

SAE Baja

Operation & Assembly Manual

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1 Introduction

Lumberjack Motorsports welcomes you to the passionate community of off-road enthusiasts with your new All-Wheel Drive Baja vehicle. We are proud of the robust construction and innovative features of this design.

We invite you to read through this operations and assembly manual. It is designed to acquaint you with your new All-Wheel Drive vehicle and help you enjoy finding new paths on many adventures to come.

When servicing your All-Wheel Drive vehicle, remember that Lumberjack Motorsports knows your vehicle best and strives to provide complete customer satisfaction. We will provide quality maintenance and minor service to your vehicle. To check out future product news and updates or address any other assistance you may require, contact Lumberjack Motorsports directly through Facebook or Instagram.

Lumberjack Motorsports

Notice

Any modification to your Lumberjack Motorsports All-Wheel Drive vehicle could impact its performance, durability and/or safety.

2 Assembly

2.1 Drivetrain

The Drivetrain consists of the Engine/Transmission, Fuel, and Gear Reduction subsystems. Associated hardware will be packaged separately by component/assembly for ease of installation. For a complete list of premade assemblies, components, and hardware, see below:

| Part | Quantity |
|--|-----------------|
| Briggs & Stratton 10 HP OHV Vanguard Model 19 (engine) | 1 |
| Najmy 3000 ECVT Primary Pulley | 1 |
| Gaged Engineering GX9 Secondary Pulley (modified) | 1 |
| Intermediate Shaft Mount | 1 |
| TJTC24 Gearbox | 1 |
| Yamaha Rhino 660 Rear Differential | 1 |
| Yamaha Rhino 660 Front Differential | 1 |
| 38" Driveshaft | 1 |
| Driveshaft Bearing Block | 2 |
| Pin and Block Single U-Joint w/ Keyway | 2 |
| Fuel Tank | 1 |
| Fuel Line | 1 |
| Hardware | Quantity |
| Engine Mount Bolts | 4 |
| Engine Mount Nylon-Insert Lock Nuts | 4 |
| Engine Mount Washers | 8 |
| ECVT to Engine Bolts | 4 |
| ECVT Washers | 4 |
| Secondary Shaft Key | 1 |
| Intermediate Shaft Mount Bolts | 3 |
| Intermediate Shaft Mount Nylon-Insert Lock Nuts | 3 |
| Intermediate Shaft Mount washers | 3 |
| Gearbox Mounts | 3 |
| Gearbox Nylon-Insert Lock Nuts | 2 |
| Rear Differential Bolts | 2 |
| Front Differential Bolt (Rear) | 1 |
| Front Differential Bolt (Front) | 1 |
| Differential Nylon-Insert Lock Nuts | 3 |
| Front Differential Bolt | 1 |
| Differential Washers | 4 |
| Driveshaft Bearing Block Bolts | 4 |
| Driveshaft Bearing Block Nylon-Insert Lock Nuts | 4 |
| Driveshaft Bearing Block Washers | 4 |
| U-Joint Set Screws | 4 |
| Fuel Tank Mount Bolts | 4 |
| Fuel Tank Mount Nylon-Insert Lock Nuts | 4 |
| Fuel Tank Mount Washers | 4 |
| Hose Clamps | 2 |

2.1.1 Engine/Transmission

Begin by detaching the ECVT Face Plate and install on the B&S Vanguard Model 19 engine using the supplied 1/4" bolts into the corresponding blind holes located around the engine output shaft. Inserting the supplied V-belt into the ECVT Primary pulleys. Then, reattach the ECVT to the ECVT Face Plate to complete the Engine/Transmission sub-assembly. Next, insert the Engine/Transmission sub-assembly into the frame through the rear of the vehicle with the ECVT positioned forward with respect to the engine and the engine resting on top of the frame's engine mount. Affix the engine to the frame using supplied 5/16" bolts through the base of the engine and the frame's engine mount. Engine/Transmission sub-assembly installation is now complete.

2.1.2 Fuel

The Fuel subsystem must be installed after Engine/Transmission subsystem is installed, as it is responsible for supplying fuel to the engine to propel the vehicle. To install the Fuel system, begin by mounting the Fuel Tank to the frame using the provided 3/8" hardware on tabs located above the engine mount. Then, attach the Fuel Line to the barbed nozzle on the bottom of the fuel tank and side of the engine, careful to use the provided hose clamps to ensure an airtight connection at either location. The Fuel subsystem is now complete.

2.1.3 Gear Reduction

After completion of the Engine/Transmission installation, begin the Gear Reduction installation by installing the Intermediate Shaft Mount using the (supplied) 5/16" bolts/washers/nuts. Next, install the Yamaha Rhino 660 Rear Differential to the frame using the corresponding mounting tabs located under the engine mount and supplied 7/16" bolts/nuts. Eventually, CV axles will insert themselves into the differential's sides (during construction of rear suspension) to allow rotational translation to the wheels. Separately, assemble the Main Reduction assembly. Start by attaching the modified Gaged Secondary Pulley to the TJTC24 Gearbox input shaft by seating the Intermediate Shaft Key into the aligned keyways located on both the secondary pulley and gearbox input shaft. The Main Reduction assembly is now ready to be installed on the vehicle.

