

Building A Race Car: Part 7

Assembler holds the key to success

story by Mark Davis
photos by Kevin Thorne

Growing up in the automotive industry and in a racing family, tagging along with Dad to a race shop to check out cars was an experience. Many times we'd watch a group of men prepping a car, then see if it cut the mustard on race day. Comments such as "That don't work" or "That's the way it's done" didn't help next time.

My dad instilled in me two lessons about automobiles: "Know what you see" and "Believe what you know."

In the early days of racing, the thirst for knowledge could be quenched only by trial and error. Written material about construction, parts and theories didn't exist. So, the most successful racers were innovators who found ways to build a better mousetrap.

In the 1970s, racers' need for shortcuts opened the door for Steve Smith Autosports to publish how-to books on racing. I remember reading these books the minute they were delivered to the house. Two of the books we ordered were *Advanced Suspension Technology* and *Stock Car Preparation and Fabrication*. At 14, I thought the suspension book had way too much math, trig and geometry for my liking. The other hit home with lots of pictures, lists of material and proper assembly procedures.

Carroll Smith also wrote a series of books, *Engineer to Win*, *Prepare to Win*, and *Tune to Win*, all packed with information for the successful racer.

The books established a new way of thinking for those assembling race cars. No more trial and error. Today, many manufacturers offer tech manuals for their products. Bowanalloy bolts has information on fasteners, MSD has ignition system diagrams, Richmond Gear has gear set-up manuals, and the list goes on.

From the first piece of tubing to the last rivet, race cars are built with purpose and reason. As we start the assembly of our Winston Cup car, there are a few things we want to talk about. Number one is who the assemblers are, what they know and what steps they take in putting the car together.

Most Winston Cup teams have a number of assemblers. On a large team, an assembler might specialize in a subassembly. Often, these specialists concentrate on their areas of expertise. Most teams have assemblers for: plumbing, electrical, driver environment, suspension, drivetrain and chassis.

ELECTRICAL AND PLUMBING

Many teams have electricians and plumbers who handle the plumbing, oil, fuel and brake lines and then wire all the fans, pumps and ignition systems.

These assemblers install brake lines, concentrating on any problem areas such as air pockets, hot spots, etc. They route oil tanks and lines, keeping driver comfort, cooling efficiency, and horsepower in mind. Wiring includes the pumps for rear end coolers and the fans for radiator, brake ducts, and drivers.

These experts design and install ignition systems, which can be switched at a moment's notice. Each of these installations has bracketry that is generated as the assembly takes place.

Finally, they wire charging systems, battery cables, battery disconnects and common grounds, insuring constant power. These master assemblers concentrate on simplicity and reparability to eliminate problems that could occur.

