A close look at Motorsport's latest entry

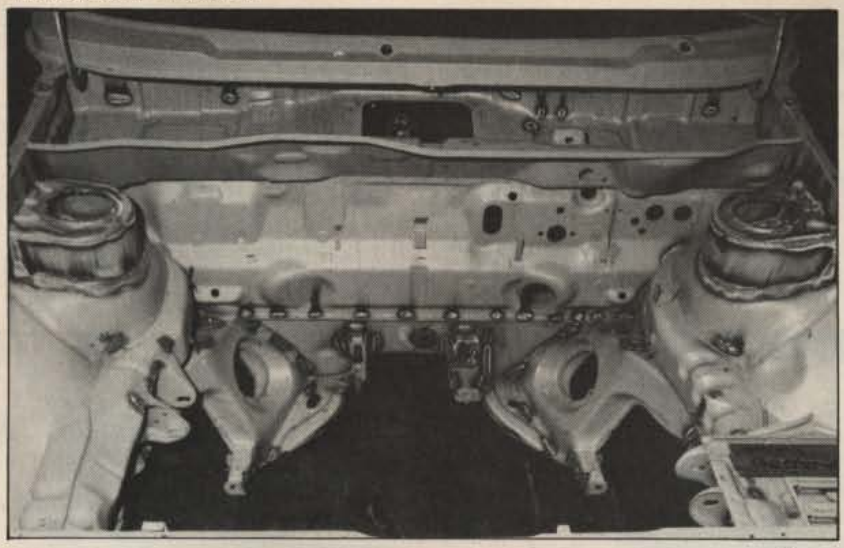
VW's Rally Golf

The basis for the Rally Golf is a two-door basic model in primmer paint and without a sunroof. This set of instructions is meant to give you some meaningful ideas and solutions, and although they don't have to be accepted entirely, they will certainly be useful in developing your own rally car. We follow roughly the chronological development of the project from raw body to finished competition car. We left the problems of the competition engine to the experts, just as we bought the drivetrain components from well-established manufacturers. Any questions regarding this rally car should be directed either to VW Motorsport, Ikarusallee 34, 3000 Hannover 1, West Germany; or write directly to the manufacturers of the various components. To get started, remove the seat tracks, the brackets for the engine coolant container and fuel injection system. This is to save weight.

BODYWORK

It is then necessary to strengthen the gutted interior and engine compartment. Gas weld the mounting points of the steering, suspension and engine, and also fill in between tack welds and around mounting bolts **(Photo 1)**. Reinforce the mounting bolts for the steering, especially on the left side to protect against them shearing off. The front of the body should be strengthened by welding in Y-shaped supports. The front suspension domes are welded to the wheel housings on the inside, and reinforcement plates are added. Then weld in the seat supports **(Photo 2)**. The final bit of reinforcing is for the mounting

Photos courtesy of VW Motorsport



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points for the rollcage according to FIA rules: a minimum, 35 cm^2 (5.43 sq. in.), one third of which is fastened to the vertical structure.

Now is a good time to get into the sheet metal work. Cut out a rectangular hole for the induction stacks of the engine into the air supply box ahead of the windshield **(Photo 3)**. The entire piece may be removed if desired. Install two sheet metal pieces with U-shaped channels so an air filter element (reinforced by wire mesh) can be slipped in from above. Later the opening will be sealed off to the engine compartment by an elastic rubber mat with cutouts for the induction stacks **(Photo 4)**. This box is covered by a flat lid to protect it from water.

Next, close off the rectangular opening for the heater blower with sheet metal to which a round, short piece of tube has been welded. This has to accept a fire- and fuel-proof air duct to the ventilation louvers in the engine cover. This duct provides air to keep the windshield defogged via an electric blower.

The following step is to fasten a bracket for the coolant expansion container to the left spring dome. Then weld bracket for the Zenith in-

jection metering unit to the right side wall of the engine compartment **(Photo 5 and 6)**.

For body modifications, start by cutting out the fenders according to Group 2 guidelines to accept appropriate fender flares. Weld the rear wheel housings to the body skin. Then, install safety hold-downs for the engine cover (NASCAR pins) and for the rear hatch (rubber hold downs). Remove the original door locks.

To install the flares, weld threaded inserts into the forward section of the rear fender arches and bolt sheet steel rock shields to them shaped according to the fender arches **(Photo 7)**. Finally, seal the body shell against water leaks and then paint.

VW Motorsport recommends a tight-fitting aluminum roll cage with additional bolted connections to the body, such as to the original seatbelt mounting points and to the dash

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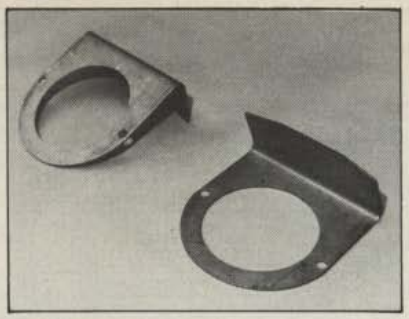