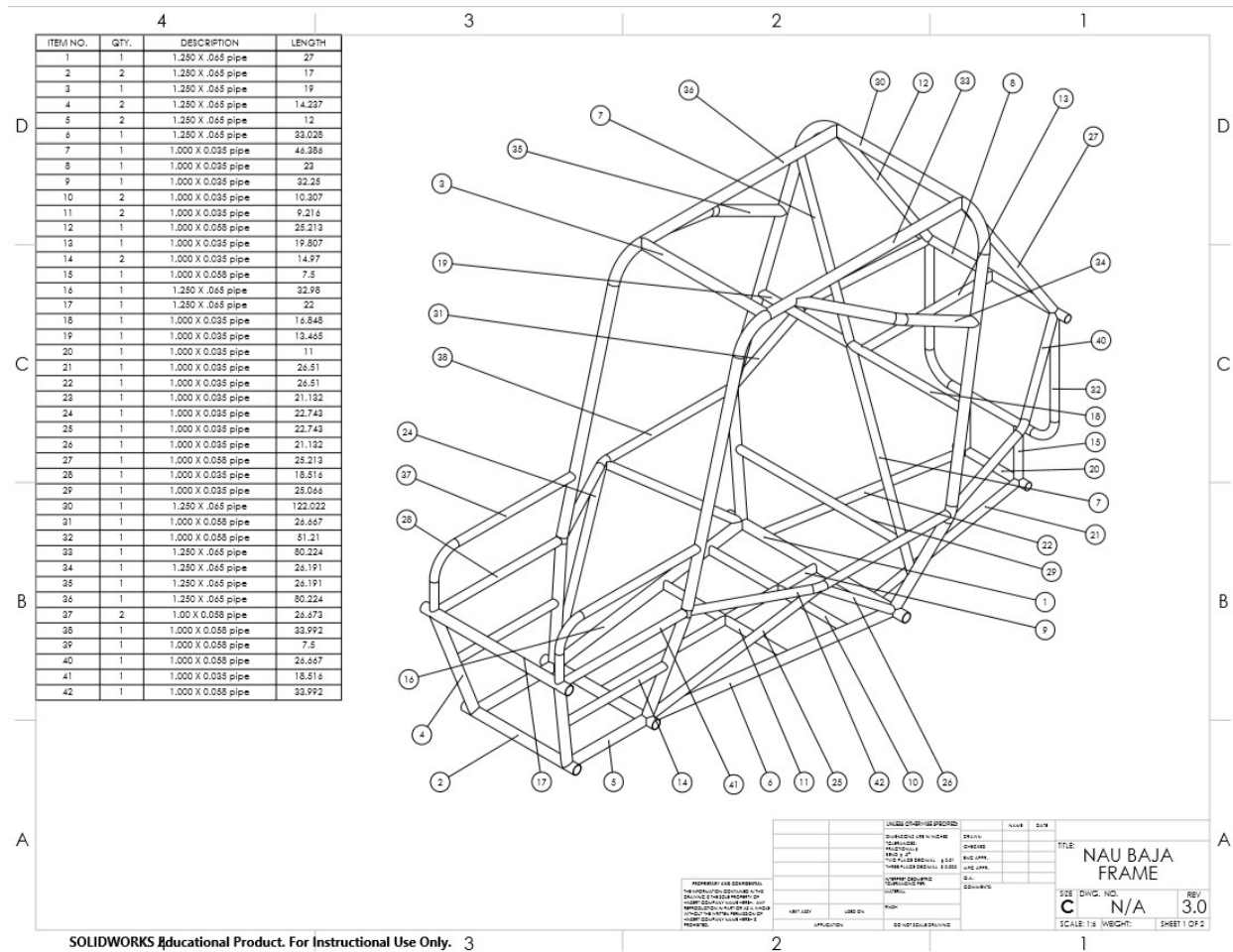
Affix the Main Reduction assembly to the vehicle by first aligning and inserting the TJTC24 gearbox input shaft with Intermediate Shaft Mount, taking special care to loop the V-belt around the inserted shaft. Then rotate the Main Reduction assembly until rear U-joint aligns with the rear differential input shaft. Attach the rear differential using the set screw provided on the U-joint. Next, attach the Gearbox to the frame using the three corresponding tabs located between the engine mount and the bottom of the frame using supplied hardware. Finally, loop the V-belt over the secondary pulley so that it rests between pulley cams on both the primary and secondary pulleys. The vehicle is now ready to propel itself under its own power.

