No Goats Racing - Chassis Tuning – Page 1

- Adjust left front and right rear to get you in to the corner.
- Adjust right front and left rear to get you out.
- Adjust stagger for the middle.
- Push (tight) means too much rear bite.
- Loose means too much front bite.
- If you’re pushing, move the seat forward.
- If you’re loose, move the seat backward.
- If you have right front camber of -2.5 and go to -3.0 what is the affect? If the kart was tight, the kart will now be freer. If the kart was right, it will now be loose.

Track Conditions
- Cool, wet, soft tracks normally like lower left side weights as well as lower cross weights.
- Harder fast track conditions normally yield higher corner force, which requires more left side, and / or more cross.
- On flat track:
  - Less rear percentage
  - More left side percentage
- On banked track:
  - More rear percentage
  - Less left side percentage

Pushes entering corner
- Understeer - Too much rear end grip
- Increase left front camber (more positive)
- Increase right front caster
- Decrease front track
- Decrease right front stagger
- Softer right front compound
- Harder right rear compound
- Wider right rear wheel
- Decrease right front air pressure
- Increase right rear air pressure
- Increase right rear stagger in 1/8”

Pushes leaving corner
- Decrease right front camber
- Increase left front caster
- Increase nose weight
- Decrease cross weight 1/2%-1% increments
- Harder left rear compound
- Harder right rear compound
- Decrease front stagger
- Move left rear wheel out 1/4”-1/2” increments
- Move right rear wheel out
- Move rear track to right
- Increase rear stagger
- Increase right rear air pressure
- Widen the front wheel width
- Stiffen rear of chassis
- Increase air in left front
- Increase air in right rear
- Decrease air in right front

Tight in center of corner
- Increase air pressure in the left front 1/2 lb. at a time
- Move left front out 1/8” - 1/4” at a time
- Reduce air pressure in the right front 1/2 lb. at a time
- Increase air pressure in the left rear and right rear 1/2 lb. at a time
- Try the same compound tire on a narrower wheel.
Decrease air in left rear
The change that’s making the difference is a reduction in cross weight. These changes either decrease left rear - right front loading, or increase left front - right rear loading, all resulting in lower cross.

Loose entering corner
Oversteer - Too much front end grip
Rear is loose
Decrease nose weight in 1/2% - 1% increments
Increase rear weight
Increase cross weight
Decrease left side weight
Decrease left front camber (more negative)
Less right front camber (more positive)
Decrease left front caster
Increase right front stagger
Decrease rear stagger in 1/8” - 1/4” increments
Move right front wheel out
Move left front wheel in
Move right rear wheel in
Move left rear wheel out
Move rear track to left
Move seat back
Raise center of gravity
Harder right front tire compound
Decrease right rear tire pressure
Softer right rear compound
Narrower right rear wheel
Stiffen front of chassis
Check toe out

Loose in center of corner
Decrease air pressure in left front
(1/4 - 1/2 lb. at a time)
Move left front in (1/8” - 1/4” at a time)
Increase air pressure in left rear and right rear (1/2 lb. at a time)

Move right rear in as close as possible

Loose leaving corner
Too much front end bite
Increase right front camber (more positive)
Decrease left front camber
Decrease right front caster
Softer left rear compound
Move left rear wheel in 1/4”-1/2” increments
Move right rear wheel in
Move rear track to left
Increase cross weight 1/2%-1% increments
Increase rear weight percentage
Decrease right rear tire pressure
Increase front stagger
Decrease rear stagger
Raise center of gravity
Raise rear of kart

Very loose or four wheel drift
Decrease left side percentage
Increase cross weight
Raise seat for more weight transfer
Softer compound for more traction
Softer right rear tire compound
If softer compound unavailable use new uncut tires over cut tires
Decrease right front tire pressure
Decrease right rear tire pressure
Decrease right rear stagger
Reduce air pressure all the way around (same amount each tire)
Move front and rear wheels in
If you start out with this condition and are 10” wheels, go to 9.5”
Increase castor on both right front and left front in equal increments
**No grip in corners**
- Other karts are faster in corners
- Too little grip/speed too fast
- Too much slide
- Loss of time in corner
- Raise seat
- Move front track out
- Move rear track in
- Adjust tire pressures