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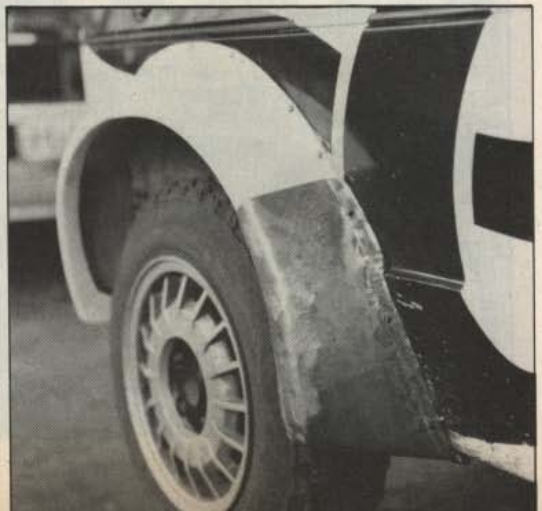


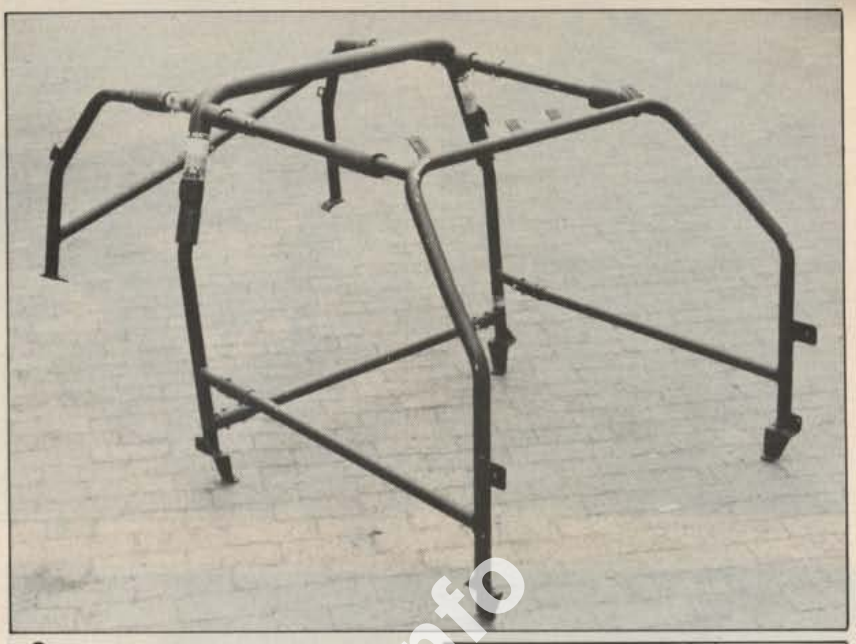
(Photos 8, 9, 10). Create at this time storage bins and brackets for safety equipment and tools in the back of the interior. Fabricate hold down for spare wheel with a provision for varying tire widths. Use cross-drilled studs, a crossbar and safety pins, similar to NASCAR hood pin arrangements so that the crossbar can be fastened at different heights.

Next, weld in thread plates for the four-point safety harnesses. Finish off the body assembly by installing the suspension, door locks, electrical wiring, lighting, engine and transmission, instrument panel and windows.

ENGINE AND AUXILIARY UNITS

The engine mounts are rubber with a harder compound than the stock mounts **(Photo 11)**. The front motor mount is reinforced by inserting an aluminum bushing into the original housing on the body side, into which the rubber mount is pressed, reduced in size accordingly **(Photo 12)**.

The oil cooler is equipped with aircraft quality fittings and hoses and installed alongside the water radiator **(Photo 13)**. Also needed is a catch container for engine crankcase ventilation with a two-quart capacity. Two accelerator cables are installed side by side, the ends securely



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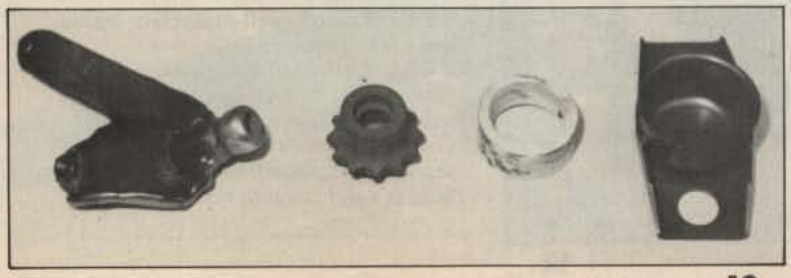

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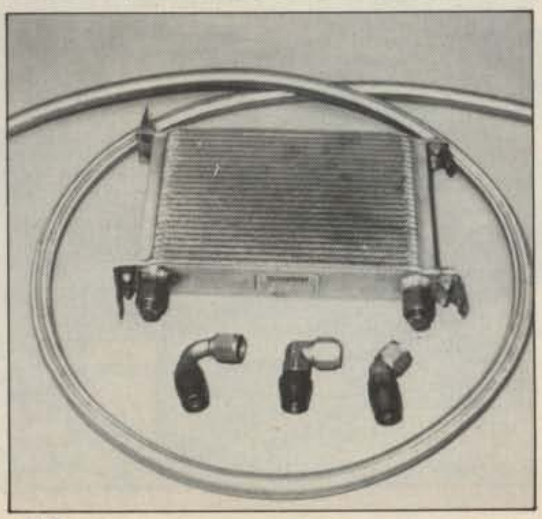

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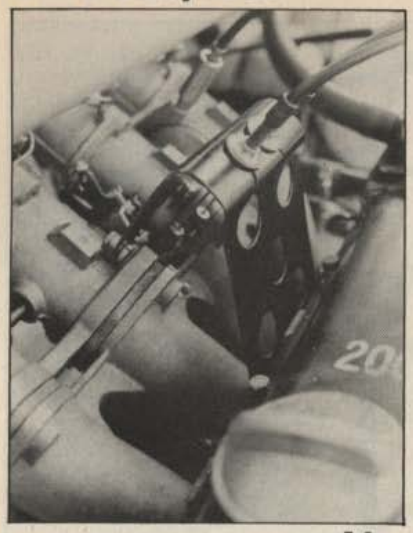

