK ALL HARDWARE TO ENSURE IT IS TIGHT AND FREE OF BINDS. MAKE SURE ALL SAFETY CLIPS AND COTTER PINS ARE IN PLACE. DO NOT OVER TIGHTEN DETENT PIN, JUST MAKE SURE THAT THE ¼ NUT IS TIGHT. IT IS PRESET FROM FACTORY. OVER TIGHTENING WILL RESULT IN PREMATURE WEAR OF SHAFT AND OR IMPAIR BIAS ADJUSTMENT.**

8. MAKING SURE YOU HAVE SHORTENED THE MOUNTING STUD IN STEP 1, YOU ARE READY TO INSTALL THE UNIT IN THE CAR. YOU MAY HAVE TO ADJUST THE LENGTH OF YOUR BRAKE ROD OR REPLACE IT WITH A LONGER ONE. YOU NEED TO MAINTAIN ½" OF THE CLEVIS THREADED INTO THE BRAKE ROD. **FAILURE TO DO SO CAN RESULT IN BRAKE FAILURE. THIS UNIT WILL NOT REQUIRE TWO ROD ENDS ON YOUR BRAKE ROD.**
REMOVE THE RIGHT HAND MALE ROD END AND SCREW YOUR BRAKE ROD DIRECTLY ONTO THE PUSH CLEVIS THAT IS SUPPLIED ON THE UNIT AFTER YOUR PROPER LENGTH HAS BEEN DETERMINED. ***IT IS VERY IMPORTANT TO MAKE SURE THAT YOUR BRAKE ROD IS IN LINE WITH THE MASTER CYLINDER RODS. IT CANNOT BE POINTED LEFT OR RIGHT. IT WILL BIND IF IT IS NOT RUNNING PARALLEL TO THE MACTER CYLINDER RODS***

IT IS VERY IMPORTANT TO MAKE SURE THAT YOUR BRAKE ROD IS IN LINE WITH THE MASTER CYLINDER RODS. IT CANNOT BE POINTED LEFT OR RIGHT. IT WILL BIND IF IT IS NOT RUNNING PARALLEL TO THE MASTER CYLINDER RODS. IF NEEDED YOU CAN ADD SPACERS BEHIND THE ROD END ON THE BRAKE PEDAL TAB. IF IT BINDS THE BALANCE BAR WILL NOT WORK PROPERLY. FAILURE TO COMPLETE THIS STEP MAY RESULT IN BRAKE FAILURE. SEE PICTURES BELOW

TOP VEIW
FRAME, MASTER CYLINDER RODS
BRAKE ROD ALL RUNNING PARALLEL

9. USE A THREAD LOCKING COMPOUND ON THE 4 MOUNTING STUDS AND TIGHTEN THE 4 NYLOCK NUTS.

10. ONCE EVERYTHING IS IN PLACE AND TIGHT, CHECK TO MAKE SURE YOU DO NOT HAVE ANY BINDS AND THAT ALL MOVING PARTS MOVE IN AND OUT FREELY.
AFTER WORKING THE PEDAL UP AND DOWN A FEW TIMES, MAKE SURE THE MASTERS ARE RETURNING ON THEIR OWN. IF NOT, LOOSEN THE 2 MOUNTING BOLTS THAT HOLD THE MASTERS ONTO THE BALANCE BAR SLIGHTLY, WORK THE PEDAL AGAIN TO LET THE MASTERS SELF CENTER THEMSELVES, THEN RE- TIGHTEN THE MOUNTING BOLTS AGAIN.

11. BLEED YOUR BRAKES AS YOU NORMALLY WOULD.

12. REMEMBER THAT THE SETTINGS ARE STARTING RECOMMENDATIONS.
IF YOU NEED TO ADJUST YOUR ROD LENGTH SO THAT THE PIVOT BLOCK SITS STRAIGHT UP AND DOWN WHEN BRAKE PEDAL IS DEPRESSED. TO ADJUST THE LENGTHS YOU CAN CRACK THE SLIDER NUTS LOOSE FROM THE ROD ENDS AND TURN THE RODS FROM THE BACKSIDE WITH A PAIR OF PLIERS. SEE PIC. MAKE SURE TO RE TIGHTEN THEM AFTER ADJUSTING

13. WEEKLY MAINTENANCE.
MAKE SURE TO WEAR SAFETY GLASSES.
DO NOT POINT COMPRESSED AIR AT ANY PARTS OF YOUR BODY
BLOW OFF ALL LOOSE DIRT WITH COMPRESSED AIR.
USE BRAKE CLEAN TO BREAK ANY CAKED ON DIRT AND GRIME FREE
ONCE CLEANED, LIGHTLY LUBRICATE AS DESCRIBED IN STEP #6.
DO NOT WASH CAR AND LET UNIT SIT WITH WATER ON IT. IF IT RUSTS, IT WILL NOT WORK PROPERLY.

WARNING
BEFORE MOVING VEHICLE, ALWAYS MAKE SURE THAT PARTS ARE FREE AND WORKING PROPERLY AND THAT BRAKES ARE WORKING WHEN APPLIED. IT IS YOUR RESPONSIBILITY TO HAVE PROPERLY WORKING BRAKES BEFORE YOU DRIVE ANY MOTORIZED VEHICLE AT ANY TIME.

Brake Bleeding Tips

1- Ensure bleed screws in calipers point straight up to ensure no air gets trapped in the caliper.
2- Always use a high quality fluid.
3- Never mix different types of fluids. Different brands and fluid types can react with each other and gel up.
4- Always make sure the master cylinders fully retract. This minimizes wear and heat on the pads and rotors.
5- Ensure balance bar is functioning properly, and free of dirt and debris.
6- Use a vacuum bleeder whenever possible to bleed the brakes. If not possible, gravity bleed brakes.
7- Always test brakes before going on the race track.

Approximate Brake Pressure All Front Brake	Approximate Brake Pressure 50/50 Brake	Approximate Brake Pressure All Rear Brake
Front: 600 PSI	Front: 450 PSI	Front: 320 PSI
Rear: 400 PSI	Rear: 550 PSI	Rear: 700 PSI

Brake Rod Lengths

NOTE: LENGTHS ARE WITHOUT ROD ENDS

Stock Engine Location		2" Engine Back Location	
BRP 411 with BRC 310-9085	- 13"	BRP 411 with BRC 310-9085	- 11"
BRP 411 with BRC 310-1000 or WIL 340-4630	- 12"	BRP 411 with BRC 310-1000 or WIL 340-4630	- 10"
BRP 411-3 with BRC 310-9085	- 10"	BRP 411-3 with BRC 310-9085	- 8"
BRP 411-3 with BRC 310-1000 or WIL 340-4630	- 9"	BRP 411-3 with BRC 310-1000 or WIL 340-4630	- 7"

ADJUSTING THROTTLE LINKAGE

The throttle linkage is probably one of the most overlooked items on the race car, along with the brakes. The throttle linkage is important because it is what connects you (the driver) to the engine. This makes adjusting the throttle linkage critical for optimum race car performance. If the throttle is too fast, then the power from the engine will be applied too quick and the tires will spin on a slick track, but if the throttle isn't fast enough, the power will be applied to slowly for tacky conditions. Ultimately, it is driver preference on how the throttle should be setup. More often than not, it is best to make the throttle as slow as possible for slick track conditions, and allow the driver to adjust his or her driving style for tacky conditions and just 'mash the gas'.

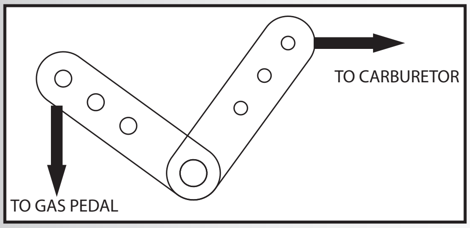


FIGURE 1

The throttle cross rod is the heart of the system. It is a simple bellcrank, which changes direction of movement (see figure 1). The downward movement of the gas pedal is converted to backward movement of the carburetor linkage. The carburetor side should always stay within the motion shown in figure 2 or the linkage could over center and bind up.

