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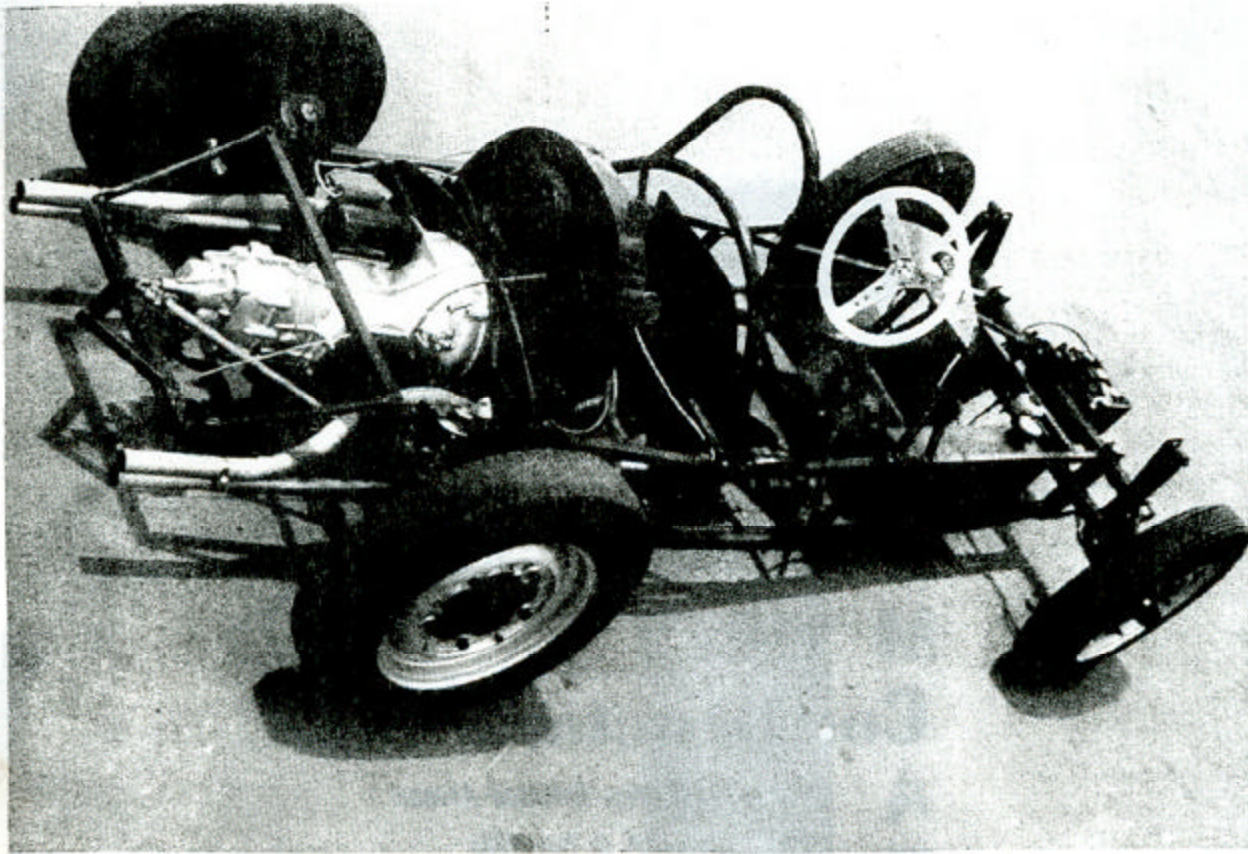
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### FORMCAR FORMULA VEE ASSEMBLY INSTRUCTIONS

It is assumed by FORMCAR that the purchaser of a Formcar Formula Vee Kit has some basic knowledge of mechanics, and of Volkswagen components. Therefore, these instructions are directed to those with this level of experience. Those with very little or no experience may find the instructions lacking somewhat. Should the builder find himself in this situation we recommend that if the problem concerns the Formcar Kit components or instructions, he contact us, clearly stating his problem. Sketches or photos of the problem area will be most helpful to us in solving your problem. If the problem concerns the VW components, we recommend that you contact your local VW dealer. He will be able to answer your questions far faster than we.

These instructions are intended for use in assembling a complete kit. If you have purchased only a partial kit, part of the instructions will be either incomplete or superfluous.