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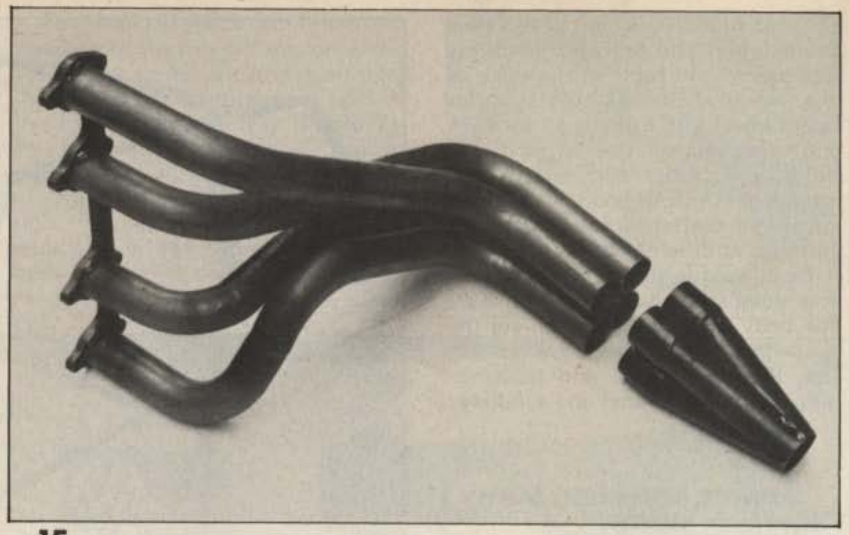

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soldered to ball-shaped terminals. **(Photo 14)**.

If engine speeds above 8000 rpm are intended, Motorsport recommends installing a larger pulley for the alternator to keep its speed down to stock level. A racing exhaust **(Photo 15)** is suspended from dual rubber hangers. Components are loosely connected by pull springs and welded-on hooks, as is practice in racing motorcycles **(Photo 16)**. Also, the driveshaft is a stronger rally version, mandatory for Group 2. Recommended, too, is a racing transmission with greater durability.

The ignition module **(Photo 17)** with quick release mount and multiple electrical connector is installed on driver's side in the air-supply box. On one panel are installed the ignition coil with ballast resistor, electronic ignition and electronic rev limiter. The electricals are finished with an additional battery hold down.

FUEL SYSTEM

The stock Golf tank of 11 gallons is used. Two high-pressure electrical fuel pumps at the location of the stock pump are connected parallel and switched separately. Protection against flying rocks is necessary here. The fuel filter is placed inside the air supply box, and metal braided fuel hoses are run well-protected inside the lower frame rail.

The fuel injection metering unit **(Photo 18)** is installed on the right side fender wall, with the electronic control boxes (dual, switched separately) placed under the glove box. A catch tank is not necessary.

RUNNING GEAR

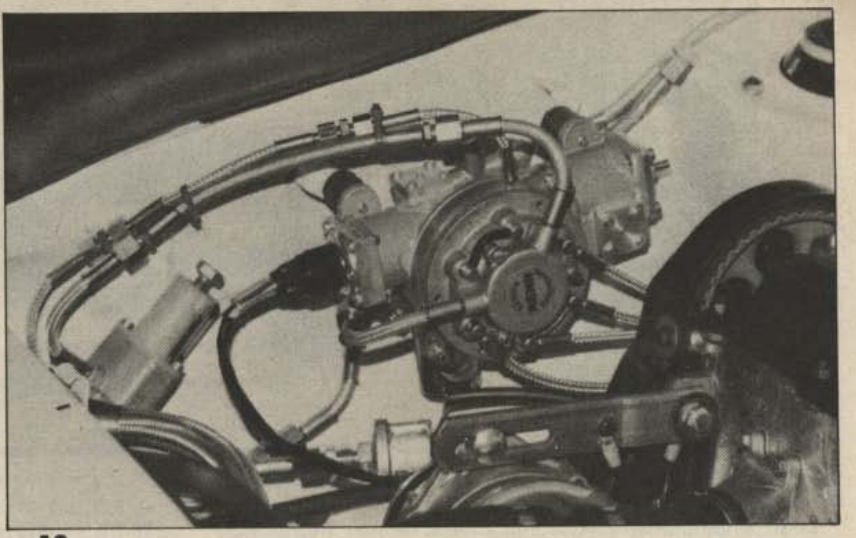
Use harder than stock rubber bushings where applicable. Install a connecting strut between the A-arms **(Photo 19)**. A support between the spring domes is now installed **(Photo 20)**. The A-arms are reinforced by welding in sheet metal with holes for access to the roll bar nuts **(Photo 21)**. Also tack on weld beads to the rear axle to prevent movement of the roll bar mounting clamps.

BRAKES

Either disc/drum or disc/disc systems are possible. The disc/drum arrangement is dual circuit with servo-assisted dual master cylinder (stock). Modify the dual chamber brake pressure proportioning unit (stock Golf GTI) for manual adjustment, allowing continuous adjustment of the braking action at the rear wheels. Front brakes use stock calipers and ventilated brake discs. For better cooling remove metal covers and install air ducts on the inside. For extreme duty, forced ventilation or water spray cooling is recommended.