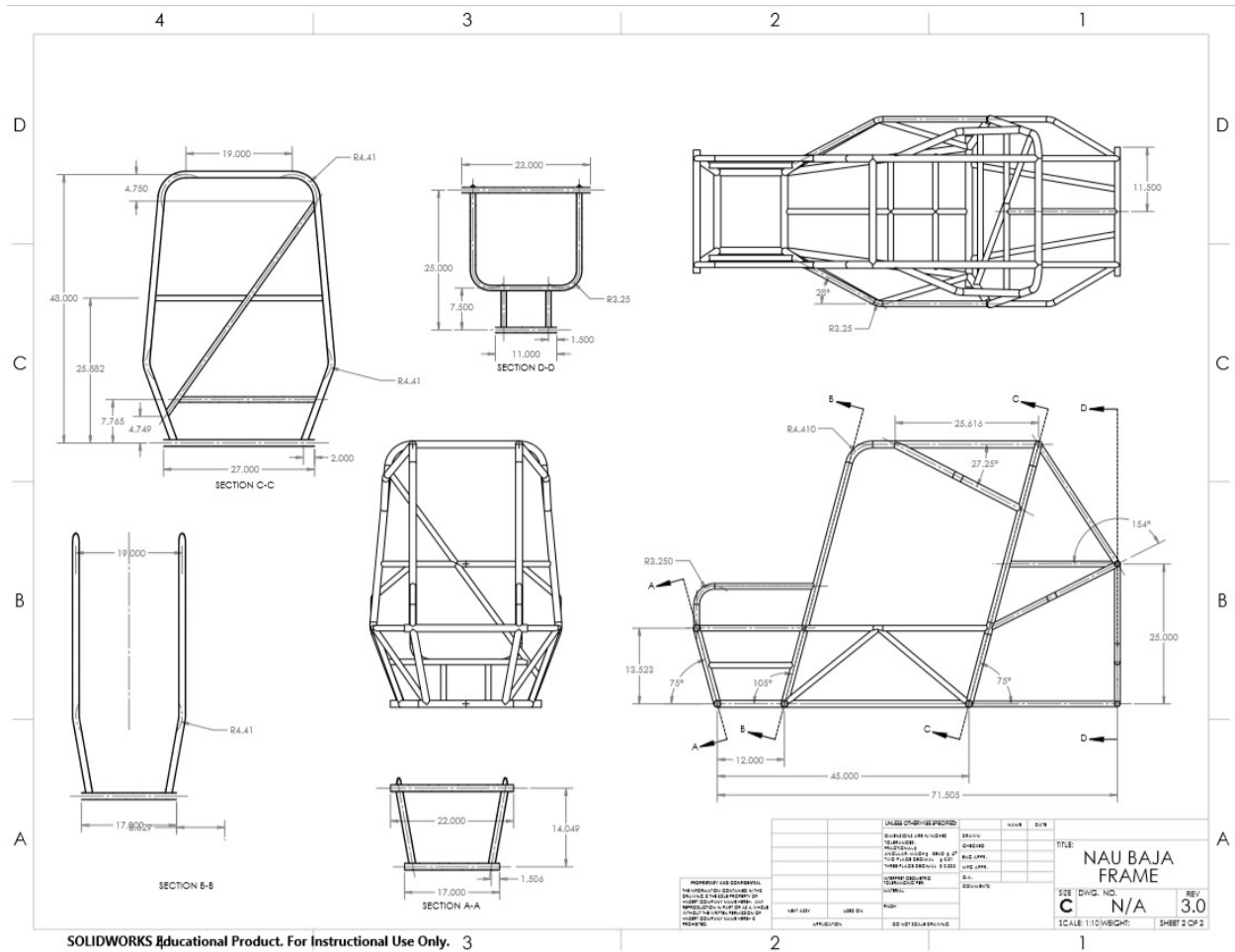
To configure the vehicle for four-wheel drive (4WD), the Gear Reduction subsystem will require the addition of a driveshaft and front differential (also provided). Begin by installing the driveshaft bearing blocks to the frame mounts located at the base of the firewall and the rear of the vehicle's nose segment using supplied 3/8" hardware. Then, insert the 38" Driveshaft through both bearing blocks starting at the front of the vehicle. Once through both bearing blocks, attach the rear U-joint to the end of the driveshaft and the TJTC24 Gearbox output shaft using the set screws on the U-joint. Repeat U-joint installation on the opposite end of the driveshaft using the front U-joint. Finally, Mount the Yamaha Rhino 660 Front Differential to the frame using the supplied 7/16" and 1/2" hardware, and to the front U-joint using the applicable set screw. The full Gear Reduction subsystem is now complete and ready for CV axles insertion to provide power to the front wheels. The vehicle is now mechanically 4WD-ready.

2.2 Frame

The assembly of the frame involves taking prefabricated members and welding them in their respective positions. There are 42 individual frame members that will need to be accounted for it is recommended to

use the frame assembly drawing with balloon callouts in conjunction with the frame assembly drawing with critical reference dimensions both of which are shown below.





The steel frame members will need to be fully TIG welded together before the frame can be considered robust enough to handle full operating conditions. It is advised to tac weld members in place before fully welding the joint. The frame should fit together naturally; this is something that can be checked and corrected if initially using only tac welds.

2.3 Rear-End

The assembly for the rear end consists of mainly the trailing arm and the two lateral links. The trailing arm is attached to the frame through a mounting tab welded to the frame that requires one bolt and lock-tie nut as well as washers on each end. The lateral links connect directly to the trailing arm through the plugs that have been welded to the arm. The lateral links have left and right-hand threaded ball joints which are connected through bolts. The plugs are threaded so only require one bolt per plug. The other end of the lateral links connects to the frame via more mounting tabs that also only require one bolt per lateral link. Lastly, the CV axle slides into the trailing arm where the press fit bearing holds the CV while the hub and wheel, bolted together, are attached on the other side of the trailing arm. The CV is locked down with a specific CV nut that matches the threads on the CV. The trailing arm itself utilizes many components welded together to eliminate parts including the CV housing and bearing as well as the ball joint that directly mounts to the frame. Finally, the shock is mounted to the frame and trailing arm using one bolt on each side, there are misalignment ball bearings on each end of the shock to allow for misalignment during assembly.

2.4 Front-End

The front-end suspension parts provided for your All-Wheel Drive vehicle include:

| Part | Qty. |
|-----------------------------------|------|
| 10" ITP A-6 series 10x5 wheel | 2 |
| 22x7 SUNF A007 tire | 2 |
| Yamaha Grizzly 350 Front Hubs | 2 |
| Yamaha Rhino 660 Steering Knuckle | 2 |
| Steering Rack Assembly | 1 |
| Steering Tie Rod | 2 |
| Yamaha Rhino 660 CV Axle | 2 |
| Upper Control Arm | 2 |
| Lower Control Arm | 2 |
| YRF 400mm Shock Absorber | 2 |

You will also need two Wilwood GP200 brake calipers and mounting brackets, brake rotors and stainless steel-braided brake lines provided in your kit. These components are listed in section 2.4.1.

First, slide the provided CV axles into the front differential.

Notice

The extended CV axle must be mounted on the left-hand side when viewed from the driver seat. This will ensure symmetrical suspension geometry.

Next, install the upper and lower control arms by inserting the eyelets into the frame mounting tabs and fasten them with the provided nuts and bolts. Each control arm bolt should have two washers on the hex side and the nut side. The upper control arm is the shortest arm.