## INVENTORY

DESCRIPTION	QUANTITY	PART NUMBER
<u>Chassis</u>		
1. Frame, with front suspension mounting brackets	1	Formcar
2. Tierods	2	VW 211 415 801D
3. Swaybar	1	Formcar
4. Front Trailing Arm Spacers	2	Formcar
5. Steering Shaft	1	Formcar
6. Steering Wheel	1	Formcar
7. Rear Trailing Arm, Left	1	Formcar
8. Rear Trailing Arm, Right	1	Formcar
9. Rear Shock Absorbers	2	Monroe LL 56
10. Rear Coil Springs	2	Monroe 51871
11. Fuel Tank	1	Formcar
12. Tachometer	1	
13. Oil Temperature Gauge	1	
14. Oil Pressure Gauge	1	
15. Generator Warning Light	1	
16. Clutch Pulley Assembly	1	Formcar
17. Starter Switch	1	Formcar
18. Exhaust Pipe, Front, Left and Right	2	Formcar
19. Exhaust Pipe, Rear, Left and Right	2	Formcar
20. Shift Linkage Assembly	1	Formcar
21. Reverse Lock-out	1	Formcar
22. Clutch and Brake Pedal Assembly	1	VW
23. Fuel Line	1	Formcar
24. Accelerator Cable and Pedal Assembly	1	Formcar
25. Clutch Cable	1	Formcar
26. Brake Lines	1	VW
27. Wiring Harness	1	Formcar
28. Battery Cable	1	
29. Ground Strap, Battery	1	VW
30. Ground Strap, Transmission to Frame	1	VW
31. Battery Holder	1	Formcar
32. Brake Master Cylinder	1	Rambler 320 3914

### Body

1. Nose Section	9. Belly Pan
2. Hood	10. Fire Wall, Upper
3. Left Side Panel	11. Fire Wall, Lower
4. Right Side Panel	12. Cooling Air Baffle
5. Left Engine Access Side Panel	13. Seat
6. Right Engine Access Side Panel	14. Windshield W/ Hardware
7. Engine Cover	15. Instrument Panel
8. Tail Section	

In addition to the Kit, to complete your Formula Vee, you will need:

- 1 VW Engine, Sedan or Transporter (Preferably 40 HP)
- 1 VW Sedan Transaxle Assembly, with Mounts
- 1 VW Front Suspension (Sedan), complete with shocks, steering gearbox and brakes. (Tierods and lower torsion bar are not needed.)
- 1 Battery, VW Sedan, Group 2
- 4 Wheels, VW Sedan
- 4 Tires, Recommended 5:00 - 15 Front, 5:60 or 5:90 - 15 Rear

## PREPARATION OF VW COMPONENTS

### 1. Engine

A. In order to increase the reliability and longevity of the engine we recommend that it be disassembled, balanced, and inspected throughout prior to installation in the car. Under Formula Vee Automobile Racing Association regulations the intake and exhaust ports may be machined and polished. Care should be taken to insure that no more material is removed than that necessary to achieve the smoothing of the passages.

B. The hot air riser on the intake manifold may be removed under the regulations, and it is recommended that this be done.

C. During reassembly of the engine, the bottom cooling duct sheet metal and the cooling air control baffle in the air intake may be left off. The exhaust system should also be left off, as the Formcar system will be installed after the engine is mounted in the frame.

D. New main and air correction jets may be installed. Jet sizes will vary with locality, but main jet #135 and air correction jet #180 may be used as a starting point.

### 2. Transaxle

A. The transaxle must be disassembled and the ring gear carrier reversed to provide the proper direction of rotation. It is recommended that this be performed by a qualified VW shop, since certain adjustments must be made that require tools not normally available. Any gear ratio changes that are desired should be made at this time. NOTE: FVARA rules allow only stock VW gear sets to be used.

B. Unless it is desired to install an emergency brake, the exterior linkage to the handbrake may be removed at this time.

### 3. Front Suspension

To prepare the front suspension for use it is necessary to install the sway bar, move the steering gearbox to the center of the assembly, and mount the battery box by welding it to the suspension tubes.