The rear brakes are stock VW Passat (Dasher) drums, 200mm self-adjusting units. Modify the hand brake lever for "fly-off" operation, i.e. it will only lock on command. Also adjust it for a higher position.

Four-wheel discs may be used for optimized braking performance, better response, and lower forces. Separate dual circuits are used for front and rear brakes. The front brakes can be as in the previous section, or they can be improved by using Group 2 brakes with larger wheels (14- or 15-inch), larger discs and light alloy calipers **(Photo 21)**.



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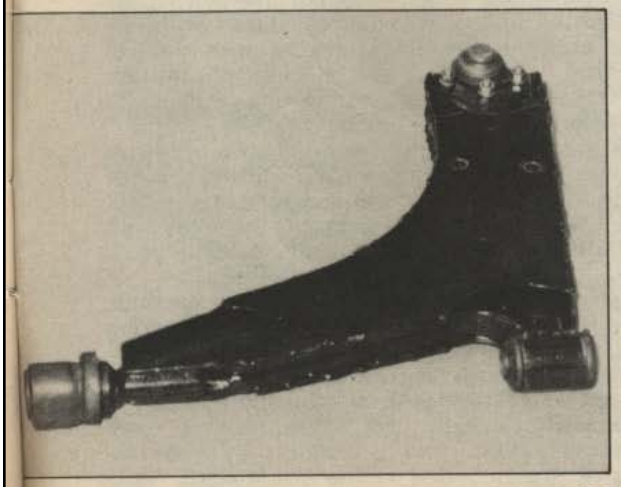

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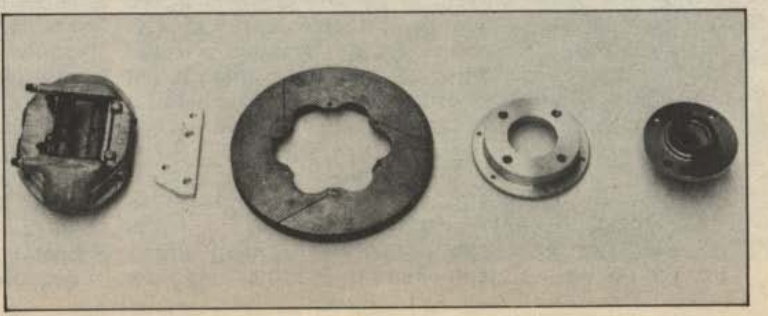


Saturday afternoon in German living rooms. Live sports on the TV. The final stages of the Baltic Rally for the European Championship. Leading characters in this action drama unknown to U.S. TV watchers are a Swede and a VW Golf. As if planned by an imaginative script writer, the hood of the Golf with the number 2 on its sides pops open and flys up just as the camera helicopter zooms in for a closeup, hovering only meters above the rough trail. But Swedish rally pro Per Eklund is not disturbed one bit. Even though his vision seems to be totally blocked, he continues full speed ahead. He squints through the ventilation louvers cut into the bottom of the engine cover while negotiating the dirt course. He wins the stage and then continues on to win the rally overall—after the mechanics had secured the bonnet.

Although it was just another victory for Eklund, it was the very first one for the "VW Motorsport" in an important rally event. This is the sporting arm of the VW factory in Wolfsburg, a non-profit association set up just for the purpose of racing all kinds of VW-powered machinery on tracks, roads and trails.

This latest victory was accomplished with a car of only 1600cc displacement against much more powerful equipment from European and Japanese manufacturers. But rallying has a very special status in the realm of motor sports. Lots of horsepower never did any harm in this full-speed chase through the woods, but power is not everything. Drifting artists with outstanding talents are able to do the near impossible given a well-prepared car with the basic potential for wilderness driving. So the 172 horses of the rally Golf were enough to beat the competition with up to 300 hp in the engine room.

The factory Golf rally car has the potential and the preparation to make it a winner. It is still a Golf/Rabbit, but from the inside you would not recognize it at all. No plush velour fabrics or deep pile carpeting here—just naked sheetmetal showing the marks of abuse on the scratched up flat black paint surface. No stereo for entertainment, just a squeaky FM transceiver for communicating with the service crew. A robust roll cage and safety belts anchored at four points suggest that these are planned excursions into the underbrush. Once seated and strapped in one of the two deep Recaro competition buckets, there is not much mobility left for driver and navigator. The helmets stored on special stands in the rear can only be reached with great difficulty.

Let's try the engine. Main power switch on, ignition on, fuel pump on, push the starter button. Incredible noise echoes through the stripped body. But the engine runs and idles as if 100 hp per liter was the most natural thing in the world. Despite more than 170 horses from 1600cc, the idle stays steady at 1000 rpm.

Cars are made to be driven, so let's go. The clutch separates neatly and allows easy feathering at take off. The gears engage almost by themselves. At only 2000 rpm the engine develops thrust you would not believe. Double that and then a good kick onto the pedal and you get the scare of your life. The car races forward with screaming tires and you almost believe you are strapped underneath a 747 at take off.

That is because the air intake stacks of the fuel injection system end right in front of the driver and passenger and produce those weird turbine-like suction noises.