Once the control arms are installed, slide the steering knuckles onto the CV axles, making sure the tie rod mounting plate is pointing toward the rear of the vehicle. Install the steering rack mounting plate onto the frame and fasten the steering rack to the mounting plate. Fasten each steering tie rod to end of the steering rack and steering knuckle with the provided nuts and bolts. Fasten the brake caliper mounting bracket to the steering knuckle, then install the front rotor onto the hub assembly. Slide the hub assembly onto the CV axle and tighten the axle nut until tight. Indent the edge of the axle nut into the lip of the axle shaft to prevent loosening. Finally, insert the brake caliper with pads onto the brake rotor and fasten to the caliper mounting bracket.

2.4.1 Brake System

Your All-wheel Drive vehicle includes the following parts for the brake system:

| Part | Qty. |
|---|-------------|
| Wilwood GP200 Brake Calipers | 3 |
| Front Stainless Brake Lines | 2 |
| Rear Stainless Brake Line | 1 |
| -3AN fittings | 6 |
| Hard brake lines - Front | 3 |
| Hard brake lines - Rear | 1 |
| Brake Pedal Mount | 1 |
| 5/16 - 18 nut | 4 |
| 5/16 - 18 bolt | 4 |
| 5/16 - 24 Nylon nut | 4 |
| 3/8 - 24 bolt | 10 |
| 3/8 - 24 Nylon nut | 10 |
| Wilwood 340-13832 Swing Mount pedal | 1 |
| Wilwood 260-2636 Master Cylinder | 2 |
| -3AN to 3/8 - 24 brass tee fitting | 1 |
| -3AN to 3/8 - 24 brass fitting | 3 |
| 7.5" Brake Rotor | 2 |
| 7" Brake Rotor | 1 |

WARNING

The braking system of your vehicle should be installed and maintained by a licensed mechanic or trained professional. Failure to follow instructions may result in a loss of braking power or system failure, resulting in serious injury.

Attention

Clean all brake rotors with brake parts cleaner to remove oils on the surface of the rotor before installing. The use of Teflon tape on brake system fittings is strongly discouraged.

First, bench bleed your master cylinders to remove air and help with the system bleeding process. Weld the

pedal bracket onto the cross member of the frame. Fasten the pedal assembly to the mounting bracket using the four 5/16 - 18 nuts and bolts included. Fasten the master cylinders to the studs on the pedal assembly using the four 5/16 - 24 nuts provided. Thread the balance bar clevis joints of the pedal assembly onto each master cylinder stud. Thread the pre-shaped hard lines into each master cylinder.

Notice: The right master cylinder on the pedal assembly when viewed from the driver seat must be used for the rear braking circuit of the vehicle.

Front circuit - install the brass tee fitting onto the other end of the hard line leading from the master cylinder. Thread the remaining two hard lines into the tee fitting, ensuring that they are in line with each other. Fasten a straight -3AN to 3/8-24 brass fitting to the end of each hard line and install the -3AN fittings followed by the two stainless steel brake lines. Next, thread a -3AN fitting on the Wilwood GP200 calipers provided and install the steel-braided lines. Install 7.5" rotors onto front hub assemblies. Fasten the front caliper mounts to the steering knuckles. Install steering knuckles onto axles followed by the front hub and rotor assemblies. Finally, fasten the brake caliper onto the caliper mounting brackets using two 3/8 - 24 nuts and bolts. Apply thread locker to bolts and tighten until snug.

Rear circuit – Weld rear rotor mounting tabs to the right rear CV axle collar, making sure they are evenly spaced apart. Fasten rotor to mounting tabs using four 3/8 - 24 nuts and bolts. Apply thread locker to bolts and tighten until snug. Mount a Wilwood GP200 caliper to the rear caliper mounting bracket using two 3/8 - 24 nuts and bolts. Apply thread locker to bolts and tighten until snug. Install hard line to rear master cylinder and thread a straight -3AN to 3/8-24 brass fitting to the end of the hard line. Thread a -3AN fitting into the brass fitting and install the stainless-steel brake line on the hard line and caliper.

WARNING

DO NOT OPERATE THE VEHICLE OR BRAKE SYSTEM AT THIS POINT. See the Operation section for further instructions.

2.4.2 Steering System

The Baja vehicle includes the following parts for the steering system:

| Part | Qty. |
|--|-------------|
| Rack Mount Plate | 1 |
| Steering Rack and Pinion | 1 |
| Tie Rods (12 in) | 2 |
| 3/8 - 7/16 Clevis Joints | 2 |
| 7/16 Heim joints (2LH – 2RH) | 4 |
| 7/16 - 24 bolts | 4 |
| Steering Coupler | 1 |
| Steering Column (15 in- 0.065 thickness) | 1 |
| Quick release Hex Assembly | 1 |
| 5/16 - 24 bolts | 7 |
| Steering Wheel | 1 |

The rack mount is welded onto the member of the frame that is stationed across the nose region. The steering rack is then mounted onto the plate and bolted using the 5/16-24 bolts. The clevis joints are screwed into the ends of the rack shaft instead of the stock 3/8 heims. The 7/16 heim joints and assembled onto the tie rods and bolted onto the rack and the knuckles. Going forward with the steering assembly, the coupler which is inserted onto the steering shaft with a 36-spline end is inserted and bolted across to the steering column. The hex end of the quick release is welded onto the steering column and locked onto the quick release assembly which has the steering wheel bolted onto it.

Attention

Clean steering rack ends after use and keep the rack greased after every operation cycle

3 Operation

3.1 Drivetrain

This year, Lumberjack Motorsports released its most technologically advanced buggy that successfully incorporates a 10.1 inch capacitive touch screen Human-Machine Interface (HMI) display that controls the first of its kind for Lumberjack Motorsports electronic continuously variable transmission (ECVT) and on-demand four-wheel-drive system with electronic selector that the user can choose between rear-wheel drive, four-wheel drive limited slip and four-wheel drive locked. While this sounds complex and hard to operate, the expert drivetrain design engineer on this year's lumberjack motorsports team was able to design the user interface to be as simple to use and forgiving as possible.