A. The sway bar is installed as follows:

1. Remove both trailing arms from both sides of the assembly.
2. Remove the grease seal from the lower trailing arms, and replace it with the brass bushings provided in the kit. See Figure I for their position in the complete assembly (Arrow 1).\*
3. Loosen the jam nut and remove the lower torsion bar retaining bolt.\*\* Pull the lower torsion bar out and replace the torsion bar retaining bolt. Do not screw the bolt into its total depth. It is being used simply to plug the hole, consequently it should be inserted only six or seven threads deep and locked in place with the jam nut.

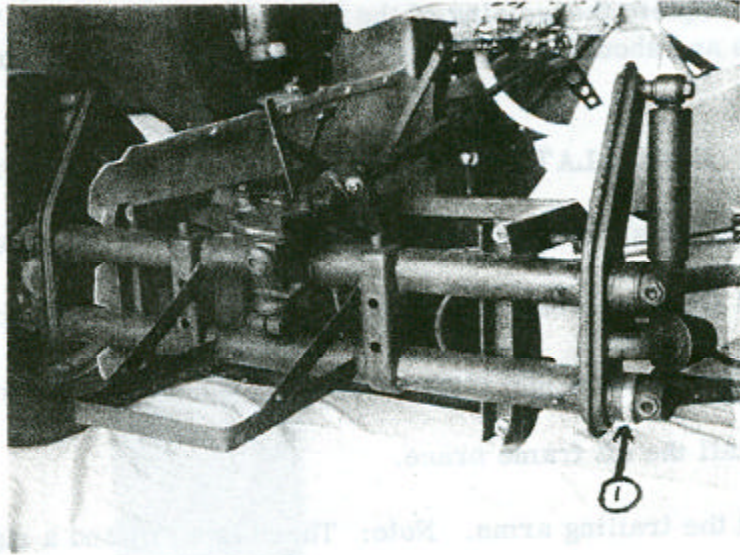


FIGURE I

4. Insert the sway bar into the torsion bar housing, and reinstall the lower trailing arms, making sure the sway bar is turned so that the detents in the end blocks of the sway bar face the trailing arm retaining bolts.
5. Reassemble the suspension. Do not install the tie rods at this time.

B. The steering gearbox is relocated by removing the clamping bolts, locating the box near the center of the suspension tube, and reinstalling the bolts. The box should be located such that the steering arm is in the center of the suspension assembly. In this position the box itself will lie slightly left of center. See Figure I.

\*If a Pre-1961 suspension is being used, it may be necessary to machine approximately .010 inches from the face of the bushing before installation.

\*\*On some 1962 and later suspensions the sway bar must be installed in the upper torsion bar tube, in which case the bushings must be installed on the upper trailing arms.



## INSTALLATION OF FRONT SUSPENSION ON THE FRAME

Most of the assembly operations will be facilitated if the frame is placed on an elevated stand, i. e., two sawhorses.

- A. Bolt the front suspension mounting brackets to the frame. Position the front suspension against the mounting brackets so that its center is bisected by the centerline of the frame. See Figure I.
- B. Clamp the suspension in place and spot weld the brackets to the suspension cross tubes.
- C. Remove the mounting bracket nuts and remove the suspension assembly from the frame. Complete the welding of the brackets to the tubes. The weld beads should be continuous and should extend completely around all eight semi-circular cutouts in the brackets.

## INSTALLATION OF TRANSAXLE AND REAR SUSPENSION

- A. Remove the aft brace from the frame. Arrow 1 - Figure II.
- B. Install front and rear transmission mounts on the transaxle.
- C. Lift the transaxle into place and install and tighten the mounting bolts.
- D. Reinstall the aft frame brace.
- E. Install the trailing arms. Note: There is a left and a right arm. See Figure III.
- F. Install the shock mounting adapters on the transaxle shock mounts. Align the adapters so that the shock bolt of the adapter is parallel with the centerline of the frame.
- G. Install the shock/coil units. Note: The springs should be adjusted for rear wheel camber after the car is completed and with the driver or a simulated driver in the driver's seat.
- H. Install the transmission - frame ground strap. See Figure IV.
- I. Install the transmission shaft/shift linkage adapter. See Figure V - Arrow 1.