It is virtually impossible to stage a clean takeoff from a standstill. Even the widest permissible tires with the softest compound do not provide enough traction for the given power and weight. The wheels just keep spinning all the way through the first and second gear range. But there is still enough to accelerate the little bomb at a rate which is sensational for a 1.6 liters FIA Group 2 sedan (touring car in official lingo). Only 7.2 seconds from a standstill to 100 km/h (62 mph) and not more than 17.6 seconds to the top speed of 160 km/h (99 mph). The rally Golf can be geared to run much faster, but that would not be practical since only a few rally events have straights long enough to get that fast. Top rpm is 8200.

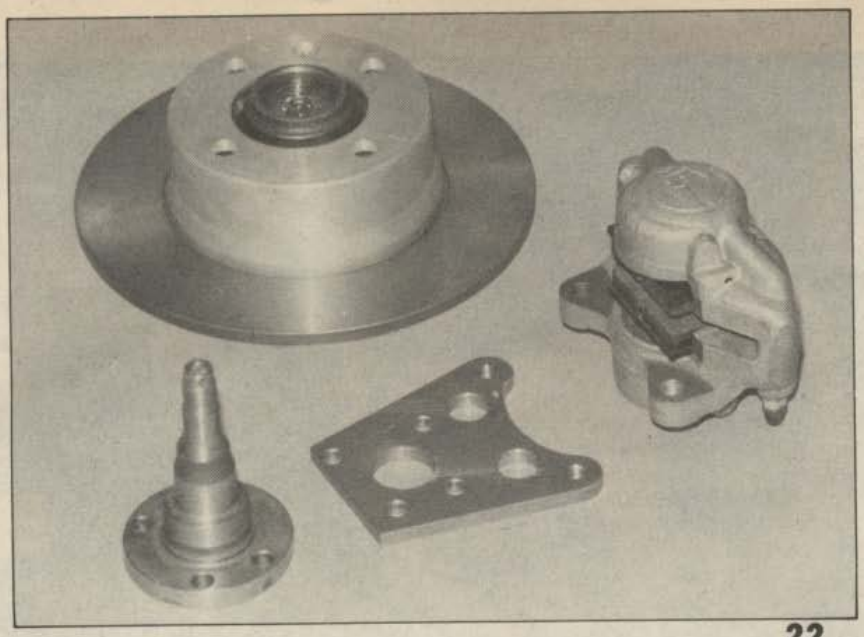
Oksar Berg builds the engines for VW Motorsport. He used to be the racing manager of the Pierburg Company which supplied the Zenith racing fuel injection system for the car.

Front-driven rally cars lend themselves to the infamous Scandinavian "left foot braking" technique. That means the right foot remains constantly on the accelerator, while the left stomps onto the brake to adjust velocity and direction of the vehicle. This keeps the revs up and cures the inherent understeering tendency of front-drive systems.

Even with a more conservative driving style, you move forward with considerable progress. The Golf displays a very forgiving character, and the only thing it does not seem to like are washboard surfaces. There the light weight flexible link axle will develop a tendency to go its own way.

Another problem for beginners is the always rebellious front axle. The raw power, the wide tires and the locking differential, combined with the surprises of the rough running surface underneath require a firm hand on the wheel, or rather both hands. Professional left foot braker Eklund is not bothered by this, however. Rather, he wants more improvements for the brake system for the next appearance off the rally Golf at the Monte Carlo Rally. Because the alpine valleys are deep indeed.

—Wolfgang Sander and Gero Hoschek



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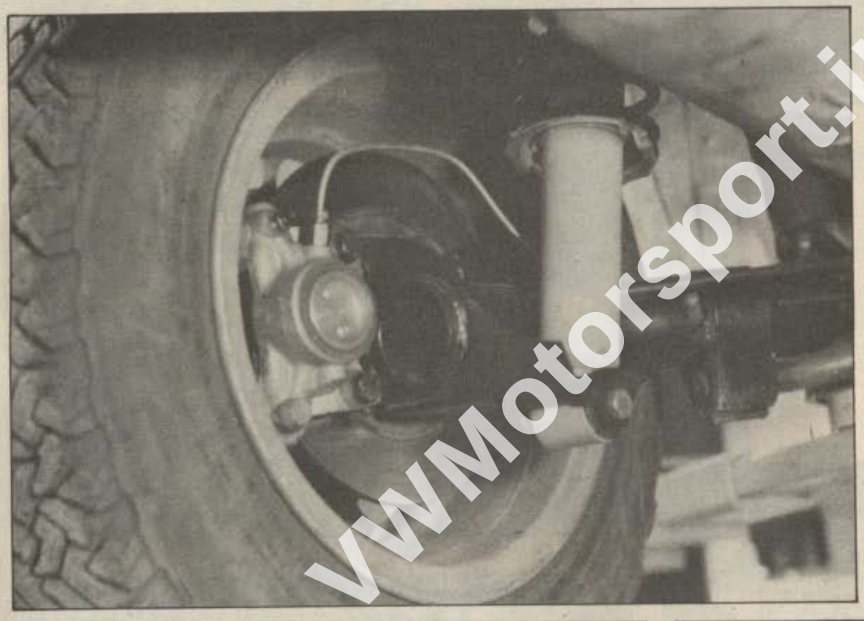
In the rear are solid discs **(Photo 22)** with the aluminum wheel carrier and hub bolted together. Brake caliper is attached to rear axle body with special adapter. No pressure retaining valves are used, either in the caliper, brake proportioning valve or master cylinder. The manually adjustable brake proportioning valve is installed ahead of the hand brake.