While this year's model features a completely redesigned drivetrain system, the operation remains relatively the same as previous year's drivetrain operation, with a few extra goodies. The first step of operation requires a pre-drive checklist to be complete, refer to the maintenance section below. Once all the systems have been verified to be in good working order the user can turn the key which turns on the buggy's operation system and allows the engine to be started. The engine can be started by pulling the pull cord on the buggy's engine.

Once the buggy is idling, it should be left to warm up for five minutes to allow for engine longevity. After warming up and the user is properly harnessed into the buggy, the user simply must select "DRIVE" on the 10.1-inch screen, then push the throttle pedal down to engage the transmission, it's that easy! When the driver is done with driving, they can select the "NEUTRAL" button on the screen, and it will disengage the transmission. When the transmission is disengaged, and the driver is ready to exit the buggy they must turn the key to the off position, and it will turn the engine off and power down the operating system. This is all relatively the same operation as last year's model. In the next section, the operations of the added features will be explained.

Now that the minimum operations of the buggy have been described this section will go into the operations of the different drive modes, steering wheel controls, and selecting four-wheel drive. The lumberjack motorsports team has worked tirelessly on providing the next level driving experience for our customers; therefore, we have added four different drive modes! These drive modes include: Automatic, Manual, Acceleration and Hill Climb. The modes are used for a more dynamic driving experience allowing the user to use the most power delivered from the engine. Automatic mode allows the user to have a casual driving experience allowing the computer to calculate the best time to shift. Manual mode allows the drive to have a more hand on drive experience. This mode allows for the customer to shift without a clutch and change between 4 gears and an overdrive setting. Acceleration mode allows the transmission to shift seamlessly and fast with programming specific for fast acceleration. Hill climb mode allows the buggy to stay within the torque band of the motor to allow the most torque to be sent to the wheels without belt slipping. All these great modes can be found within the terrain page on the 10.1" touch screen. Once on the terrain page the driver can effortlessly and on-command which between modes, you do not even have to stop!

Another first ever for lumberjack motorsports buggy is steering wheel controls. The steering wheel controls allow the user to change gears and navigate through performance setting on the screen without even taking their hands off the steering wheel, this allows for the safest possible operation of the buggy. While in automatic mode, acceleration mode and hill climb mode the drive has the option of hitting the left shift button which allow the buggy to drop to a low gear ratio which will give the buggy more instantaneous torque when necessary, on-command. The drive also has the option of hitting the right steering wheel button which allows the buggy to shift into neutral which allows the buggy to free wheel which is necessary for high speed downhill portions of the track. Once either button is released the original mode and settings will reengage allowing the buggy to have optimal control and perform better than other models out on the market.

Lastly, our engineers pride themselves on the ability to design an electrically engageable and disengage four-wheel-drive system. This is a first ever for lumberjack motorsports. The operation of the four-wheel drive system is controlled through user input through the 10.1-inch screen located on the dash of the buggy. The four-wheel drive settings can be found on the terrain page. Once the user is in the terrain page, they can select either two-wheel drive, four-wheel drive limited, four-wheel drive locked. These settings are on-command and can be shifted while driving. This allows the buggy to compete in dynamic events that normal buggies would need to stop and engage gears. Also programmed into the buggy is a failsafe incase the gear box cannot shift into desired drive. When shifting the buggy will sense it is not engaged and will display a message that the desired gear was not selected and prompt the driver to try again.

3.2 Frame

The frame is a structural component of the vehicle and therefore not operated. The only operable component that could be included as part of the frame is the harness. When operating the five-point harness it is imperative to ensure the lap belts, shoulder straps, wrist restraints, and anti-submarine belt are on the male piece of the latch before it is locked. The straps should not be loose and ensure the driver would not be detached from the seat in the event of a rollover.

3.3 Rear-End

To operate the buggy the rear end suspension should be checked for any abnormalities or deformation of the system. The bearings and ball joints should be moving freely and not be bound up. The shocks should appear intact and not be experiencing any leaks. The wheels should be properly inflated and checked for any damage to ensure safety during your ride. Be sure that the CV joints are free of debris and properly attached to the differential and the wheel. Once the rear suspension has been checked, ensure the rest of the system is operating as expected. During operation the rear end needs no additional attention. After use be sure to keep up proper buggy maintenance.

3.4 Front-End

3.4.1 Suspension

Your All-Wheel Drive vehicle features a nitrogen reservoir for adjustable damping. The ride quality can be stiffened or softened to preference by increasing pressure with nitrogen gas or compressed air for a firmer ride and decreasing the pressure for a softer ride. Additionally, the spring preload can be adjusted by tightening or loosening the collars with the provided spanner wrenches. The adjustment range is 20 mm.

WARNING

Shock absorbers contain highly pressurized nitrogen gas and preloaded springs, which may cause serious injury if handled improperly. Adjustments should be performed by a licensed mechanic or trained professional.

The control arms feature threaded heim joints for camber and toe angle adjustments. To adjust alignment, support the vehicle using a rack or lift. Remove fasteners from eyelets and slide control arm away from the frame. Extend or shorten the eyelets by tightening or loosening them. The adjustment range is approximately 1 inch. Note the number of full turns made after performing each change. Reinstall control arms onto frame and lower the vehicle onto the ground.

Before driving, set the front tire pressures to the recommended value found on the sidewall of the tire. Ensure shock absorber pressures are constant and do not exceed 0.5 MPa (72.5 psi).