## INSTALLATION OF FOOT CONTROLS AND SHIFT LINKAGE

- A. Install the brake master cylinder, the clutch/brake pedal cluster and connect the brake cylinder operating rod.
- B. Attach the clutch cable to the clutch pedal and route the cable along the floor and through the firewall. See Arrow 1, Figure VI.
- C. Install the clutch cable pulley. See Figure V. Route the clutch cable through the pulley and attach it to the clutch release lever. See Figure II.



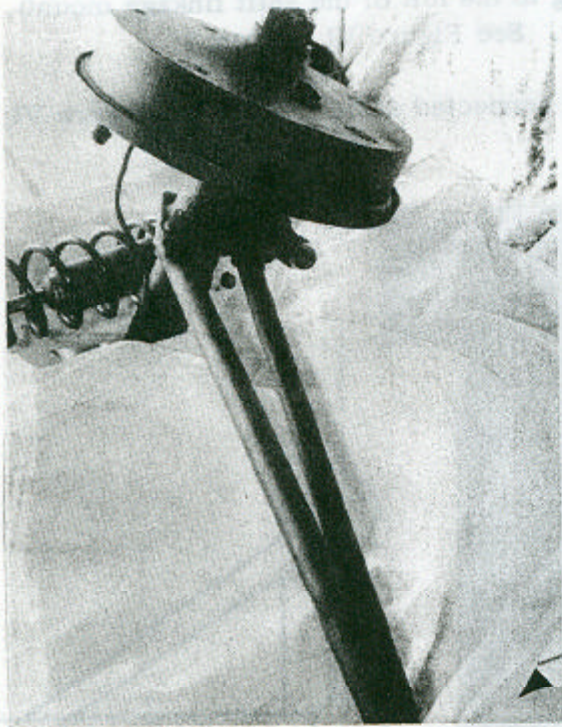


FIGURE III

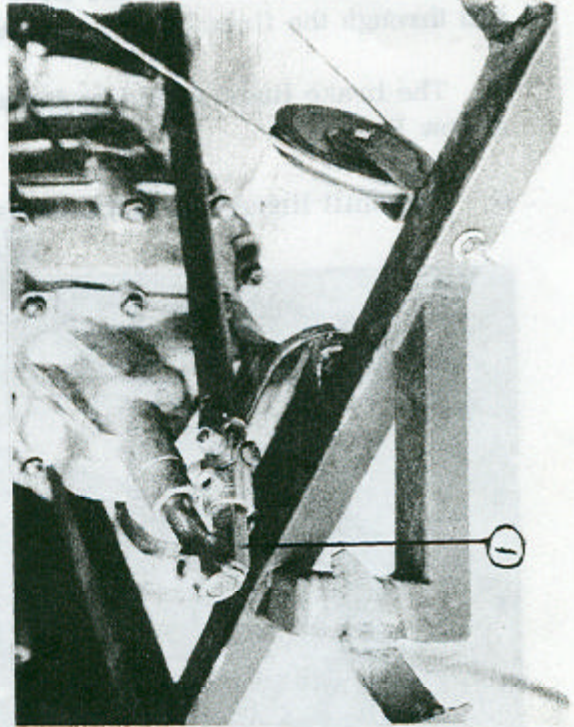


FIGURE V

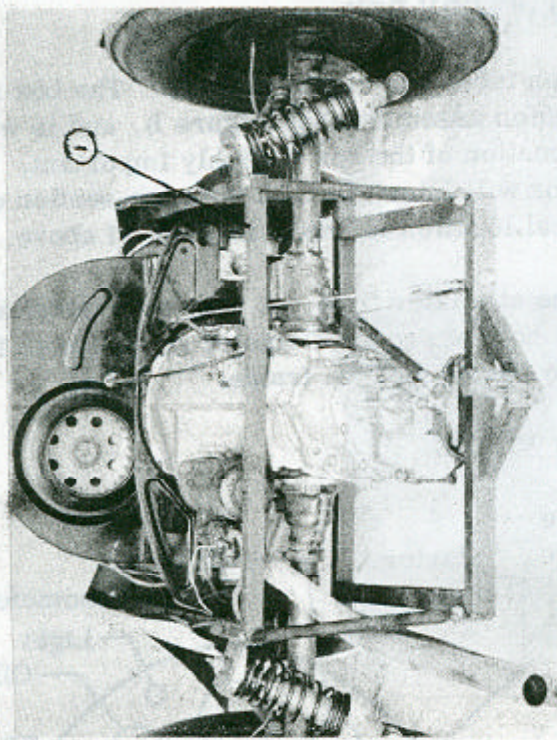


FIGURE II

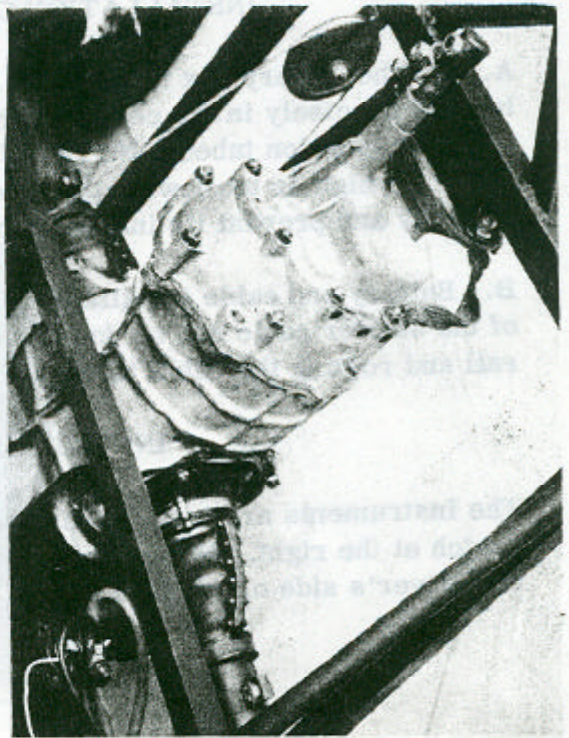
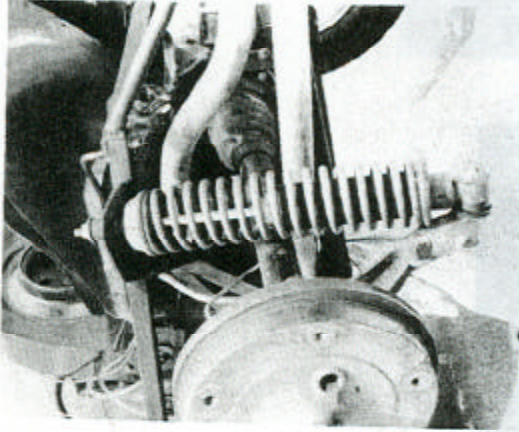


FIGURE IV

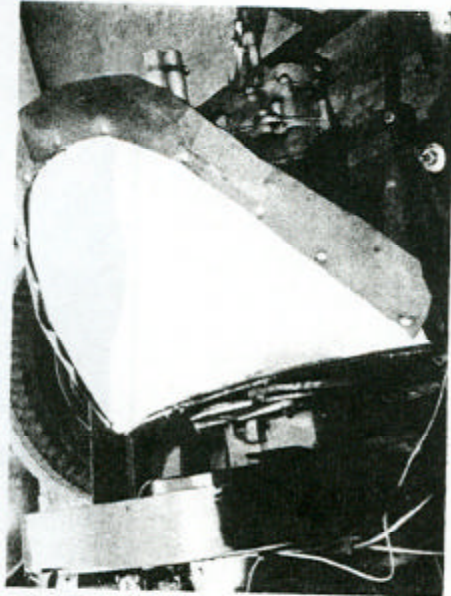




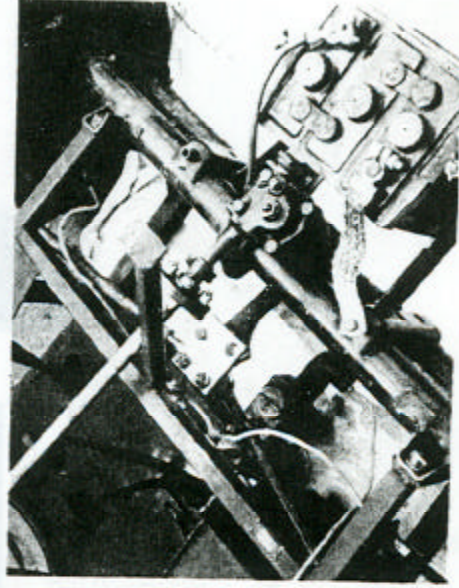
GEAR-SHIFT AND  
LOCK-OUT DEVICE.  
ADJUST FOR PROPER  
OPERATION.