The hand brake is of the "fly-off" variety, and works off a small brake master cylinder installed into the rear brake line. A valve inside the cylinder allows brake pressure to rear wheels only. Free play between brake lever and brake rod should be about 1 mm. Fasten brake rod to hand brake lever near pivot point since only a short distance is needed. Use a ball joint **(Photos 23 and 24)**.

INTERIOR AND CONTROLS

General information: Remove the rear seats and the carpet. A fire extinguisher is installed behind the navigator's seat. Use an 11-pound unit; fasten securely using no straps. The intercom control box is installed on roll cage main tube. Integrate an FM radio transceiver with roof antenna. The instrument panel should be secured, with additional screws and storage bins and door pockets fabricated. Sun visors are installed on the front tube of the roll cage. Recaro bucket seats with Nomex upholstery are used, and then rubber mats are glued in. **(Photo 25).**

Driver area: A 350mm leather steering wheel is used. A foot rest is installed on the left and the pedals are



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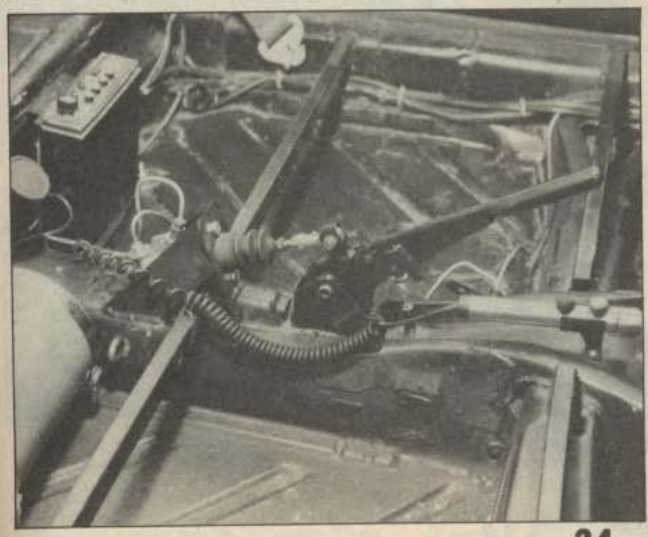

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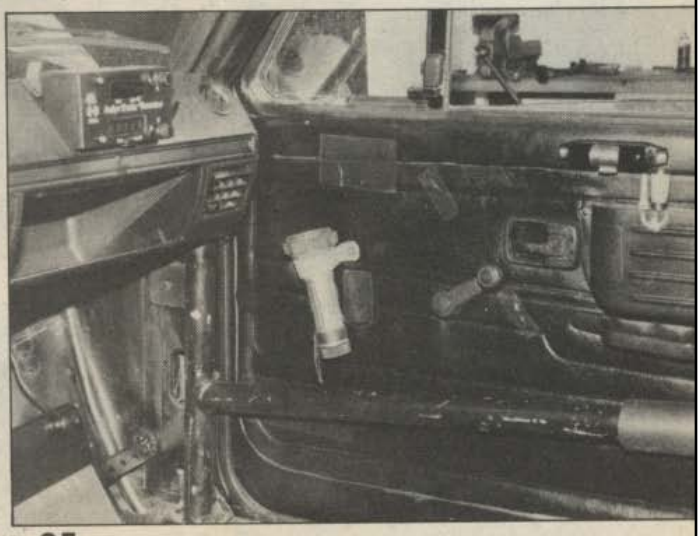

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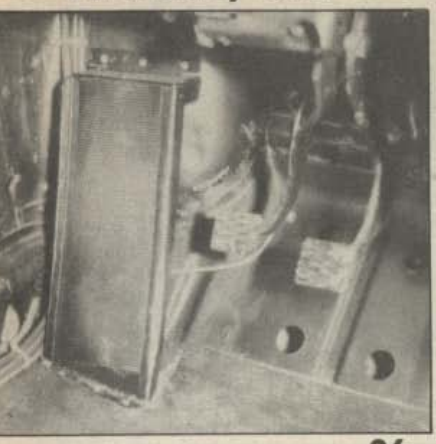

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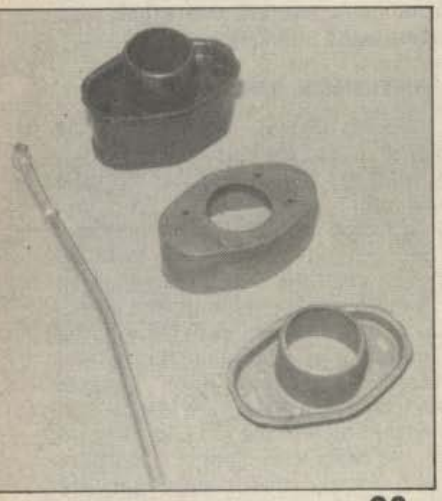

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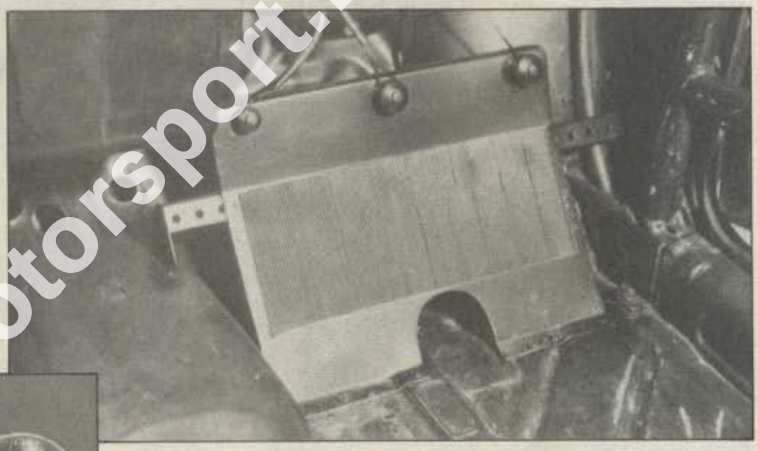