3.4.2 Steering

Once the steering system is fully mounted, apply heavy duty grease to the rack shaft of the steering rack. Check the response of the steering system by performing stationary lock to lock movements. Once movements are smooth, the steering system is good to use under rough terrains.

3.5 Brake System

3.5.1 System Bleeding

Once the brake system assembly is fully assembled, pour DOT 3 or DOT 4 brake fluid into the master cylinders until full. Use brake fluid from a sealed container only. **DO NOT OPERATE THE VEHICLE** after assembling the brake system. You must bleed the brake system to remove trapped air. This ensures the brake system is operating efficiently and safely.

To bleed the brake system, have another person assist you by stepping on the brake pedal. Start by bleeding the brake caliper furthest from the master cylinder. You will need a brake bleeder kit to do this step. The recommended order to bleed is the rear caliper first, right front caliper second (when viewed from the driver seat) and left front caliper last. Fit a ¼" wrench over the bleeder valve and attach the plastic tubing from the brake bleeder kit over the valve opening. Have your assistant depress the brake pedal as far as it will travel and loosen the rear caliper bleeder valve until brake fluid flows into the bottle for collection. When flow slows or stops, tighten the bleeder valve and release brake pedal pressure. Repeat until the brake fluid flows at a steady stream and contains no air bubbles. Have your assistant monitor the brake fluid levels and refill as necessary.

Attention

Do not allow master cylinder reservoirs to become low on brake fluid. This will reintroduce air in the brake system and lengthen the bleeding process.

Continue the bleeding process for the remaining brake calipers. Tighten master cylinder caps and inspect brake system for leaks. Ensure all fittings are snug before moving onto the next procedure.

3.5.2 Bedding Pad Material onto Brake Rotors

Once the bleeding procedure is complete and no leaks are detected in the braking system, you are now ready to embed pad material onto the brake rotors. This will improve the friction between the brake pad and rotor, providing short stopping distances as well as safe, stable and consistent braking performance.

Attention

Before driving the vehicle, pump the brake pedal repeatedly to build pressure in the brake system with the engine off. If the pedal sinks to the floor after repeated presses, inspect the brake system for leaks or rebleed the system.

Begin the bedding procedure by travelling at moderate speeds, about 20 mph, within an open area and apply moderate to firm pressure to the brake pedal. Quickly decelerate until the vehicle nearly stops. Repeat at least 3 - 5 times intermittently every 5 seconds. Next, travel at least 30 – 35 mph and apply moderate pressure to the brake pedal. Gradually decelerate until the vehicle nearly stops. Repeat at least 3 – 5 times

intermittently every 5 seconds. The brake rotors should feature an even glaze on the surface when the process is complete. You are now ready to safely enjoy your All-Wheel Drive Baja vehicle.

Attention

Do not come to a complete stop during the bedding process. High temperatures will cause the brake pad material to transfer onto the rotor, causing accelerated pad wear and warped rotors. If the brake pads show signs of smoking or produce a burning smell, reduce braking when possible to allow the pads and rotors to cool.

4 Maintenance

4.1 Drivetrain

In order to maintain the drivetrain systems, the user is responsible for visual inspection of the engine, transmission, gear reducer, and front and rear final drives before and after each use. If the user notices an abnormality in the operation of the buggy, the user should immediately stop and refer to the owner's manual. The next paragraphs will describe necessary visual inspection and maintenance required for each drivetrain component.

The engine is what makes the buggy move and is one of the most important components on the buggy. Before and after each ride the user should inspect the oil level and quality using the dipstick on the engine case. If the engine oil is low, the user should add oil until its operating at correct levels. If the engine oil appears dark or dirty, the user should preform and oil change. The engine oil should be changed annually or every 50 hours, whichever comes first. Before and after each ride the user should inspect the exhaust system and air filtration system for any obstruction. Without proper ventilation the engine can overheat and cause serious mechanical failure and injury to the user. Lastly, shaft seals and linkages should be inspected to verify correct operation. If a shaft seal is leaking, immediate action is required to prevent further damage to the engine. All linkages should be inspected to make sure all connection is properly tightened and secured, if the linkage is improperly connected or loose, this will require immediate action to prevent loss of control of engine control.

The electronic continuously variable transmission (ECVT) helps the buggy produce torque and speed based off the continuously varying gear ratios. The user is required to visually inspect the ECVT's electric stepper motor, drive belt, electrical connections and power supply. The stepper motor requires only visual inspection to verify the chain is correctly tensioned and the mounting bolts are correctly tensioned. If the user notices the transmission slipping the chain attached to the stepper motor should be tensioned by adjusting the stepper motor's mounting bolts. The drive belt is what transmits power from the engine to the gear reducer, this belt is a critical drivetrain component. If the belt fails and immediate loss of power will be noticed. The drive belt requires inspection before and after every use, this requires the user to verify the tension on the belt enough to transmit the power without slipping. If the belt needs to be tensioned the user will notice the distance between the primary and secondary sheaves are less than the 8.5 inches required. The user will need to shim the engine until the proper distance is achieved. The ECVT uses a complex system of sensors and computers to monitor the health and position of the transmission as well as the buggy. The user should do a visual inspection of the wiring harness to make sure there are no pinch points and chaffing of the harness. If the user notices and pinch points the harness will need to be secured out of the way of the pinch points. If the user notices chaffing the user will need to wrap the harness in electrical tape to avoid an electrical fire. Lastly, the before and during each uses the user will need to inspect the battery voltage level. If the voltage drops below 12.8V the user should immediately stop and charge the onboard battery. This is easily done using the 10.1" touch screen that shows the status of the battery and gives an estimation on time before next charge.