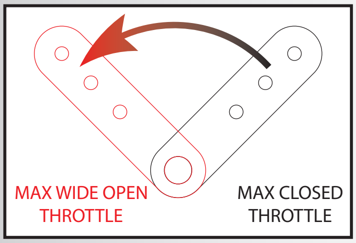
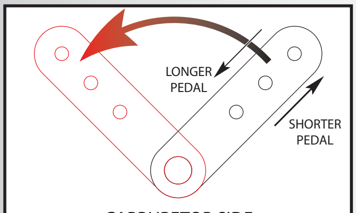
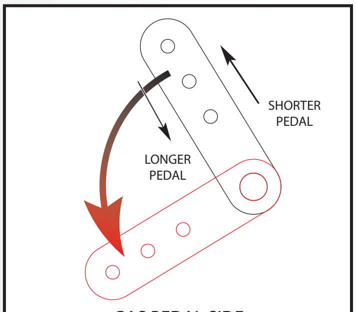


FIGURE 2

The linkage on almost all Holley carburetors has 2 1/2" of stroke. The carburetor side of the cross shaft is really what sets your linkage. The closer you are to the center of the pivot, the longer the pedal or the more control you have. The longest hole gives you the shortest pedal or the least amount of control. The gas pedal side of the cross rod can give the pedal a mechanical advantage or dis-advantage depending on the holes that are chosen. So on both sides of the throttle cross the closer to the center the more control you will have or the slower the pedal will be.



CARBURETOR SIDE



GAS PEDAL SIDE

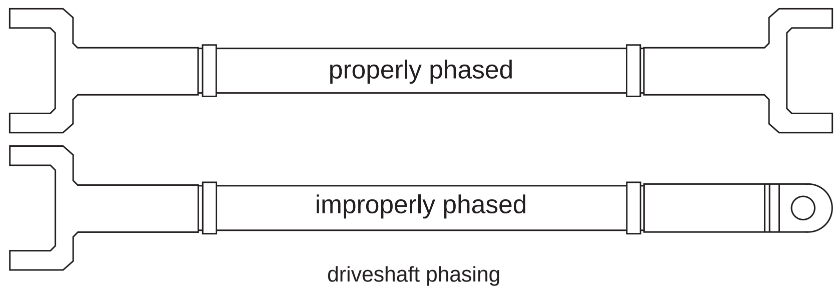
LOCATIONS TO LOOK FOR BINDS

It is important to the operation of a race car that the suspension move freely. A bind is anything that inhibits the movement of the suspension. There are many items that can create a bind, but the majority of the time a bind is caused by a bent part. It is important to inspect all parts on the car for bends or cracks. A bind in the suspension can have dramatic effects on the handling, and can also cause the driver to mis-diagnose what the car is actually needing. For example, if a car has a front radius rod that is bound up and the car doesn't get on the right front the driver could complain about the car being tight on corner entry when in fact the bind in the radius rod has made the car tight. It could lead you into making chassis adjustments that are not needed. Here is a list of locations to look for binds:

1- Rear torsion bearings seized up - make sure bearings spin free
2- Rear torsion rollers siezed up - make sure rollers turn free
3- Torsion bars - make sure bars aren't bent and they turn free in torsion rack
4- Rod ends - check for bent rod ends and make sure radius rods are free
5- Torque arm slider - make sure slider is lubed and slides free
6- Torque arm front slider shaft - make sure it slides free
7- Rear end tubes - make sure tubes are straight and axles run true (check toe and camber on rear)
8- Bent shock shafts - make sure shafts are straight and shocks go in and out
9- Dented shock bodies - make sure shocks go in and out with no sticky spots
10- Make sure the rear end doesn't hit the seat plate - especially on driver back chassis

(NOTE: KIRKEY 89 series seats should be aprox. 22 1/2" from back of engine plate)

11- Make sure shocks aren't bottoming out and proper shock stem heights are achieved
12- Make sure driveshaft if phased properly so it doesn't bind and/or vibrate. Ensure driveshaft has 1/2" to 3/4" of end play at ride height to make sure it doesn't bottom out



driveshaft phasing

13- Rear torsion arms rubbing on birdcages- make sure arms aren't hitting birdcages
14- Rear torsion arms rubbing on radius rods - make sure they aren't rubbing
15- Rear torsion arms - make sure no flat spots or excessive wear on rollers or wear plates
16- Drag link and tie rod clearanced on radius rods - no rubbing
17- Left front or right front bolt or lower shock bolt hitting chassis during chassis roll

IMPORTANT

Inspect race car after every day of racing. When ispecting suspension binding, it is imperative that the condition of all rod ends be checked. While performance may not be hurt by any rod ends that are not free, ANY ROD END THAT IS WORN BEYOND TOLERANCE MUST BE REPLACED BEFORE OPERATION OF THE RACE CAR IS RESUMED.

DO NOT WORK ON RACE CAR BEFORE SUPPORTING IT ON ADEQUATE JACK STANDS OR OTHER SUITABLE WORK STANDS. NEVER WORK NEAR OR UNDER A RACE CAR SUPPORTED ONLY ON A JACK. WORK ONLY ON A LEVEL, HARD SURFACE CAPABLE OF SUPPORTING STANDS.

RADIUS ROD LOCATIONS - LONG RODS

Both rear radius rods in middle holes is stock BRP location (see page 16).
This creates a tight (pushy entry) because you will have reverse roll steer of the rear end. This will make the car slightly pushy on entry and mid turn until the throttle is applied. If the car is in what we call a driveable push, then the car will still get good forward drive off the corner.

If you raise only the right rear radius rod:

This will create more roll steer, as the right rear will move back further on corner entry. The car will be looser on corner entry. This will also cause the car to be looser when he throttle is applied. The higher the right rear radius rod gets, the looser the car will be. If the car is laying on the right rear too much, you have the choice to increase the right rear torsion bar or raise the right rear radius rod. Raising the right rear radius rod will also loosen corner exit when throttle is applied. If you only install a larger torsion bar, this will stop the car from rolling to the right rear, but will still allow better forward drive as long as the car does not get loose before throttle is applied.

If you raise the left rear radius rod:

This will cause a looser corner entry, and then better forward drive when the throttle is applied.

If you raise both rear radius rods:

This will create maximum roll steer on corner entry (loose race car) and will also make the car more eratic on throttle as the car will be lifting when throttle is applied. This will also allow the rear radius rods to aid in lifting the chassis, and create more drive off.

29" TORSION BAR RATES

	14"	15"	16"	17"	18"
0.875	*147*	*128*	*112*	*100*	*89*
0.900	*164*	*143*	*126*	*111*	*99*
0.925	*183*	*160*	*140*	*124*	*111*
0.950	*204*	*178*	*156*	*138*	*123*
0.975	*226*	*197*	*173*	*153*	*137*
1.000	*250*	*218*	*192*	*170*	*152*
1.025	*276*	*241*	*212*	*187*	*167*
1.050	*304*	*265*	*233*	*206*	*184*
1.075	*334*	*291*	*256*	*277*	*202*
1.100	*367*	*319*	*281*	*249*	*222*
1.125	*401*	*349*	*307*	*272*	*243*

CHASSIS ADJUSTMENTS - CAR TIGHT ON ENTRY

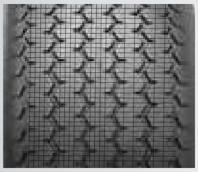
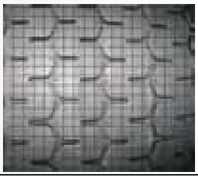
Car Tight On Entry - There are a few questions to ask when the driver is tight on corner entry:
1- Is the driver on the throttle or off the throttle?
2- Does the car have body roll?
3- Is the driver on the brakes and is it a brake push?