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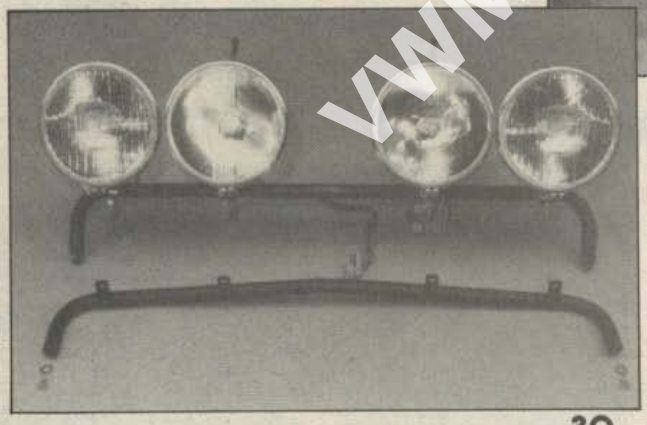

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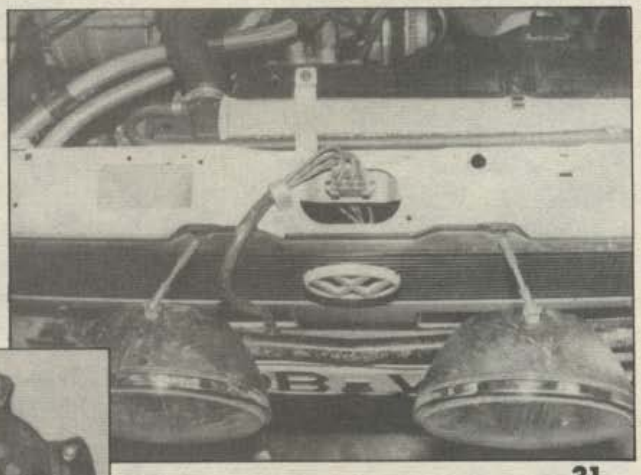

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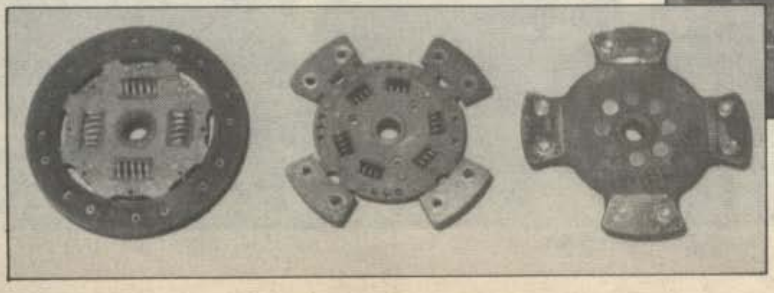

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made skid-resistant by welding on extruded steel grille **(Photo 26)**. The accelerator pedal is enlarged for heel-to-toe operation.

The instruments within the steering wheel perimeter **(Photo 27)** include a 10,000 rpm tachometer in the center; oil pressure and temp gauges; fuel pressure for injection system; coolant temp; speedometer with fuel gauge to the right (stock Golf unit). Switches for main power relays (a second switch is installed outside left ahead of the windshield), fuel pumps, heater blower, FM radio transceiver and auxiliary lights are also installed in the area.

Modify the stick shift **(Photo 28)** for more precise and convenient operation. Raise shift console with plastic joint by 50mm. Lengthen the lower part of the stick shift by the same amount. The upper part is extended to come closer to the steering wheel.

Navigator area: Install reading lights, either of the goose-neck variety or a folding light on the door. A rally computer is installed on the dash with a foot switch for reset. Re-position the window winder to the rear by 200mm. Install a foot rest with foot switches for four-jet window washer/wiper, horns and rally computer **(Photo 29)**.

ADDITIONAL EQUIPMENT

The four auxiliary lights are mounted to the front bumper with two screws. Vibration dampers are fastened to the body, and central, quick release electrical connectors are used **(Photo 30 and 31)**.

Two loud horns are put under the front bumper, fastened to the body. Four windshield washer jets are installed, and aluminum skid panels are placed under the oil pan, transmission, gas tank and rear axle. A high-performance clutch with sintered metal lining and torsion springs may also be utilized **(Photo 32)**.

The following is a list of the wheels that can be used: One-piece alloys—5½Jx13, offset 38mm; 6Jx13/14, offset 33mm; 5½Jx15, offset 38mm. Three-piece racing wheels—8Jx13; 8Jx15. Recommended tire sizes for mud and gravel: 155x13; asphalt and gravel: 165/70x13.