The last maintenance and visual inspection components on the buggy are the 2:1 gear reducer and front and rear final drives. The 2:1 gear reducer and rear final drive are static gears that require no outside input other than the input and output shafts. These components require the shaft seals to be inspected before and after each use. If a shaft seal is leaking it should be replaced immediately due to the lack of gear lubrication. The oil in the 2:1 gear reducer, front and rear final drives should be changed with gear oil annually or every 50 hours, whichever comes first. The front final drive requires an additional inspection of the wires and the electric four-wheel-drive motor. The electric four-wheel-drive motor requires the user to grease with plastic gear grease annually or every 50 hours. This is necessary for the longevity of the plastic gear pieces within the front final drive.

4.2 Frame

The safety of the driver is of utmost importance for this Baja. In order to maintain key safety features, regular maintenance and checks to the frame must be performed. The following safety check should be performed before every use.

- Ensure the seat bolts and nuts are still secure and tight
 - If loose, tighten to 30 ft-lbs or replace with 1/4-inch bolts
- Check the seat cover snaps and ensure the foam padding is still in the proper position
 - Reposition the foam and snap all the cover points
- Test the dzus fasteners and rivets on all body panels and the firewall for a secure connection
 - Tighten any loose dzus fasteners with a flat head screwdriver or replace. Replace any loose rivets
 - If dzus fasteners need to be replaced, ones can be ordered online. Rivets are 1/8-inch rivets
- Ensure the driveshaft guard is not loose and completely covers the driveshaft
 - Tighten or replace the 1/8-inch bolts
- Check the seat belt connection points and ensure all bolts are tight and the tabs are not bent
 - Tighten or replace the 1/4-inch bolts
 - If the tabs are bent or broken, please contact our service department for further assistance
- Check that the seat belts are not frayed, and the hardware is intact
 - A replacement 5-point seatbelt harness can be ordered online with appropriate attachment points
- Look over the frame for any broken or bent tubes
 - If any faults are identified, please contact our service department for further assistance
- Check the structural integrity of the body panels and firewall
 - Please contact our service department for replacement panels
- Check all drivetrain guards for tightness and structural integrity
 - Tighten or replace any bolts holding the guards to the frame
 - Please contact our service department for replacement guards

4.3 Rear-End

In order to maintain the rear-end suspension system, before and after each use of the vehicle the rear system should be checked for any signs of potential failures. Tires should be properly inflated to the recommended PSI found on the sidewall of the tire. After each use, the rear system should be cleaned to reduce the chance of dirt entering bearings. Adjust the rear links to gain the correct toe and camber angles at the ride height. Any changes to suspension will cause the rear suspension to come out of alignment.

4.4 Front-End

To maintain the Front Suspension of your vehicle, Lumberjack Motorsports recommends the following actions should be completed at our service center or by a licensed technician:

- Inspect the shock absorber assemblies for signs of air leakage or worn seals after each use.
- Clean the steering system and the surrounding cockpit area to ensure debris does not enter the steering rack.
- Tires should be properly inflated to the recommended PSI found on the sidewall of the tire.
- Rotate tires every 500 miles
- Inspect control arms, wheel and steering assemblies for signs of deformation after hard landing or impact
- Periodically adjust alignment specifications at your local ATV/UTV dealer.
- Inspect brake pad and rotor thickness
- Inspect brake lines for signs of abrasion or leaks
- Check hardware and tighten all nuts and bolts until snug

5 Troubleshooting

5.1 Drivetrain

Lumberjack Motorsports conducts rigorous testing of all Drivetrain components, including static and dynamic actuation of all subsystems. Testing includes component integration with existing vehicles to determine ensure the safety of the driver. However, Drivetrain components may fail during extended use due to fatigue, weather conditions, or improper installation. Should a component fail in the drivetrain system, contact the original manufacturer to receive replacement parts/components. For custom-fabricated assemblies such as the Najmy 3000 ECVT or the TJTC24 Gearbox, contact Lumberjack motorsports directly to replace and reinstall faulty components/assemblies. Due to the intricacy of our custom assemblies, direct communication with Lumberjack Motorsports will ensure a safe, efficient, and speedy solution.

5.2 Frame

If any problems are encountered that may relate to the frame, please consult the bellow table to diagnose and troubleshoot the problem.

| Problem | Possible Cause | Suggested Action |
|---|---|--|
| Sagging of the Baja | <ul style="list-style-type: none"> • Broken welds or tubes, inspect the frame for breaks | <ul style="list-style-type: none"> • Contact our service department for replacement parts or guidance |
| Seat is wobbly | <ul style="list-style-type: none"> • Loose or broken seat bolts, inspect the bolts • Seat broke around bolts, inspect the seat • Seat mount tubes broken, inspect the square tubes and welds | <ul style="list-style-type: none"> • Tighten or replace the bolts • Contact our service department for a replacement seat • Contact our service department for replacement parts or guidance |
| Seat belt is jammed | <ul style="list-style-type: none"> • Bent seat belt hardware, check connection points for breaks or bends | <ul style="list-style-type: none"> • Replace seat belt |
| Noise from a body panel or firewall while driving | <ul style="list-style-type: none"> • Loose or broken attachment point • Broken panel | <ul style="list-style-type: none"> • Tighten any loose dzus fasteners with a flat head screwdriver or replace. Replace any loose rivets • Contact our service department for replacement parts or guidance |
| Noises from engine area | <ul style="list-style-type: none"> • Loose or broken drivetrain guards, Check the drivetrain guards for loose bolts or broken panels | <ul style="list-style-type: none"> • Tighten or replace the mounting hardware • Contact our service department for replacement parts or guidance |

5.3 Rear-End

In order to assure the rear end assembly would function without breaking the team went through many troubleshooting processes. The initial test done was an FEA analysis of the 3D model created for the trailing arm. After the trailing arm had been manufactured the team assembled the rear-end system and proceeded to complete a drop-test where the vehicle was lifted and dropped down with full force. The team also had people on each side of the vehicle bouncing each side to ensure the system could withstand the force accompanied with a normal off-roading drive. There were plans to take the vehicle out and complete actual drive tests as well with all other sub-components working together. Due to the thorough analysis and testing, problems with the rear-end suspension system will be rare. If a part does fail, a new part will need to be fabricated to replace it.