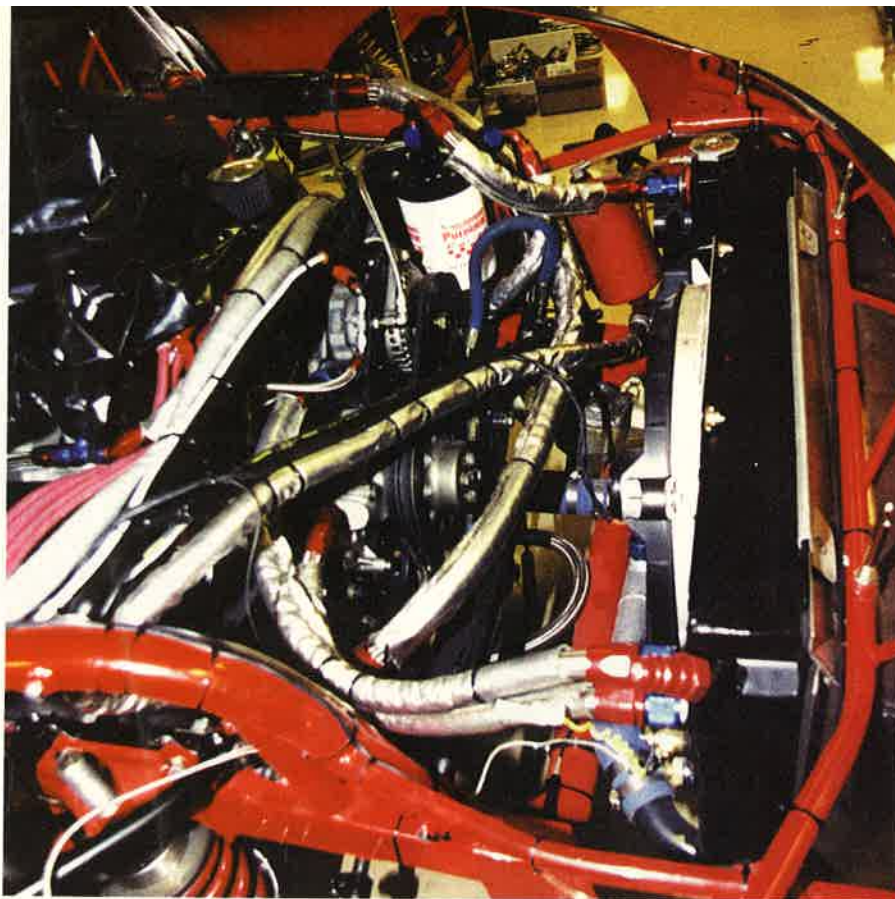


Above: This complete chassis is ready for setup. Each component has been hand fitted to perfection. Notice a lot of components are safety wired, such as the tie-rod end nuts and pitman arm nuts. Above right: Once the chassis is plumbed and wired, drivetrain assemblers install the power plant. The lines from chassis systems are connected to the engine, creating a maze of lines and electrical connections. Notice the fuel line is double insulated to protect the fuel from heat.

DRIVER ENVIRONMENT

Once wiring and plumbing duties are completed, most teams have an assembler who installs the driver environment: fire systems, steering, seats, leg braces, head braces, roll bar padding, floor mats, window nets and radio systems.

All these have special locations, depending on the driver. This assembler, working closely with the driver, puts each piece in place carefully to allow the driver the utmost comfort and safety.



SUSPENSION

Suspension assemblers pack bearings with grease and fit each hub-spindle combination perfectly. They assemble and disassemble rotors and calipers until they obtain a precise fit. Any drag or misalignment can cause valuable tenths of seconds on the race track. They follow the same process on the rear end housing. They check rear ends to thousandths of an inch for toe-out, camber, and straightness. They fit each axle to exact lengths. They set bearings for precise pre-loads and pack these.



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Group 3: #12 J Mayfield, #18 B Labonte, #20 T Stewart, #31 M Skinner, #43 J Andretti
Group 4: #4 B Hamilton, #7 M Waltrip, #22 W Burton, #28 K Irwin, #33 K Schrader
Group 5: #10 R Rudd, #36 E Irvan, #40 S Marlin, #44 K Petty, #94 B Elliott
Group 6: #16 K Lepage, #23 J Spencer, #25 W Dallenbach, #26 J Benson, #42 J Nemechek, #97 C Little
Group 7: #1 S Park, #9 J Nadeau, #11 B Bodine, #55 K Wallace, #66 D Waltrip, #75 T Musgrave
Provisional Drivers: #00 B Jones, #8 D Earnhardt, Jr #21 E Sadler, #30 D Cope, #41 D Green, #45 R Bickle #58 R Craven, #60 G Bodine, #77 R Pressley, #98 R Mast