LIST OF SUPPLIERS

VW Motorsport, Ikarusalle 34, 3000 Hannover 1, West Germany
Front suspension dome reinforcement plates; engine and transmission mounts; connecting strut between A-arms; support between spring domes; auxiliary lamp holder; transmission parts

Zender GmbH, Florinstrasse, 5403 Muelheim-Kaerlich, West Germany
Fiberglass/resin fender flares

Matter, Industriegebiet, 7523 Graben-Neudorf 1, West Germany
Roll cage; aluminum skid panels

Technikraft, Hopfwiesenweg 1, 6941 Troesel, West Germany
Oil cooler, aircraft fittings

Dr. Schrick, Dreherstr. 5, 5630 Remscheid 11, West Germany
Exhaust manifold

Robert Bosch, P.O. Box 50, 7000 Stuttgart 1, West Germany
Electronic ignition; electric fuel pumps; horns; main relay switch

Pierburg, Leusschstr. 1, 4100 Neuss 13, West Germany
Zenith fuel injection

Abt. Oberwangerstr. 15, 8960 Kempten, West Germany
Rubber bushings for running gear

Girling GmbH, P.O. Box 720, 5400 Koblenz, West Germany
Brake calipers and discs, brake cylinders

Nothelfer, Caecilienstr. 10-12, 4330 Muelheim, West Germany
Brake proportioning valve (ATE)

TEROG, P.O. Box 710626, 8000 Muenchen 71, West Germany
Intercom control box

TEKADE, Thurn & Taxis-Str. 10, 8500 Nuernberg 1, West Germany
FM radio transceiver with roof antenna

RECARO, GmbH, Stuttgarter Str., 7312 Kirchheim, West Germany
Front bucket seats

Atiwe, Wetzlarer Str. 96, 6335 Wetzlar, West Germany
Leather steering wheel

VDO Instruments, (from local dealers)
Cockpit instruments and dash switches

Hotl Electronic, Schlippental 58, 6430 Bad Hersfeld, West Germany
Datec rally computer

Fichtel & Sachs, Ernst-Sachs Str. 62, 8720 Schweinfurt, West Germany
High-performance clutch

BBS-Seral, Freiburger Str. 5, 6940 Weinheim, West Germany
Three-piece racing wheels

OSCAR-PS, In der Schlaa 40, 4050 Moenchengladbach, West Germany
Group 2 engines

Bilstein, P.O. Box 3015, 5828 Ennepetal 13, West Germany
Suspension parts

SPECIFICATIONS

Engine: Watercooled, 4-cylinders in line, transversely installed, 2 valves per cylinder, 1 overhead cam shaft

Otto cycle: four stroke

Displacement: 1598cc

Bore: 79.51mm

Stroke: 80.00mm

Performance: 172 hp (DIN) or 127 kW at 7200 rpm

Torque 18.9 mkp at 6000 rpm (137 ft-lbs)

Specific performance: 4.6 kg per hp or 10 lbs/hp

Useful rev range: 3500 to 8200 rpm

Max. rev: 8200 rpm

Compression ratio: 11:1

Fuel system: Zenith racing fuel injection (mechanical/electronic)

Fuel: High octane gasoline

Fuel tank capacity: 42 ltr/11 U.S. gal

Lubrication: Wet sump, oil pump, oil cooler

Oil used: Castrol RS

Oil capacity: 4.5 ltr/1.18 U.S. gal

Battery voltage: 12 volt

Battery capacity: 54 Amp hr.

Alternator: 14 V/ 55 A/ 610 W

Ignition: Electronic, breakerless Bosch

Spark plugs: Bosch 310 Sport 25

Additional lights: 2 Bosch spot lights "Rallye," 200mm 2 Bosch flood lights "Rallye," 200mm

Front suspension: MacPherson struts with lower A-arm, additional support of upper and lower end, reinforced A-arm.

Rear suspension: reinforced flexible link axle with 2 longitudinal trailing arms ("Verbundlenkerachse")

Shock absorbers: Bilstein gas pressure shocks (rally tuned), progressive coil springs

Torsional roll bars: front 19mm, rear 24mm

Brakes: Girling 4-wheel disc brakes, ventilated discs 239.4mm with rigid calipers (as stock). Same in rear. Dual circuits, pressure to rear brakes manually adjustable from cockpit

Handbrake: Hydraulic to rear discs with "fly-off" handle

Steering: Rack and pinion system

Wheels: BBS/ATS Alloy wheels 5½Jx13 —8Jx13, 5½Jx13—8Jx15

Tires: Pirelli 155x13—245/45x13 135x15—205/50x15

Bodywork: Stock Golf/Rabbit 2 door hatchback with Zender wheel flares, Matter roll cage (aluminum), 5 kg fire extinguisher, Recaro competition seats with Nomex upholstery, aluminum skid plates front and aft.

Power train: Clutch—Fichel Sachs 1-disc dry clutch, sintered metal lining Gear Box—VW

Gear ratios: 1st gear 2.77 or 250, 2nd gear 1.94 or 1.65, 3rd gear 1.46 or 1.17, 4th gear 1.20 or 0.94, reverse 3.17 3.17

Final drive ratios: 3.9, 4.22 or 4.53 locking differential

Wheelbase: 2400mm/94.5 in.

Track front: 1404mm/55.3 in.

Track rear: 1372mm/54.0 in.

Length: 3710mm/145.7 in.

Width: 1630mm/64.2 in.

Height: 1390mm/54.7 in.

Ground clearance: 100 to 160mm—(3.9 in. to 6.3 in.) variable

Weight: 790 kg (1738 lb.)

Performance: 0-100 km in 6 seconds
Top speed: 150 to 200 km/h (93 to 124 mph) according to gear and final drive ratios

Fuel consumption: 22 ltr. per 100 km (11 U.S. mpg)

Cost: about 40,000 DM or $23,000