**Bogs down in corners**
- Unstable, hops and loss of time
- Too much grip
- Right rear tire overloaded
- Move front wheels out
- Move right rear wheel out
- Move rear track to right
- Increase front and rear stagger
- Increase left side weight
- Lower cross weight
- Increase rear weight
- Lower seat
- Increase right side air pressure
- Harder tire compound

**Much slower in the straights**
- Gear ratio too short
- Wrong driving line in previous corner
- Take off a few teeth
- Evaluate driving line
- Check carb settings

**No short distance acceleration**
- Gear ratio too tall
- Wrong line in previous corners
- Evaluate driving line in corner
- Add a few teeth
- Check carb settings
- Check kart setup

**Loose in the rear (oversteer)**
- Wider front track
- Narrower front tires
- Harder compound in front
- Narrower rear tires

**Pushing (understeer)**
- Narrower front track
- Wider front tires
- Softer compound in front
- Wider rear track
- Narrower rear tires
- Harder compound in rear
- Lower air pressure in front
- Higher air pressure in rear
- Move weight to front
- Increase stagger
- Tighten rear bumper
- Decrease frame flex

**Bite: Front, left, cross weight**
To increase bite:
- Increase nose weight
- Decrease left side weight
- Decrease cross
To decrease bite:
- Decrease nose
- Increase left side weight
- Increase cross
- Tight kart has more rear grip than front
- Loose kart has less rear grip than front
- Stiff chassis is tight
- Stiff chassis transfers more weight
- Flexible chassis is loose
- Flexible chassis transfers less weight
**Tires**

Sidewall:
- Stiff sidewall for hard track
- Soft sidewall for soft track

Screwdriver test:
- Blade all the in track = 22
- Blade in 1/2" = 33
- Blade in 1/4" = 44

Hardness:
- Hard tire for abrasive track
- Soft tire for not abrasive track

Air pressure:
- Less available grip = less air
- More available grip = more air

Rear stagger:
- Pushes rear of kart in corner
  - Tighter turning radius, more stagger
  - Wider turning radius, less stagger

Front Stagger:
- Controls weight transfer across front of kart
  - Less stagger = quicker transfer
  - More stagger = slower transfer

Increase or decrease weight percentages with tire pressure

Very little changes required in tire pressure and stagger as small as 1/4 lb. to 1/8" stagger to notice performance change

Let air out of mounted tires after racing. When air is left in mounted tires they will grow larger in diameter especially in warm and/or sunny locations.

A properly treated tire compound will show grain but no feathering/shredding. It will pick up .3 to .4 in 5 to 7 laps and maybe another .1 through the run

If your tires are gaining .7 to .8 through a run and level off in the last 5 laps, your compound is right but your chemical is not aggressive enough

If your tires are still picking up at the end of the run, you have too much compound

If your tires feather but don’t fall off on the clock, you have the right compound but to much chemical

If your tires feather and fade on the clock, your compound is too soft

When the kart is locked down to the track or your tires are showing signs of wear, they are too soft

If you time other classes when you’re not racing and the track is getting quicker, it is time to go to a harder tire

If the track is getting slower, it’s time to go to a softer tire

**Durometer readings from Burris**

The durometer readings below are taken with a lab grade durometer at 70 F with 20 psi in the tire

<table>
<thead>
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<th>SS</th>
<th>62 - 64</th>
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<tbody>
<tr>
<td>SS-44</td>
<td>54 - 56</td>
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<tr>
<td>SS-33 / DXA</td>
<td>50 - 52</td>
</tr>
<tr>
<td>SS-22 / DXB</td>
<td>42 - 44</td>
</tr>
<tr>
<td>SS-11 / DxC</td>
<td>32 - 34</td>
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</table>

**Air pressure**

Higher air pressure loosens chassis:
- Less bite (looser)
- Same effect as harder
**compound**

Tire wears in center
Lower air pressure tightens chassis:
  More bite (tighter)
  Reduce loose condition
  Same effect as softer compound
Tire wears on outside edges
The bigger the split, the freer your kart.
Left: 4-10 lbs.
Right: 5-12 lbs.