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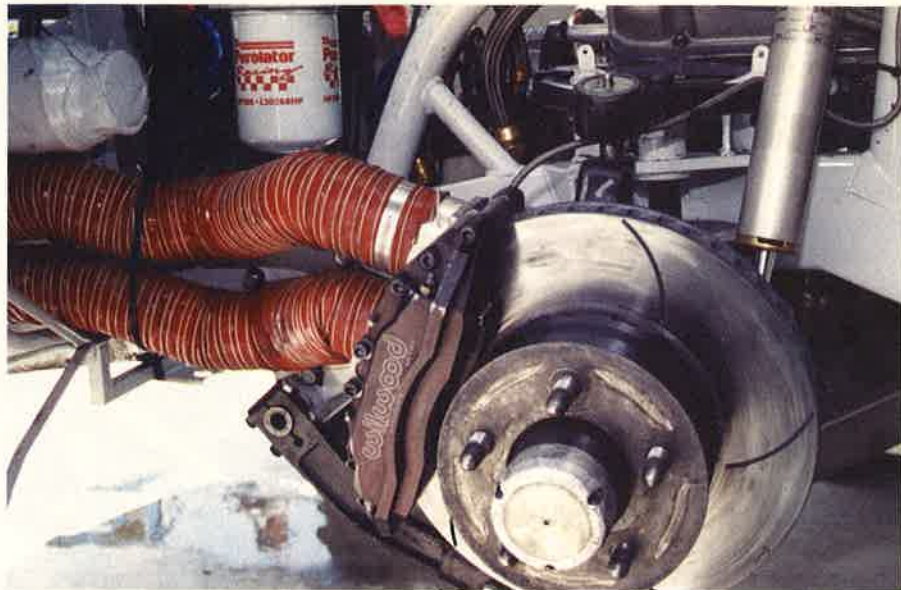
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Not Associated with NASCAR or Winston Cup Racing.

No purchase necessary for Void of Services entry (limit 1 per household).

Must be 18 yrs or older.

Void Where Prohibited.



Left: This assembler is making up a braided oil line. The red covering is known as the "fire sleeve" and protects the line from outside heat sources. Vices with special jaws and precision line wrenches are used to attach "AN" style fittings to lines. Above: In this already assembled rotor and caliper, a precise fit is crucial and may require several instillation attempts to obtain the perfect fit. Assemblers know that misalignment can lose valuable tenths of seconds on the track.

They put breathers in place and install the differential. Drivetrain assemblers on many teams deal strictly with transmissions and third members (the ring-and-pinion assembly that establishes the gear ratio). Most teams cycle more than 100 different gear assemblies throughout the season.

Teams keep exact records of laps for testing and racing. Some combinations are just for qualifying, others are for races. Transmission and gear assemblers also tailor packages on ratios for driver feel and habits. Driver who use excessive brakes need different ratios than those who do not. Drivers who pass on the high side use taller gears than those who do not.

CHASSIS

These assemblers take the component clusters and install each on the chassis. They choose each bolt to fill its need. Size, strength and weight are all issues. If a bolt is one thread too long, it is shortened; if it can be replaced with a smaller fastener, it is. They fit lower control arms using mono-ball type bearings with solid bushings. Sometimes they remove thousandths of an inch from bushings to produce no bind.

The same applies for each steering component. They assemble idlers, pitman

arms and drag links, always checking for binds or friction. They check trailing arms in the rear and upper control to perfection as they assemble these. Misaligned truck arms at the rear housing can mean as much as 25 pounds of unwanted spring rate. They fit sway bars following tight tolerances. Each component on the car is under constant observation.

ENGINE DRIVETRAIN

Engine drivetrain assemblers install power plants into chassis, attaching the plumbing and electrical systems that have already been installed in the car. They route each line on the plumbing cooling systems, oil systems and fuel systems so no damage occurs during race situations. They place fuel lines as far away from heat sources as possible. Headers, oil lines and water lines can boil fuel in the lines if improperly installed.

These assemblers hook up ignition systems. Each head, intake, and block are commonly grounded to insure that each plug and the distributor, along with the starter, work in the proper fashion.

They install the shifter and driver shaft, fitting each so shifting problems do not occur. The slightest contact with the body,

exhaust, or chassis can cause the transmission to jump out of gear under load. They also check the angles of the drive line because misalignment can cause vibrations.

All good assemblers must have the patience of a saint. Many times, people trying to enter the racing industry lean on past experience as a mechanic as proof of ability, but previous experience in the automotive industry is often no help in racing.

Crew chiefs know that years of work and certifications in the automobile industry, where income is often commission-based, mean the mechanic is an expert in the short cuts necessary to make a living. By contrast, good racing assemblers are experts in metallurgy, engineering, machine work and fastener technology.

In addition, good assemblers are perfectionists. Nothing — long hours or difficult working conditions — stands in the way of doing the job right. In *Engineer to Win*, Smith says, "All failures are human in nature." Every time a race car falls out of a race, some assembler rolls his thoughts around and wonders what can he do to be better. 🏁

Next month, we cover alignment and setup of a race car.