5.4 Front-End

In the event you experience problems with the front suspension when operating your Four-Wheel Drive vehicle, we have provided a list of potential issues and the recommended actions to take based on an extensive Failure Modes and Effects Analysis (FMEA). Consult the Lumberjack Motorsports service center or your local ATV/UTV dealer for assistance, evaluation, parts and repairs.

| Problem | Possible Cause | Suggested Action |
|--|--|--|
| Stiff or soft ride quality | <ul style="list-style-type: none"> Inspect shock absorber assembly for air leakage or broken seals. This may indicate a blown shock absorber. Improper shock absorber dampening settings | <ul style="list-style-type: none"> Replace shock absorber assembly on both sides of vehicle. Adjust dampening settings by increasing/decreasing nitrogen reservoir pressure with nitrogen gas or compressed air. Ensure the pressure holds and does not exceed 0.5 MPa (72.5 psi) |
| Uneven brake pad wear | <ul style="list-style-type: none"> Worn or damaged caliper guide pins Seized caliper | <ul style="list-style-type: none"> Replace brake hardware, caliper and pads as necessary. |
| Vehicle pulls toward one direction under braking | <ul style="list-style-type: none"> Inspect caliper and pad condition. The caliper piston may have seized. Creases or kinks in brake lines | <ul style="list-style-type: none"> Replace caliper assembly. Replace brake line. |
| Shock Binding | <ul style="list-style-type: none"> Frame mounts misaligned Bent control arms | <ul style="list-style-type: none"> Replace upper control arm assembly, inspect lower control arm for damage Realign frame mounting tabs parallel |

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| | | to shock body. Consult our service center for further assistance. |
| Vehicle pulls to one direction while in motion | <ul style="list-style-type: none"> • Bent steering tie rods or knuckle • Low tire pressure or flat tire • Misalignment of front end steering components | <ul style="list-style-type: none"> • Inspect tire for leaks by spraying soap and water on tire surface. Bubbling indicates a hole in the tire. Consult a trusted mechanic for patch or tire replacement. If one tire needs replacement, replace all tires on the vehicle. Failure to do so may result in transmission or drivetrain damage. • Replace valve stem on tire • Inspect tie rods and steering knuckle for damage, replace as needed. Inspect vehicle alignment. |
| Uneven tire wear | <ul style="list-style-type: none"> • Improper tire pressures • Suspension out of alignment | <ul style="list-style-type: none"> • Inspect tire pressures and inflate/deflate as needed. See recommended pressure on tire sidewall. • Consult a trained mechanic or professional to inspect the front and rear end suspension alignment |
| Squeaking under braking or while driving | <ul style="list-style-type: none"> • Worn brake pads • Debris in caliper/brake pad | <ul style="list-style-type: none"> • Clean brake parts thoroughly with brake parts cleaner only. Avoid touching the brake rotor with hands and use gloves. Failure to do so will strongly affect braking performance |

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| | | <p>and result in increased stopping distance.</p> <ul style="list-style-type: none"> • Inspect and replace brake pads on left and right axles. |
| <p>Brake pedal sinks to floor or feels “spongy” when depressed</p> | <ul style="list-style-type: none"> • Ruptured brake line • Master cylinder failure • Air in brake system • Brake fluid/rotor/pad temperature too hot • Moisture in brake fluid. | <ul style="list-style-type: none"> • Inspect brake lines for leakage or damage from abrasion. Replace brake line and bleed brake system using DOT 3 or DOT 4 brake fluid. Do NOT use DOT 5 brake fluid as the brake lines will deteriorate. • Replace master cylinder. Bench bleed the master cylinder prior to installation and bleed brake system. • Avoid repeated instances of hard braking and allow the brakes to cool. Do not “ride” the brakes downhill. Repeated hard braking under high temperatures will cause severe warping on brake rotor or complete rotor failure. • Brake fluid should be clear amber in color. If the fluid color is black, flush the system as soon as possible with new brake fluid from a sealed container. |
| <p>Steering Wheel shakes under braking/ brake pedal “pulsates”</p> | <ul style="list-style-type: none"> • Inspect brake rotor for irregularities such as intermittent dark spots. This may indicate a warped | <ul style="list-style-type: none"> • Replace brake rotors. • Have front wheels re-balanced by a professional technician |

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| | <p>brake rotor.</p> <ul style="list-style-type: none"> • Front wheels may be out of balance | |
| Front or rear brakes lock prematurely | <ul style="list-style-type: none"> • Your vehicle is designed to lock the front brakes first in the event of hard braking for optimal deceleration and maximum safety. This can be adjusted according to driver preference through the bias bar on the pedal assembly | <ul style="list-style-type: none"> • Adjust the brake bias bar on the pedal assembly. Make sure the clevis joints are aligned parallel and the bias bar lever (bolt) does not bind on the pedal assembly. |
| Steering wheel shakes at a set speed | <ul style="list-style-type: none"> • Wheels are out of balance • Bent wheel | <ul style="list-style-type: none"> • Consult your local ATV/UTV dealer for wheel and tire balancing. • Replace wheel |
| Dead zone in steering system | <ul style="list-style-type: none"> • Worn steering rack bushings | <ul style="list-style-type: none"> • Replace steering rack bushings |

6 Appendix: Maintenance Log

| Maintenance Log | | | |
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| Date | Service Performed | Place of Service | Performed By |
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