**Higher air pressure**

Left front:
  Helps kart turn in center of corner
Right front:
  Less turn at the center of corner
Left rear:
  Loosens from center of corner out
Right rear:
  Less bite at center of corner and exit

**Lower air pressure**

Left front:
  Less turn at center of corner
Right front:
  Turn better at center of corner
Left rear:
  Tightens from center of corner out
Right rear:
  More bite at the center of corner and exit

**Stagger**

Rear stagger is used to make the left and right rear tires correspond with each other so the castor doesn’t have to completely lift the left rear. The kart will want to turn left at a greater degree as stagger is increased.

Front stagger: 1 1/4” to 2”
Rear stagger: 1/4” to 1”
Starting point:
  Front: 1 1/2”
  Rear: 3/4”
Rear stagger helps kart turn
Increase rear stagger for tighter turns
Decrease rear stagger for wider, more sweeping turns.
Too much stagger can create too high inside tire temperatures
Too much rear stagger causes a scrubbing effect and increases rolling resistance
Front stagger is commonly increased or decreased to change cross weight
Increases in front stagger will create more negative camber in both wheels

**Balancing tires**

Mount tire on the balancer and let it roll to a stop.
Mark a spot on the tire 180 degrees from the heavy spot.
Estimate how much weight it will require to balance.
Tape weights in place using duct tape.
Rotate tire until the weight is at three (or nine) o’clock and observe which direction it wants to rotate.
If the weight wants to rotate back to 12 o’clock, add more weight.
If it wants to rotate to 6 o’clock, take some off.
Do this until you can rotate the tire to three or nine o’clock and let it go and there is little or no movement.
Peel off the adhesive strip and permanently attach the
weights to the wheel.
Place duct tape over the weights for safety.

**Stretching tires**
To stretch start with more air, first 30 to 40 psi for an hour and if that doesn’t work about 60 psi for longer (up to days). Take it slow, try not to overshoot. After you get them sized, check them every few days to make sure they haven’t moved. If they do, work on them some more. You need to check them each week.

**Front track**
If kart is not turning into the corner properly:
Widen the front on each side to reduce the front end slide (understeer) causing the steering to be more direct.
Narrowing the front track will make the steering less responsive.
Wider front track is tight
Wider front track steers harder
Wider front track transfers less weight
Wider front track makes rear bite more
Narrow front track is loose (more bite)
Narrow front track steers easier
Narrow front track transfers more weight
Narrow front track makes rear bite less

**Rear track**
Move rear wheels in for more grip
Moving rear wheels in will make front bite less (push more)
Move rear wheels out for less bite
Moving rear wheels out will make
front bite more (push less)
Wide rear track is loose
Wide track transfers less weight
Narrow rear track is tight
Narrow track transfers more weight

**Left front (Timing)**
Increase air pressure:
Frees chassis at apex
Increase camber:
Starts rotation sooner
Increase caster or move wheel out on spindle:
Speeds reloaded chassis center off
Raise spindle & reset cross:
Slows weight transfer across the kart
Tire choice:
Determined by track conditions
Controls amount of left front use

**Left rear (Timing)**
Increase air pressure:
Reduces contact patch and slightly decreases stagger
Move out on axle:
Slows rate of transfer
Frees kart coming out
Tire choice:
Determined by track conditions
Controls amount of left rear use