Item	Adjustment
front end bind	free up and lube
rear spoiler	decrease in size or remove / gurney lip back
rear stagger	increase rear stagger
right rear wheel offset (move wheel out)	decrease right rear wheel offset (watch rules)
left rear weight	increase right rear weight. (sometimes too much right rear weight will also pin right rear on corner entry). Start with 0 - 30 pounds left rear weight.
brake bias	increase rear brake and ensure master cylinder sizes are proper, ensure brake pad compounds are correct.
caster split	check caster split - ensure 4° of split
right front camber	increase right front camber (more pounds per square inch on tire)
front springs	install stiffer left front spring to help car roll to right front - also ensure right front shock has 5” of shaft
wheel lead	bring left rear wheel ahead 3/8” NOTE: on a torsion bar car this softens the LR spring rate
left rear shock	add more gas pressure, or add compression or rebound depending on whether driver is entering the corner on the throttle or off throttle
left front shock	add more rebound
front panhard bar	mount lower on outboard side
right side rear panhard bar	raise outboard side and/or lower inboard side
left side rear panhard bar	lower outboard side and/or raise inboard side
left side rear j-bar	lower outboard side and/or raise inboard side
rear torsion bars or springs	stiffen left rear or both
frame heights	raise rear frame heights, or lower front frame heights. Also flatten chassis left to right
rear radius rods	raise the right rear rod up to create roll steer on corner entry
race car balance	ensure car has 54-54.4% left side percentage and 64% - 66% rear percentage

CHASSIS ADJUSTMENTS - CAR LOOSE ON ENTRY

Car Loose On Entry - There are a few questions to ask when the driver is loose on corner entry:

1- Is the car okay on the straight away?
2- Is the driver entering the corner reasonably or is he entering too fast? (slower entry = fast exit)
3- Is the driver on the brakes and is it brake loose? Use an in car camera to verify what the driver is saying. Pictures can also help as well.

Item	Adjustment
rear stagger	reduce (watch rear stagger does not get too low causing the car to shear loose)
front springs	stiffen right front and soften left front and stiffen right front shock compression
brake bias	increase front brake bias, or install stickier brake pads
rear end bind	lube and free up
left rear weight	increase left rear weight (sometimes too much left rear weight can cause loose entry - no weight on right rear tire to plant the right rear tire)
right rear wheel (move wheel in)	increase right rear offset (note- moving wheel 1" will decrease aprox. 20# of left rear weight) NOTE: NOT RECOMMENDED
left rear shock	soften left rear rebound or take nitrogen out of shock
right rear panhard bar	lower outboard side and/or raise inboard side
left rear panhard bar	raise outboard side and/or lower inboard side
left rear J bar	raise outboard side and/or lower inboard side
left rear spring/torsion bar	install softer torsion bar or spring (on torsion bar car move roller forward to front hole)
toe out	increase toe out - as much as 1/4"
frame height	raise front frame height, or lower rear frame height
rear spoiler	add more rear spoiler where applicable (gurney lip forward)
rear radius rods	move both rear radius rods in the bottom holes
tires  	sipe and grind all tires (if rules permit) on a track that is not abrasive. Track conditions dictate siping patterns- start with sipes 1/8" deep and go deeper until tire begins to chunk then decrease siping a touch on the blocks that do chunk.

WARNING

ALL CHASSIS SETTING AND ADJUSTMENTS ARE INTENDED FOR USE BY PROFESSIONAL RACE TEAMS AND TO BE PERFORMED BY QUALIFIED TECHNICIANS. IF YOU ARE NOT QUALIFIED TO DO THE WORK, SEEK THE ASSISTANCE OF A QUALIFIED TECHNICIAN. IF YOUR DRIVER IS NOT EXPERIENCED IN THE OPERATION OF A RACE CAR OF THIS TYPE, SEEK THE ASSISTANCE OF A QUALIFIED RACE DRIVING INSTRUCTOR OR SCHOOL BEFORE OPERATING THIS RACE CAR.

SERIOUS INJURY OR DEATH CAN OCCUR IN AUTO RACING.

CHASSIS ADJUSTMENTS TO IMPROVE PERFORMANCE IN SPECIFIC AREAS

Auto Racing, especially on dirt tracks, require finding a delicate balance of adjustments which will maximize the performance of the race car both relating to acceleration and top speed on the straights and reducing the needs to slow or increasing the speed through the corners. Any adjustment which will improve the performance of the race car relating to its ability to accelerate in a straight line, may decrease its ability to maintain speed while cornering. Conversely, those adjustments, which will enable the race car to go faster while cornering, may decrease its ability to accelerate in a straight line.

DRIVER'S ABILITY TO CONTROL THE RACE CAR MAY BE ADVERSELY AFFECTED AFTER CHASSIS ADJUSTMENT. USE CAUTION WHEN RESUMING OPERATION AFTER ANY CHASSIS ADJUSTMENT.

DO NOT WORK ON RACE CAR BEFORE SUPPORTING IT ON ADEQUATE JACK STANDS OR OTHER SUITABLE WORK STANDS. NEVER WORK NEAR OR UNDER A RACE CAR SUPPORTED ONLY ON A JACK. WORK ONLY ON A LEVEL, HARD SURFACE CAPABLE OF SUPPORTING STANDS.

CHASSIS ADJUSTMENTS - CAR TIGHT IN APEX OFF THROTTLE

Item	Adjustment
right rear panhard bar	raise inboard and outboard panhard bar up 1”
left rear panhard bar	lower outboard side
left rear J-bar	lower outboard side
right rear radius rod	incease angle by moving to top hole
front weight percentage	install 25# ballast weight high on front nose to left front
right front shock	add more rebound to right front
right rear shock	install stiffer compression only (leave rebound same) or less rebound
left rear shock	take away left rear rebound to get car on the right front
right rear spring rate	stiffen right rear spring rate
rear end offset	make sure you have maximum rear end offset as per rules
rear wheel track	make sure you have maximum rear wheel track as per rules
frame heights	raise right rear frame height 1/2” and lower left front frame height 1/2”

CHASSIS ADJUSTMENTS - CAR LOOSE IN APEX OFF THROTTLE

Item	Adjustment
right rear panhard bar	lower outboard side
left rear panhard bar	raise outboard side
left rear J-bar	raise outboard side
left rear torsion bar / spring rate	install softer left rear spring or torsion bar (on torsion bar car move roller ahead to front hole)
left rear wheel offset	decrease offset by installing 1” wheel spacer on the left rear (remember to adjust wedge) aprox. 20# per inch NOTE: NOT RECOMMENDED
left rear weight	decrease left rear weight when track is slick to gain side bite back (0-20 # left rear weight)
frame heights	raise chassis heights 1/4” to 1/2” to aid in side bite or raise LF, LR and RF only
left front shock	decrease left front rebound
left rear shock	take away left rear rebound to get car on right front and right rear
ballast weight	raise over rear end

CHASSIS ADJUSTMENTS - CAR TIGHT IN APEX ON THROTTLE

Item	Adjustment
spring rod	remove and install solid radius rod
left rear weight	decrease left rear weight - closer to even or 0 # left rear weight
torque arm location	lengthen torque arm
left rear torsion bar / spring rate	istall stiffer left rear spring or torsion bar (if torsion roller is front hole, move to back hole)
rear ride height	raise rear of car 1/4" - 1/2" (watch rear spoiler height)
left rear shock	increase left rear nitrogen pressure to as much as 250 #
left front shock	increase rebound on the left front shock
right front shock	increase rebound on the right front shock
right rear shock	decrease rebound on right rear shock

CHASSIS ADJUSTMENTS - CAR LOOSE IN APEX ON THROTTLE

Item	Adjustment
left rear spring / torsion bar	install softer left rear spring / torsion bar (on torsion bar car move roller to front hole)
left rear wheel offset	decrease left rear wheel offset by installing 1” wheel spacer- remember to adjust wedge NOTE: NOT RECOMMENDED
front springs	stifffen right front spring, soften left front spring but no more than 175 RF spring
right rear shock	more rebound on right rear shock
left front shock	decrease left front rebound
left rear shock	lower left rear nitrogen pressure
left rear weight	add more left rear weight 40# - 60#, or 110#
spring rod	install spring rod and set spring length at 4 1/4”
torque arm	ensure -3° torque arms are installed, and pick up is the 29 1/2” hole (from the bottom hole in the rear end)
birdcage timing	ensure birdcage timing is set to 0°

WARNING

ALL CHASSIS SETTING AND ADJUSTMENTS ARE INTENDED FOR USE BY PROFESSIONAL RACE TEAMS AND TO BE PERFORMED BY QUALIFIED TECHNICIANS. IF YOU ARE NOT QUALIFIED TO DO THE WORK, SEEK THE ASSISTANCE OF A QUALIFIED TECHNICIAN. IF YOUR DRIVER IS NOT EXPERIENCED IN THE OPERATION OF A RACE CAR OF THIS TYPE, SEEK THE ASSISTANCE OF A QUALIFIED RACE DRIVING INSTRUCTOR OR SCHOOL BEFORE OPERATING THIS RACE CAR.
SERIOUS INJURY OR DEATH CAN OCCUR IN AUTO RACING.