**Right front (In charge of turning)**
Increase air pressure:
Decreases front grip on entry
Increase camber:
Controls contact patch across the tire
Increase caster:
Controls amount of weight transfer to right front
Pull out on spindle:
  Reduces amount of weight transfer to right front
Raise spindle & reset cross:
  Increases rate of weight transfer across front of kart
Tire choice:
  Determined by track conditions

**Right rear (In charge of rotation)**
Increase air pressure:
  Decreases contact patch
  May change stagger
Move out on rear axle:
  Decreases weight transfer to right rear
Tire choice:
  Determined by track conditions

**Wheel placement**
Moving wheel out from frame:
Left front:
  Helps turning in center of corner
Right front:
  Increase in cross weight speeds steering.
Left rear:
  Less bite
  Frees it up off corner
Right rear:
  Less bite in center of corner
Moving wheel into frame:
Left front:
  Tightens from center out
Right front:
  Slows steering reaction
Left rear:
  Tightens from center of corner out
Right rear:
  More bite in center of corner

**Small wheel circumference**
Left front:
  Smaller will increase the cross weight which effects kart ability to turn in and exit
Right front:
  Less turn into the corner
  Helps keep kart behind you
  Keeps kart from becoming loose in rear
Left rear:
  Turns better into corner
  Helps from getting push in middle of corner.
Right rear:
  Tightens kart entering into corner

**Large wheel circumference**
Left front:
  Will decrease cross weight
Right front:
  Tightens kart, increase cross weight
Left rear:
  Less turn into corner
  Rear tight
  Too much could cause push

**Bearings**
Worn bearings at the spindles or hubs in the front end can affect castor / camber and the overall handling of the chassis, it can mask a problem that no changes will cure.
Neglected rear axle bearings can rob the engine of horsepower that could be sent to the rear wheels instead.

**Toe in / toe out**
Vital to the driveability and speed on the straightaways
A scrubbing front track will make the tires heat up faster
and diminish speed when driving straight.
Toe settings from 1/16 to 1/8 of an inch out seem to be adequate and help the kart turn in quicker.

**Cross**
Moving rear axle down toward track raises chassis up = raises cross
Move rear axle up to decrease cross
1 turn of rear screw = 1 percent change in cross
Lower right front spindle to increase cross
Raise right front spindle to lower cross
Lower left front spindle to decrease cross
Raise left front spindle to increase cross
Increase front stagger to increase cross
Check toe and camber after changing washers

Low cross low stagger setups work good for long hairpin tracks - tracks where you can make up more time on the straights than you can in the corners.

Say 50% is neutral. If you put the left front down = more weight on it, that will lower cross.
That puts less weight on the right front. That would be the same as raising the right front.

If you raise the right front you will take pressure off of the left rear.
Raising the right front will take weight off of that corner and the left rear corner.

**Ballpark left rear weight**
To come up with a ballpark left rear weight, multiply right weight × left side%. This is how much your left rear should weight. Adjust cross to get there.

**Camber**
After finding your setup numbers, paint the top flat of the camber nut for reference when making changes. One flat = approximately .1.
Changing camber on RF
Yellow on top flat = -2.5
Turn outer nut toward back for more negative camber.
Turn outer nut toward front for more positive camber.

Changing camber on LF
Yellow on top = + 1.2
Turn outer nut toward back for more positive camber.
Turn outer nut toward front for more negative camber.

**Caster**
More caster (both sides) will make the front end jack more weight and thus, make it grip harder.

Less caster (both sides) will make the front end jack (transfer) less weight and therefore, make it grip less (tend to push).

More caster split (more in right front than left front) will make the kart want to turn into the corner on its own. If there is too much caster split in the
center, the kart may want to push because the left front isn’t de-wedging the kart enough with respect to the right front to free up the left rear.

Less caster split will make the kart more responsive to driver input getting in and in the center but may either A) make the kart too twitchy or B) make the kart bind up because its not wanting to travel the corner radius as much on its own.