CHASSIS ADJUSTMENTS TO IMPROVE PERFORMANCE IN SPECIFIC AREAS

Auto Racing, especially on dirt tracks, require finding a delicate balance of adjustments which will maximize the performance of the race car both relating to acceleration and top speed on the straights and reducing the needs to slow or increasing the speed through the corners. Any adjustment which will improve the performance of the race car relating to its ability to accelerate in a straight line, may decrease its ability to maintain speed while cornering. Conversely, those adjustments, which will enable the race car to go faster while cornering, may decrease its ability to accelerate in a straight line.
DRIVER’S ABILITY TO CONTROL THE RACE CAR MAY BE ADVERSELY AFFECTED AFTER CHASSIS ADJUSTMENT. USE CAUTION WHEN RESUMING OPERATION AFTER ANY CHASSIS ADJUSTMENT.

DO NOT WORK ON RACE CAR BEFORE SUPPORTING IT ON ADEQUATE JACK STANDS OR OTHER SUITABLE WORK STANDS. NEVER WORK NEAR OR UNDER A RACE CAR SUPPORTED ONLY ON A JACK. WORK ONLY ON A LEVEL, HARD SURFACE CAPABLE OF SUPPORTING STANDS.

CHASSIS ADJUSTMENTS - CAR TIGHT ON EXIT

Car Tight On Exit - There are a few questions to ask when the driver is tight on corner exit:

1- Is the car entrering the turns okay?

2- Does the car push on throttle in apex? See page 11.

Item	Adjustment
rear stagger	increase rear stagger - may cause loose entry
left rear weight	decrease left rear weight
wheel base	bring left rear wheel ahead 3/8”
left rear spring / torsion bar	install stiffer left rear spring / torsion bar (on torsion bar cars, move roller to back hole)
front shocks	stiffen rebound on both front shocks
ride heights	raise rear frame heights 1/4” and/or drop front frame heights 1/4”
rear weight percentage	decrease rear weight percentage and increase left front weight
spring rod	remove spring rod and install solid rod
rear radius rods	install right rear radius rod in top hole, move left rear radius rod to bottom hole

CHASSIS ADJUSTMENTS - CAR LOOSE ON EXIT

Car Loose On Exit - There are a few questions to ask when the driver is loose on corner exit:

1- Is the car entrering the turns okay?
2- Is the car loose on throttle in apex? See page 12.
3- Is the driver loose on exit because the car is tight on corner entry and he is shearing the car loose in the apex? See page 7.

Item	Adjustment
rear stagger	reduce rear stagger - may cause tight entry or too little stagger causing tight entry can cause loose exit
left rear weight	increase left rear weight
front shocks	soften rebound on both front shocks or install digressive shocks
left rear shock	soften compression on left rear shock
left rear spring / torsion bar	install softer left rear spring / torsion bar (on torsion bar car move roller to front hole)
right front spring	stiffen right front coil MAX 175#
ride heights	raise front ride heights and lower rear ride heights
wheel lead	square rear end (no lead) or bring right rear forward or LR back 1/4”
spring rod	install spring rod with spring at 4 1/4”
torque arm	shorten torque arm (go from 2nd hole to 3rd hole from transmission - 3rd hole is 29 1/2” from bottom hole)
tires	make sure tires are siped and ground where applicable
tire pressures	make sure gauge is reading properly - normal pressure build up should be no more than 4# (use air drier)
rear radius rods	raise left rear radius rod up

CHASSIS ADJUSTMENTS - INCREASING FORWARD BITE

Increasing Forward Bite - There are a few questions to ask when the driver needs forward bite:

1- Is the car entrering the turns okay? Most times lack of forward bite is caused by insufficient corner entry and/or midturn speed.
2- Are the tires siped and ground properly? Are the proper tire compounds on the car?
3- Is the shock travel correct?

Item	Adjustment
front shocks	soften rebound on front shocks - install digressive shocks
rear shocks	soften compression on rear shocks or install digressive LR
front springs	stiffen right front spring and soften left front spring
rear spring / torsion bar rates	soften left rear spring torsion bar or both - start with LR only. Note: this may also tighten your entry
left rear weight	increase left weight and rear percentage
ride heights	lower rear frame heights, raise front frame heights
rear percentage	increase rear percentage
tire pressures	soften rear tire air pressures (check gauge to ensure it is reading properly)
rear spoiler	add more rear spoiler where applicable (gurney lip forward)
rear radius rods	raise both rear radius rods - may cause loose corner entry due to more roll steer or just LR up
torque arm	shorten torque arm (go from 2nd hole to 3rd hole back from transmission 29 1/2” from bottom hole in rear end)
nitrogen pressure	increase front nitrogen and decrease rear nitrogen (125# front and 75# rear)

CHASSIS ADJUSTMENTS - INCREASING SIDE BITE

Increasing Side Bite - There are a few questions to ask when the driver needs side bite:

1- Is the car entrering the turns okay? Most times lack of side bite is casued by tight entry, and then the driver shears the car loose at the apex. Once you break traction, the car will not have side bite.

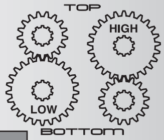
2- Are the tires siped and ground properly? Are the proper tire compounds on the car?

3- Is the shock travel correct?

Item	Adjustment
right rear panhard bar	lower outboard panhard bar or raise inboard side or install BRP 9120 rubber panhard bar
left rear panhard bar	raise outboard panhard bar or raise inboard side
left rear J-bar	raise outboard panhard bar or raise inboard side
right rear wheel	increase right rear wheel offset (go from a 3" offset to a 4" offset) NOTE: NOT RECOMMENDED
rear tires	lower rear tire air pressure
left rear weight	decrease left rear weight (put more weight on the right rear tire)
right rear spring / torsion bar	soften right rear spring (sometimes too soft a spring will not plant the tire - car rolls too much)
right rear shock	soften compression on right rear shock and stiffen rebound
ride heights	raise all 4 corners of car to raise the center of gravity in the car - flatten car from left to right
center of gravity	raise weight (ballast) higher in chassis to increase body roll or install over rear end
body measurements	make sure doors are to maximum legal measurements
birdcage timing	check page 17-20 for proper birdcage timing