A good rule of thumb for caster split is 2 degrees. Some manufacturers run more but, with the high cross weights being run these days, the right front is so much more pre-loaded than the left front that more caster split isn’t generally needed to get the front end to turn left on its own.

Too much caster split is worse than not enough as it will tend to make the kart want to be pushy lazy getting in and through the center of the corner.

Rule of thumb: 2* split. Never run less than 8* on the right front (high biting track) or more than 13* on the right front (low biting, slow track).

Cross weight 53 - 54 %  59 - 65%
Front 44 - 45 %  44 - 46%

Nothing can work correctly without proper percentages, settings and a well-balanced chassis. Your first successful race starts on the scales, the information you obtain on the scales is directly related to your success on the track. Notes should be taken at this time using different air pressures and how it will change the cross weight. Front to rear and left to right weight has to be changed by moving the seat or moving added weight.

Although driver comfort is first, close attention to the VCG (vertical center of gravity) is important. The VCG is changed by the seat height and can effect the dynamic weight transfer while cornering. A higher VCG will require a higher left side percentage most of the time to control side bite of the right side tires. A lower VCG has the opposite effect.

**Gearing Info**

Gear ratio is rear sprocket divided by driver. It multiplies the engine’s torque by the ratio and divides the axle speed by the ratio.

The higher the number in the ratio, the more torque (acceleration). A 5.00:1 ratio has more torque than a 3.00:1 ratio

The smaller the number, the higher the potential top speed. A 3.00:1 ratio will go faster than a 5.00:1 ratio at the same engine rpm.

The bigger the driver with the same gear ratio, the more inertia the kart will have. It will resist

### Starting point percentages

<table>
<thead>
<tr>
<th>Low cross kart</th>
<th>High cross kart</th>
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<tr>
<td>Left side</td>
<td>55 - 56 %</td>
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</table>
acceleration more than the smaller driver but will also resist deceleration.

1 tooth on the driver = 3-5 teeth on the rear sprocket, depending on where you are on the ratio chart.

Larger driver = higher top speed, but harder to get up to speed
Smaller driver = more pull off corner, but less high speed
Smaller driver = more RPM
Larger rear gear = more RPM
Larger rear gear = more pull off corner
1 front gear = 3 rear gears
Add 1 driver gear to drop RPM
Each rear gear = 100 RPM
1 driver gear = 400-500 RPM
If track gets faster - drier - more grip, drop teeth in rear and go up in air
If track gets slower - less grip, add gear in rear and drop air
Larger track use a larger driver
Change rear gear to keep gear ratio 13 driver to rear = 4 to 1 15 driver to rear = 4 to 1
If you are flat footing it, keep taking some gear off the rear until your lap times slow down. You should end up with more top end

Lead weight positioning
Fit lower down for bigger driver and higher up for small driver
Heavier driver should secure weight to sides of the seat to keep the kart balanced
Mount weights more toward front for better front end grip, and to back for better rear end grip
In the wet have the weight as high as possible to achieve better grip all around

Jetting
The main jet affects the carb at all RPM’s. After selecting the correct jet (48-50) adjust performance with EGT. If not available use CHT to adjust with mixture screw.
General rule of thumb:
Rich-out on mixture screw helps bottom end pulling power
Lean-in on screw helps top end max RPM’s.
Lean = higher CHT
Rich = lower CHT.
Shoot for 385-410 degrees
If your engine cuts out at the end of the longest straight or appears sluggish in the mid range, decrease the jet size.
When the air contains more moisture (humidity), there is less oxygen to burn. Thus you need less fuel = smaller jet.

Clutch adjustment
Spring tension, lever weight and air gap affect the stall speed or clutch slip.
You need to know what RPM your engine produces its maximum torque. This is the RPM at which you want your clutch to engage.

Stiffer springs achieve higher stall speeds (more clutch slippage).