GEAR RATIO CHART

10 Spline Quick Change Gears (1 3/8")



GEAR SET #	LOW SPUR RATIO	HIGH SPUR RATIO	NUMBER OF TEETH	4:11 AXLE RATIO 9 - 37 TEETH		4:57 AXLE RATIO 7 - 32 TEETH		4:86 AXLE RATIO 7 - 34 TEETH	
				LOW	HIGH	LOW	HIGH	LOW	HIGH
1	1.00	1.00	21/21	4:11	4:11	4:57	4:57	4:86	4:86
2	.96	1.03	27/28	3:96	4:26	4:41	4:71	4:68	5:04
5	.96	1.04	24/25	3:95	4:28	4:39	4:75	4:66	5:07
15A	.95	1.05	21/22	3:92	4:31	4:36	4:79	4:64	5:09
15	.95	1.05	19/20	3:91	4:33	4:34	4:80	4:63	5:10
26	.93	1.07	27/29	3:83	4:41	4:25	4:91	4:52	5:23
6	.92	1.08	23/25	3:78	4:46	4:20	4:97	4:47	5:28
25	.90	1.10	20/22	3:74	4:52	4:15	5:03	4:42	5:35
12	.89	1.11	26/29	3:68	4:58	4:10	5:10	4:36	5:42
7	.88	1.13	23/26	3:63	4:64	4:04	5:15	4:30	5:49
7A	.87	1.14	21/24	3:58	4:69	4:00	5:22	4:23	5:54
17	.86	1.15	26/30	3:54	4:76	3:96	5:27	4:19	5:64
17A	.85	1.16	24/28	3:52	4:80	3:92	5:33	4:17	5:67
8A	.85	1.17	23/27	3:50	4:82	3:89	5:36	4:14	5:71
8	.84	1.18	22/26	3:48	4:85	3:87	5:40	4:11	5:75
19	.84	1.19	21/25	3:45	4:89	3:84	5:44	4:08	5:78
9A	.83	1.20	25/30	3:42	4:93	3:81	5:48	4:05	5:83
9	.82	1.21	19/23	3:39	4:97	3:78	5:53	4:01	5:88
11	.81	1.22	22/27	3:35	5:04	3:72	5:61	3:96	5:97
3	.80	1.24	25/31	3:31	5:10	3:69	5:67	3:92	6:03
13	.80	1.25	20/25	3:29	5:14	3:66	5:71	3:89	6:08
18	.79	1.26	23/29	3:26	5:18	3:62	5:76	3:85	6:13
18A	.79	1.27	22/28	3:23	5:23	3:59	5:82	3:82	6:19
4A	.78	1.28	18/23	3:21	5:26	3:58	5:84	3:80	6:21
4	.77	1.29	24/31	3:18	5:31	3:54	5:90	3:76	6:28
20	.76	1.30	20/26	3:16	5:34	3:52	5:94	3:75	6:32
22	.76	1.32	19/25	3:12	5:41	3:47	6:01	3:69	6:39
16	.75	1.33	18/24	3:08	5:48	3:43	6:09	3:65	6:48
10	.73	1.35	17/23	3:04	5:56	3:38	6:18	3:59	6:58
10A	.73	1.36	22/30	3:01	5:60	3:35	6:23	3:56	6:63
34A	.72	1.37	16/22	2:99	5:65	3:32	6:28	3:53	6:68
34	.72	1.38	21/29	2:98	5:68	3:31	6:31	3:52	6:71
14	.71	1.39	23/32	2:95	5:72	3:28	6:36	3:50	6:76
14A	.71	1.40	20/28	2:93	5:76	3:26	6:40	3:47	6:81
35	.70	1.41	17/24	2:91	5:80	3:24	6:45	3:44	6:86
32	.70	1.42	19/27	2:89	5:85	3:22	6:49	3:42	6:90
32A	.70	1.43	23/33	2:87	5:88	3:19	6:56	3:39	6:97
24	.69	1.45	20/29	2:83	5:90	3:15	6:63	3:35	7:04
36	.68	1.47	17/25	2:80	6:04	3:11	6:72	3:30	7:15
37	.67	1.48	21/31	2:78	6:07	3:10	6:75	3:29	7:19
23	.67	1.50	22/23	2:74	6:17	3:05	6:86	3:24	7:29
21	.65	1.52	19/29	2:70	6:27	2:99	6:98	3:20	7:42
21A	.65	1.53	15/23	2:68	6:30	2:98	7:01	3:17	7:45
27	.64	1.54	22/34	2:66	6:35	2:96	7:06	3:15	7:52
43	.64	1.56	16/25	2:63	6:42	2:92	7:14	3:11	7:59
28	.63	1.57	19/30	2:60	6:49	2:89	7:22	3:08	7:68
28A	.63	1.59	17/27	2:59	6:53	2:88	7:26	3:06	7:72
29	.62	1.59	15/24	2:57	6:58	2:86	7:31	3:04	7:78
39	.62	1.61	18/29	2:55	6:62	2:84	7:36	3:02	7:83
30	.61	1.62	16/26	2:53	6:68	2:81	7:43	2:99	7:91
40	.61	1.63	19/31	2:52	6:71	2:80	7:46	2:98	7:93
41	.61	1.65	17/28	2:50	6:77	2:77	7:53	2:95	8:00
31	.60	1.67	21/35	2:47	6:85	2:74	7:62	2:92	8:10
33A	.59	1.69	16/27	2:44	6:94	2:71	7:71	2:88	8:20
33	.58	1.70	20/34	2:42	6:99	2:69	7:77	2:85	8:26
31A	.58	1.71	21/36	2:40	7:05	2:67	7:83	2:84	8:34
30A	.57	1.73	15/26	2:37	7:12	2:64	7:92	2:80	8:42

DAILY MAINTENANCE SHEET

General Maintenance	Inspect	Replace	Comments
Torque all bolts			
Check shocks - leaking or bent?			
Wheel bearings and hubs			
Fluid levels			
Fuel level			
Bleed brakes			
Clean & lubricate brake calipers			
Change gears			
Check and lubricate rod ends			
Check steering box and steering arms			
Grease and lubricate			
Wheels - check for bends and cracks			

Cockpit Area	Inspect	Replace	Comments
Lubricate balance bar			
Lubricate gas pedal and check			
Charge and check battery & cables			

Engine Area	Inspect	Replace	Comments
Engine Oil - check or replace?			
Inspect belts and pulleys			
Inspect or replace air filter			
Adjust valves			
Check timing			
Inspect valve springs & rocker arms			
Check fuel pressure and float levels			

SET-UP	Inspect	Replace	Comments
Frame Heights			
Toe out			
Tire pressure			
Wheel lead			
Scale chassis			

WEEKLY MAINTENANCE SHEET

Inspected By	Item	Inspected By	Item
	Front brake rotors		Body condition - mounts and fasteners
	Front brake pads		Bumpers and bumper pins
	Front calipers		Lug nuts and wheelstuds
	Rear brake rotors		Front and rear panhard bars
	Rear brake pads		Front radius rods
	Rear calipers		Rear radius rods
	Mounting bolts and brackets		Rod ends
	Bleed brakes		Tire conditions
	Ensure bleeder screws are tight		Dash gauges and lights
	Lubricate master cylinders		Seat belts and seat
	Check brake fluid		Fuel cell and fuel lines
	Clean and inspect radiator		Front spindles and steering arms
	Radiator hoses and clamps		Front and rear wheel bearings
	Coolant level		Front coil springs
	Belts and pulleys		Front shocks
	Ensure dampner is tight		Front shock mounts
	Fan bolts		Tie rod and drag link
	Oil filter and drain plug		Torsion bars - free with no binds
	Ignition - distributor and rotor		Birdcage rollers
	Carburetor and fuel lines		Torsion bearings
	Throttle return springs		Toe out
	Fuel filter		Caster and camber
	Set timing		King pins- check play at bushings
	Ingition wires and spark plugs		Fuel level
	Valve springs		Battery terminals
	Valve lash		Battery cables
	Valve covers and gaskets		Battery mount
	Header bolts		Charge battery
	Shifter linkage and clutch		Check for cracks in frame
	Frost Plugs		Tire pressure
	Engine mounts		Steering box
	Bellhousing		Torque arm slider and rods
	Transmission and fluid		Oil cooler and oil lines
	Driveshaft - U joints and U bolts		Dry sump tank and lines
	Oil level		Rear end gear condition
	Air filter		Ring and pinion condition
	Rear end level and plugs		
	Rear end tubes		
	Rear wheel bearings		
	Pinion and transmission seals		
	Hub seals		

MONTHLY MAINTENANCE SHEET

Item	Date	Inspected By	Comments
Front Suspension			
Rear Suspension			
Steering			
Rear Driveline			
Transmission			
Brakes			
Fuel System			
Cooling			
Wheels			
Safety Equipment			
Chassis			
Fluids			
Engine			
Tow Vehicle			
Trailer			
Racing Jack			
Air Tools			
Cordless Tools			

DECIMAL EQUIVALENTS

1/64	=	.015625		33/64	=	.51525
1/32	=	.03125		17/32	=	.53125
3/64	=	.046875		35/64	=	.546875
1/16	=	.0625		9/16	=	.5625
5/64	=	.078125		37/64	=	.578125
3/32	=	.09375		19/32	=	.59375
7/64	=	.109375		39/64	=	.609375
1/8	=	.125		5/8	=	.625
9/64	=	.140625		41/64	=	.640625
5/32	=	.15625		21/32	=	.65625
11/64	=	.171875		43/64	=	.671875
3/16	=	.1875		11/16	=	.6875
13/64	=	.203125		45/64	=	.703125
7/32	=	.21875		23/32	=	.71875
15/64	=	.234375		47/64	=	.734375
1/4	=	.250		3/4	=	.750
17/64	=	.265625		49/64	=	.765625
9/32	=	.28125		25/32	=	.78125
19/64	=	.296875		51/64	=	.796875
5/16	=	.3125		13/16	=	.8125
21/64	=	.328125		53/64	=	.828125
11/32	=	.34375		27/32	=	.84375
23/64	=	.359375		55/64	=	.859375
3/8	=	.375		7/8	=	.875
25/64	=	.390625		57/64	=	.890625
13/32	=	.40625		29/32	=	.90625
27/64	=	.421875		59/64	=	.921875
7/16	=	.4375		15/16	=	.9375
29/64	=	.453125		61/64	=	.953125
15/32	=	.46875		31/32	=	.96875
31/64	=	.484375		63/64	=	.984375
1/2	=	.500		1"	=	1.000

HANDY FORMULAS

Area of a triangle: Area : ½b × h
Area of a circle : Area = π × r²
Area of a rectangle - L x W

Circumference of a circle : π x D
Volume of a cylinder : π x r² x h
Volume of a cube : L x W x H

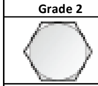
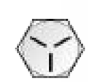
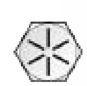
WEIGHTS OF VARIOUS LIQUIDS

Water : 8.34 lbs/gal
Antifreeze : 9.38 lbs/gal
Lubricating Oil : 7.59 lbs/gal
Methanol : 6.58 lbs/gal
Kerosene : 6.67 lbs/gal
Brake Fluid : 8.55 lbs/gal

Gasoline : 6.07 lbs/gal
D98 : 5.96 lbs/gal
D109 : 6.02 lbs/gal
D110 : 6.01 lbs/gal
D12 : 5.98 lbs/gal
Beer : 8.42 lbs/gal

BOLT TORQUE SPECS

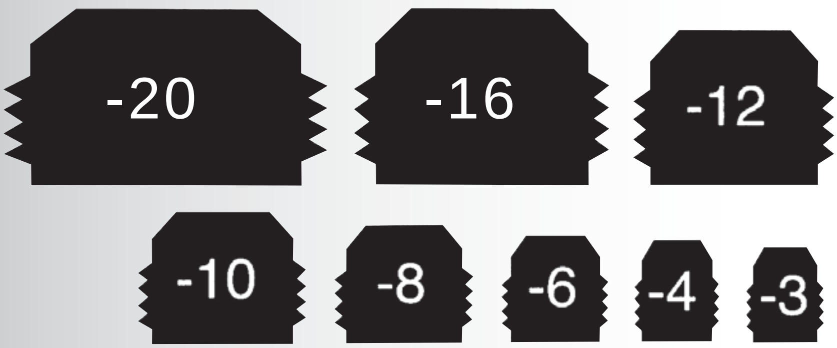
Bolt size - Thread pitch	Grade 2	Grade 5	Grade 8
1/4-20	6	10	12
1/4-28	7	12	15
5/16-18	13	20	24
5/16-24	14	22	27
3/8-16	23	36	44
3/8-24	26	40	48
7/16-14	37	52	63
7/16-20	41	57	70
1/2-13	57	80	98
1/2-20	64	90	110
9/16-12	82	120	145
9/16-18	91	135	165
5/8-11	111	165	210
5/8-18	128	200	245
3/4-10	200	285	335
3/4-16	223	315	370

Head Marking	Material	Size	Tensile Strength
Grade 2 	Low or medium carbon steel	1/4 thru 3/4	74,000
No Markings		Over 3/4 thru 1-1/2	60,000
Grade 5 	Medium Carbon Steel, Quenched and Tempered	1/4 thru 1	120,000
3 Radial Lines		Over 1 thru 1-1/2	105,000
Grade 8 	Medium Carbon Alloy Steel, Quenched and Tempered	1/4 thru 1-1/2	150,000
6 Radial Lines			

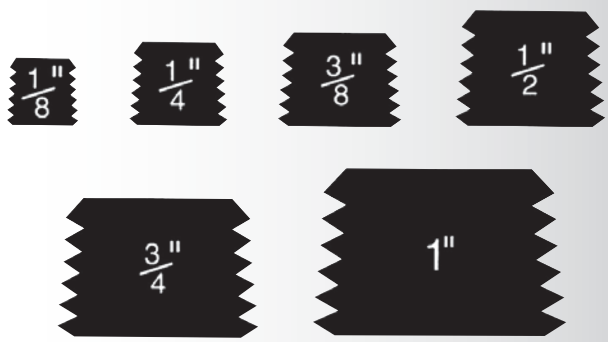
AN / NPT THREAD SIZES

images are shown actual size

AN THREAD SIZES



NPT THREAD SIZES



WHAT ARE SHOCKS?

A shock absorber is a mechanical or hydraulic device designed to absorb and dampen spring oscillation. It does this by converting kinetic energy into another form of energy - typically heat. So basically, it takes the motion of the car (kenetic energy) and tranfers the energy into heat within the fluid in the shock. Always remember that springs only store energy, shocks absorb energy. In race cars, springs control how much weight moves to a particular corner, while the shock controls how fast or slow weight moves to a particular corner.

Most shocks used in racing today are monotube (or gas pressurized) shock. It consists of a single tube, with 2 pistons. The main piston or working piston houses the valve stacks, and controls the vehicle while the floating piston seperates the oil from the gas pressure.

So why use does a gas shock need nitrogen pressure?
First, we use nitrogen gas because it is less affected by heat. As stated earlier, shocks convert motion into heat. So it is very important that the small amount of gas in the shock not expand due to heat which would build up the pressure inside the shock. 2nd, the gas pressure prevents the oil from cavitating. The oil needs pressure to keep it from being pulled apart.

How much gas is needed is directly related to the amount of compression a shock has. So a shock that has a relatively soft compression stack, would only need 100 psi of gas pressure while a shock with a stiff compression stack would need 150 psi. This is why the initial or 'factory' gas pressure settings are different on many shocks. Typically the front shocks have very little compression stack in them, so 100pis is all the gas they need where rear shocks typically have more compression and require 125-150 psi.

So how much gas pressure can you change in a shock? Again, depends on the shock. Typically no more than + or - 50 psi from the factory recommended setting. Anything more or less, tells you you have the wrong spring combination or shock valving. For every 25 pounds of gas pressure change, you are changing aprox. 10 pounds of spring. The valving is unaffected by gas pressure. A 4 valve is always a 4 valve (or a 162/55 is always a 162/55). For example, lets say you have a shock on the RF with 100 psi and 150 pound spring and you increase the gas pressure to 150 psi. You have increased the gas pressure by 50 psi, so you have added 20 pounds of spring making the RF feel like it has a 170 pound spring now.