Change the spring height by turning the bolt clockwise, which will increase the tension on the spring and raise the stall speed.

The more weight on a lever, the faster it will engage the clutch.

The levers are controlled by the springs. The more weight you put on the lever, the faster the lever can overcome the rate of the spring and achieve lockup.

Fine tune the clutch by adjusting the springs or the lever weights.

Air gap, measured with a feeler gauge, is the distance between the clutch discs.

Air gap affects stall speed. The greater the air gap, the further the pressure plate must travel to compress the discs and engage the clutch.

Air gap has the least affect on the stall speed.

If the air gap becomes too great, the clutch cannot fully lock-up and can chatter.

Minimum air gap would be .030.
Maximum air gap .060.
Air gap .040” to .050” is ideal.

Use floater discs in various thicknesses to keep the desired air gap at a constant amount.

**Clutch cleaning**

Remove clutch basket and sprocket from the clutch.

Soak all of the remaining parts in acetone for 5 to 10 min.

Blow the disks dry with clean air.

Repeat the above a couple of times.

Remove all the contaminates possible.

When reinstalling the clutch, put no lubricant on the thrust bearing and only enough grease on the sprocket bearing to prevent it from locking up.

Use petroleum jelly. Don’t use a hi-temp lubricant. The smallest amount can get on the disks.

On the grid, put your foot on the brake and flat foot the throttle for 5 - 10 seconds. Wait 1/2 a minute and repeat. Do this 5 or 6 times, or until you start to feel the clutch "hit" harder.

This process burns out the contaminates.

Repeating the process several times brings heat slowly into the steel parts which prevents distortion. Some smoke coming off of the clutch during is evidence of contaminates burning off.

**What does a fast kart feel like?**

**Bite**

To get everything working you have to get a good entry.

Front must snap, almost to the point of being loose if the driver “yips” at the wheel to initiate weight transfer.

Weight must transfer pushing the driver into the right side of the seat, loading the right side tires and unloading the left.

Kart must not slide at the apex.

The steering wheel may feel
Flex and Pivot
The driver should feel...
The seat pushing hard into your side
The left side unloading and moving up
The right side loading and moving down
The kart rotating at the apex
After rotation the steer effort should go down and the kart should begin to accelerate (the earlier after the apex the better)

Center Off
Once the kart has navigated the apex at maximum speed and pivoted, you have to get the best run possible off the corner.
The front end should still remain positive
The left rear will begin to reload and the kart should feel “alive” (as in not flat or dead)
The kart shouldn’t feel dead (LR overworking) or boggy (RR overworking)

Questions to answer to make the kart faster
How does the kart feel?
Can you still drive it if it is freed up a little more, or does it feel like the kart is sliding?
Does the kart feel faster at the beginning or the end?
Did it get tighter or looser the longer you ran?
Do you have to turn the steering wheel a lot or just a little bit?

Some advice from Todd Godwin:
www.dynamicsofspeed.com
- Always start with a good baseline and don’t veer too far from it; you’ll always be faster in the end
- Never run a 2 lb split with tire pressures
- Don’t overanalyze things. Karting is very complex and most of the “conventional wisdom” answers are wrong. A theory may seem logical but often the more logical solutions that people come up with are incorrect (I’ve had about 3 tons of my own theories proven wrong because I simply didn’t have a good enough understanding); if you truly want to understand you’ll have to do lots of reading (which isn’t too difficult) and you’ll need to work with one or two of the most experienced, best drivers in the business (this is far more critical than...
all the reading)

- Keep it simple, use as few adjustments as possible. With every adjustment there is just as great of likelihood that you’ll go the wrong way as the right

Please Note:
I’ve accumulated this information from many different sources, many of them from Bob’s 4-cycle and other places on the Internet. I thank everyone who supplied this information for the use of us beginners in karting. Since the information came from many different sources, some of it may or may not be correct or may conflict with something else on the list. If something you change doesn’t work, try something different. Good luck!