On page 5, we have discussed the difference between compression and rebound of the shock but how can we affect the handling of the car? Remember compression is a term used to describe the shock being pushed in - or weight moving toward that particular corner. So compression controls how fast weight gets to a particular corner while the rebound controls how long the weight stays on that particular corner. The spring's job is still to control how much weight is moved, but a shock controls how fast the weight is moved.

Vehicle dynamics are very complex, but if you can understand where weight is moving in the car and how fast it is moving, then you can really begin to understand the race car. Understanding this movement of weight, and applying it to different track conditions is what makes the good drivers good. Below is a simple cheat sheet of what shock DO and DON'T DO for reference:

WHAT SHOCKS DON'T DO:

1. Shocks do not support the car.
2. Shocks do not control weight transfer - they control speed of weight transfer.
3. Shocks do not affect chassis balance at mid-turn.
4. Shocks are not a cure-all for basic handling problems

WHAT SHOCKS DO:

1. Shocks control (limit speed of) motion of the chassis and suspension.
2. Shocks, with varying designs of resistance, allow more or less rapid movement of a suspension corner than opposing corners.
3. Shocks regulate the amount of time it takes for a corner of the car, while in transition, to assume a new ride height.
4. Shocks can be used to redistribute the amount of weight on the four corners of the car as the car is in transition on corner entry and exit.

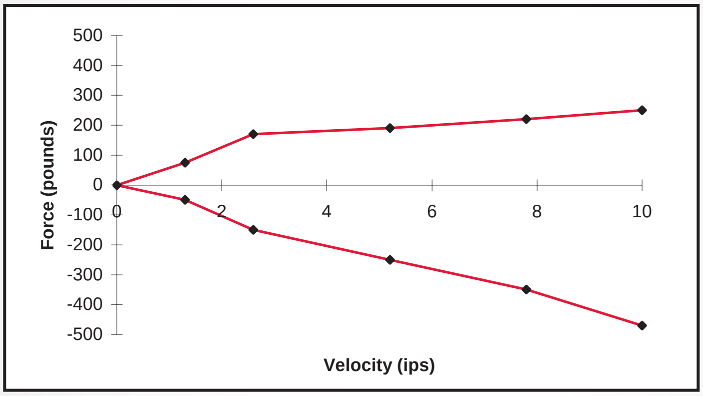
So now we understand a bit more about shocks, but how do we take that information and apply it to our car? We need a way of classifying or 'putting a number' on a shock. How much compression and rebound does a specific shock have? Enter the shock dyno, and more importantly the graph of a shock.

WHERE SHOCK GRAPHS COME FROM

So where do shock graphs come from anyways? Almost every custom shock available comes with a dyno sheet. Reading and understanding these graphs can be the key to understanding the "voodoo" magic of shocks.

There really isn't any magic to shocks. A shock is basically an oil pump installed between the tire and the chassis. It controls or "dampens" the chassis movement in relation to the race track. How fast or slow the shock moves in and out is really the critical factor, which is where a shock dyno graph comes in.

A shock is velocity sensitive. It only knows how fast it is moving. So the typical graph that you receive with most shocks are force vs. velocity graphs. It shows you the amount of force the shock makes at a specific speed. The force in the below graph is on vertical, while the velocity (speed) is horizontal.



Here is a good way to think about a shock dyno - think of a shock like an engine. If your engine builder tells you your engine makes 700 horsepower, and doesn't tell you at the RPM it makes it he hasn't given you a clear picture. Imagine if your engine builder told you your engine makes 700 horsepower, but it makes it at 10,000 RPM. It is unrealistic to tell you horsepower ratings at that RPM because your engine will not race at that RPM. A shock is the same way - you have to look at the numbers on the graph where you will be racing that shock. If the engine builder then tells you the engine makes 500 horsepower at 3,000 RPM he has given you a clearer picture where you will actually be racing at.

A shock is the same way. If a shock is a 4 valve, at what speed is it a 4 valve? This is where the dyno graph comes into play. There is no set of "standards" for what a 4 valve actually is. A 4 valve is just a number to classify the shock. That is one of the biggest misconceptions about shocks. A 4 valve from manufacturer A may be different from manufacturer B. The biggest thing is keeping notes and understanding why a certain shock performed better than another, and in the situation that it worked better. There is no such thing as the "wrong" shock - only the wrong situation or track condition for that particular shock.

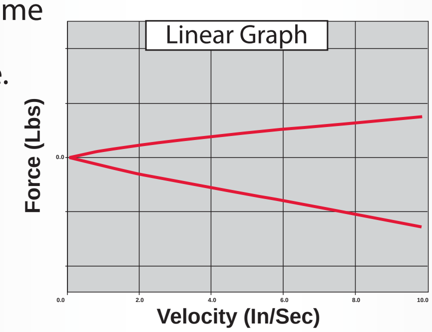
Typically, low shaft speeds control the race car on cornering. Low shaft speeds are from the 1 inch per second to 5 inch per second range.

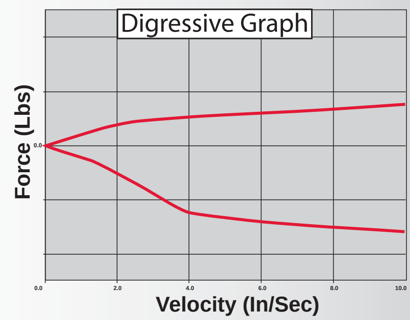
High shaft speeds control the race car as you encounter bumps on the track or if you hit the cushion. High velocity shaft speeds are typically 6 inches per second to 10 inches per second.

Another critical factor regarding shocks to remember is that as the race track slows down on the stop watch, so does the motion of the race car. So lets say you are at your saturday night race track. The heat races are tacky, and the lap times are 18 seconds. In the feature the track slicks off and the lap times go to 21 seconds. The lap times have slowed, so the actions of the race car have also slowed. Think of how much more critical throttle pedal movement is when the track is slick.

So on a tacky, fast race track the motion of the race car may be controlled by a shock in the 2 in per second to 6 inch per second range, where that same track in the feature may need a shock that is controlled by a shock in the 1 in per second to 4 inch per second range. Same race track- 2 different sets of criteria for what shock to pick. The point is- there is no "magic" shock, only the correct shock for YOUR race car on THAT night.

Linear VS. Digressive- The difference between a linear and digressive shock is the piston design. Their are advantages to each piston. A linear piston has a flatter more predictable slope on the graph, where the digressive has a pre-determined point where the valve blows open. A linear shock is more predictable, and more forgiving making it the baseline for almost all shock manufacturers. A digressive is more track specific, and can improve handling in some cases. It is more difficult to predict, and can make the car feel unpredictable. All shocks are available in linear and digressive, so knowing what situation to bolt each on is the key.





Another thing to remember about digressive shocks is the low speed and high speed are indepenendent on both compression and rebound. There is a lot of tuning ability in a digressive shock, but it does make things more complicated for the average racer. A 4 valve in a linear shock doesn't necessarily coralate to a 4 valve in a digressive shock so the understanding the graph is the key.

TUNING WITH SHOCKS

SHOCKS

INCREASE OR DECREASE DAMPING:

MAKE ONLY ONE CHANGE

BUMP = COMPRESSION

REBOUND = EXTENSION

BOLD *IS BEST CHANGE*

	RIGHT FRONT BUMP	RIGHT FRONT REBOUND	LEFT FRONT BUMP	LEFT FRONT REBOUND	RIGHT REAR BUMP	RIGHT REAR REBOUND	LEFT REAR BUMP	LEFT REAR REBOUND
CORNER ENTRY PUSH	DECREASE			INCREASE				***INCREASE***
MID- CORNER PUSH				***INCREASE***				
CORNER EXIT PUSH		***INCREASE***					INCREASE	
CORNER ENTRY LOOSE	INCREASE							***DECREASE***
MID-CORNER LOOSE				***DECREASE***	DECREASE	***INCREASE***		
CORNER EXIT LOOSE		DECREASE					DECREASE	

SHOCK TIPS

1. Tune entry performance first. If there are no entry problems, make small changes if you want to experiment to see if entry can be improved. Entry problems include a tight car or a loose car. The worst problem, by far, would be the loose-in condition. Nine times out of 10 this is an alignment problem and not shock related.

2. Tune exit performance last. If there are no exit problems, don't make any significant changes. Exit problems can include a car that pushes under acceleration or one that goes loose under power. Be sure that you do not have a tight /loose condition where the car is basically tight and goes loose just past mid-turn.

3. On dirt tracks, reduce rebound settings on the left side and decrease the compression rates on the right side for dry, slick surfaces to promote more chassis movement. This helps to maintain grip as the car goes through the transitional phases of entry and exit.

BASELINE SHOCK PACKAGES

Integra Heat / Heavy Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	LF STD+1R	PCR 45170-LF+1REB	PCR 310-40170+1R
RF	RF STD+1C+2R	PCR 45170-RF+1C+2R	PCR 310-40170+1C+2R
LR	LR Medium	PCR 45190-LR-MED	PCR 310-40190L-MED
RR	LR Medium	PCR 45190-LR-MED	PCR 310-40190L-MED

Integra Average to Slick Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	LF Standard	PCR 45170-LF-STD	PCR 310-40170
RF	RF Standard	PCR 45170-RF-STD	PCR 310-40170
LR	LR Standard	PCR 45190-LR-STD	PCR 310-40190L
RR	RR Standard	PCR 45190-RR-STD	PCR 310-40190R

Integra All Track Package - SHORT LINK W/ COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	LF FSR-076	PCR 45170-LF-FSR	PCR 310-40170-LF-FSR
RF	RF FSR-076	PCR 45170-RF-FSR	PCR 310-40170-RF-FSR
LR	LR RSR-076	PCR 45190-LR-RSR	PCR 310-40190-LR-RSR
RR	RR RSR-076	PCR 45190-RR-RSR	PCR 310-40190-RR-RSR

Fox Heat / Heavy Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	60C/200R	FOX 983-91-507-11	FOX 983-90-007-11
RF	75C/165R	FOX 983-91-507-12	FOX 983-90-007-12
LR	115C/230R	FOX 983-91-509-18	FOX 983-90-009-18
RR	115C/230R	FOX 983-91-509-18	FOX 983-90-009-18

Fox Average to Slick Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	65C/190R-D	FOX 983-91-507-50	FOX 983-90-007-50
RF	75C/165R-D	FOX 983-91-507-51	FOX 983-90-007-51
LR	145C/145R-D	FOX 983-91-509-52	FOX 983-90-009-52
RR	100C/200R-D	FOX 983-91-509-53	FOX 983-90-009-53

Fox All Track Package - SHORT LINK W/ COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM PART #
LF	60C/230R	FOX 983-91-507-17	FOX 983-90-007-17
RF	75C/300R	FOX 983-91-507-24	FOX 983-90-007-24
LR	150C/175R	FOX 983-91-509-41	FOX 983-90-009-41
RR	125C/200R	FOX 983-91-509-29	FOX 983-90-009-29

Bilstein Heat / Heavy Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM AS2 PART #	ALUMINUM XVA PART #
LF	208/55	BIL B46-0210-208/55	BIL 33-247915-208/55	BIL 33-252506-208/55
RF	208/72	BIL B46-0210B	BIL 33-247915-208/72	BIL 33-252506-208/72
LR	230/120	BIL B46-0207-230/120	BIL 33-247892-230/120	BIL 33-252520-230/120
RR	230/120	BIL B46-0207-230/120	BIL 33-247892-230/120	BIL 33-252520-230/120

Bilstein Average to Slick Track Package - TORSION OR COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM ASN PART #	ALUMINUM BGT PART #
LF	208/55	BIL B46-0210-208/55	BIL 33-247915-208/55	BIL 33-252506-208/55
RF	208/72	BIL B46-0210B	BIL 33-247915-208/72	BIL 33-252506-208/72
LR	162/120	BIL B46-0207-162/120	BIL 33-247892-162/120	BIL 33-252520-162/120
RR	230/72	BIL B46-0207-230/72	BIL 33-247892-230/72	BIL 33-252520-230/72

Bilstein All Track Package - SHORT LINK W/ COILS

POSITION	DESCRIPTION	STEEL PART #	ALUMINUM ASN PART #	ALUMINUM BGT PART #
LF	208/55	BIL B46-0210-208/55	BIL 33-247915-208/55	BIL 33-252506-208/55
RF	300/78	BIL B46-0210-300/78	BIL 33-247915-300/78	BIL 33-252506-300/78
LR	162/150	BIL B46-0207-162/120	BIL 33-247892-162/120	BIL 33-252520-162/120
RR	230/120	BIL B46-0207-230/120	BIL 33-247892-230/120	BIL 33-252520-230/120

NOTE: Although there are many other shock valvings on out there, the above packages are what BRP recommends as a baseline. Please call the tech department at 905-685-4291 or e-mail tech@bicknellracingproducts.com to discuss further shock package options.

Here is are some frequently asked questions regarding coil springs. Obviously we can write a separate book on coil springs and spring smashers and what they do, but here are some answers to the more common questions.

What is a coil spring?

A coil spring is a mechanical device which is typically used to store energy and subsequently release it, to absorb shock, or to maintain a force between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded.

What is spring rate?

Spring rate is the measurement of how much a coil spring can hold until it compresses 1 inch. The spring rate is normally specified by the manufacture. If a spring has a rate of 100 then the spring would compress 1 inch with 100 pounds of load. To compress the spring 2", it will take 200 pounds and so on.

Does the length of a coil spring matter?

In simple terms, the length of the spring does not matter unless a spring rubber is used. If we talk about a 100 pound spring, we know from the above defintion that it takes 100 pounds to compress the spring 1". So a 14" spring will compress to 13", while a 12" spring will compress to 11". There are a few instances where the length of the spring does matter:

1 - When using spring rubbers, the shorter the spring the faster the spring rate will ramp up.
2 - When talking about coil bind.

The length of the LR spring with the same rate will NOT give you more extension load. It will take the same amount of spring compression to get the car back to ride height because it carries the same load. Angles and mounting location will affect how much weight a spring carries, and will change the installed height of the spring (at ride height) but the overall length of the spring doesn't matter.

What is spring pre-load or droop load?

Spring pre load (or droop load) is the measurement a coil spring is compressed to when the shock is fully extended. Typically the right rear for instance, will be pre loaded. For instance a 200 pounds spring on a 9" shock will usually be pre-loaded 1" (a 14" X 200 pound spring will be compressed to 13" on the shock even when fully extended).

What is extension load?

Extension load is the same as pre load, but we usually refer to left rear springs in terms of extension load and right rear spring in terms of pre load. On a left rear spring, we typically want to know how much load the spring has when it is fully extended.

How can we build extension load on the left rear?

We can build extension load on the left rear by decreasing te spring rate, which will increase the pre load on the spring. Remember it takes the same amount of energy to get the car back to its ride height, so a softer spring will need more turns in it (or pre load) in order to get the car to sit proper. The softer the spring, the more extension load it will have and more pre load.

What is a spring rubber?

A spring rubber is a donut shaped rubber or polyurethane spring spacer designed to quickly adjust spring spring rate. Spring rubbers come in a variety of thicknesses and hardnesses so it is important to keep track of the ones you use. Spring rubbers will affect your spring rate based on the following:

- the rate of the spring.
- the length of the spring.
- the number of active coils in the spring.
- the gap between the coils
- the installed height of the spring (or how much pre load the spring has).
- the thickness of the spring rubber.
- the density (hardness) of the spring rubber.

BICKNELL
RACING PRODUCTS

www.twitter.com/bicknellracing

www.facebook.com/bicknellracingproducts

www.instagram.com/bicknell_racing_products

www.youtube.com/bicknellracing

www.bicknellracingproducts.com