COIL SHOCK UNIT  
-LEFT REAR VIEW



MOUNTING OF AIR BAFFLE TO COVER  
PLATE #113119517B



PITMAN ARM EXTENSION BLOCK-DRILL  
ARM FOR 7/16 BOLTS



- D. Install the accelerator pedal and attach the accelerator cable.
- E. Route the cable along the floor (Passing to the left of the shift linkage mount), and through the firewall into the engine bay. See Figure VI, Arrow 1.
- F. The brake lines should be installed and connected at this time. See Figure VI, Arrow II.
- G. The shift linkage is installed as shown in Figure VI.

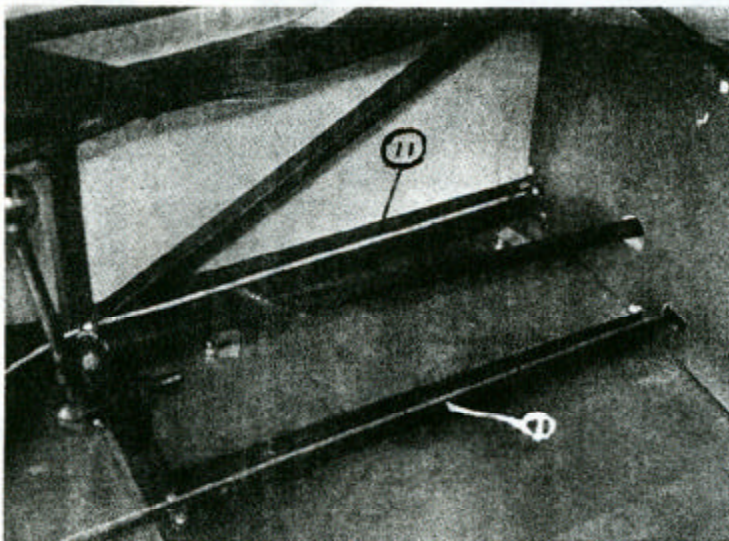
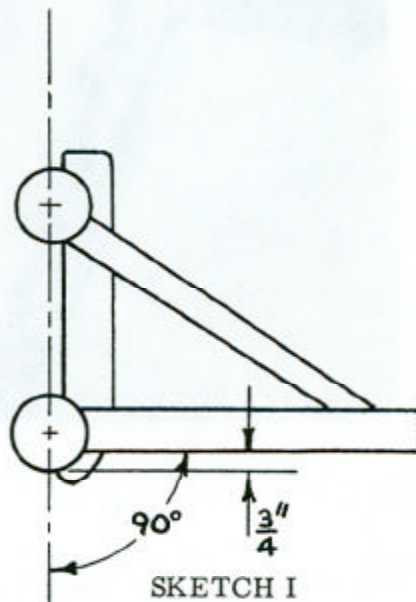


FIGURE VI

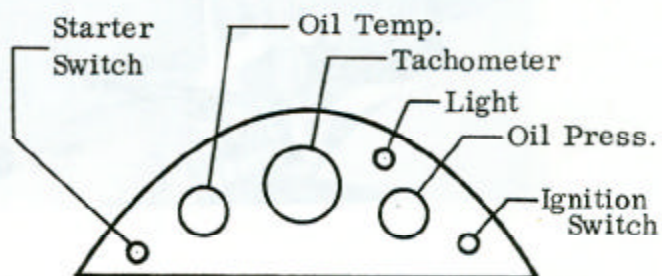


### INSTALLATION OF THE BATTERY BOX

- A. Fit the battery box to the front suspension tubes and clamp in place. The box is located precisely in the center of the suspension assembly (See Figure I), and is welded to the suspension tubes. NOTE: Vertical location of the box is highly important. If fitted too high or too low on the tubes, the box will interfere with the nose section of the body and prevent its installation. Vertical location is shown in Sketch I above.
- B. Battery and cable installation can be done at a later time. A very neat installation of the starter cable can be done by drilling a hole of proper diameter in the lower frame rail and routing the cable through this tube to the rear of the frame.

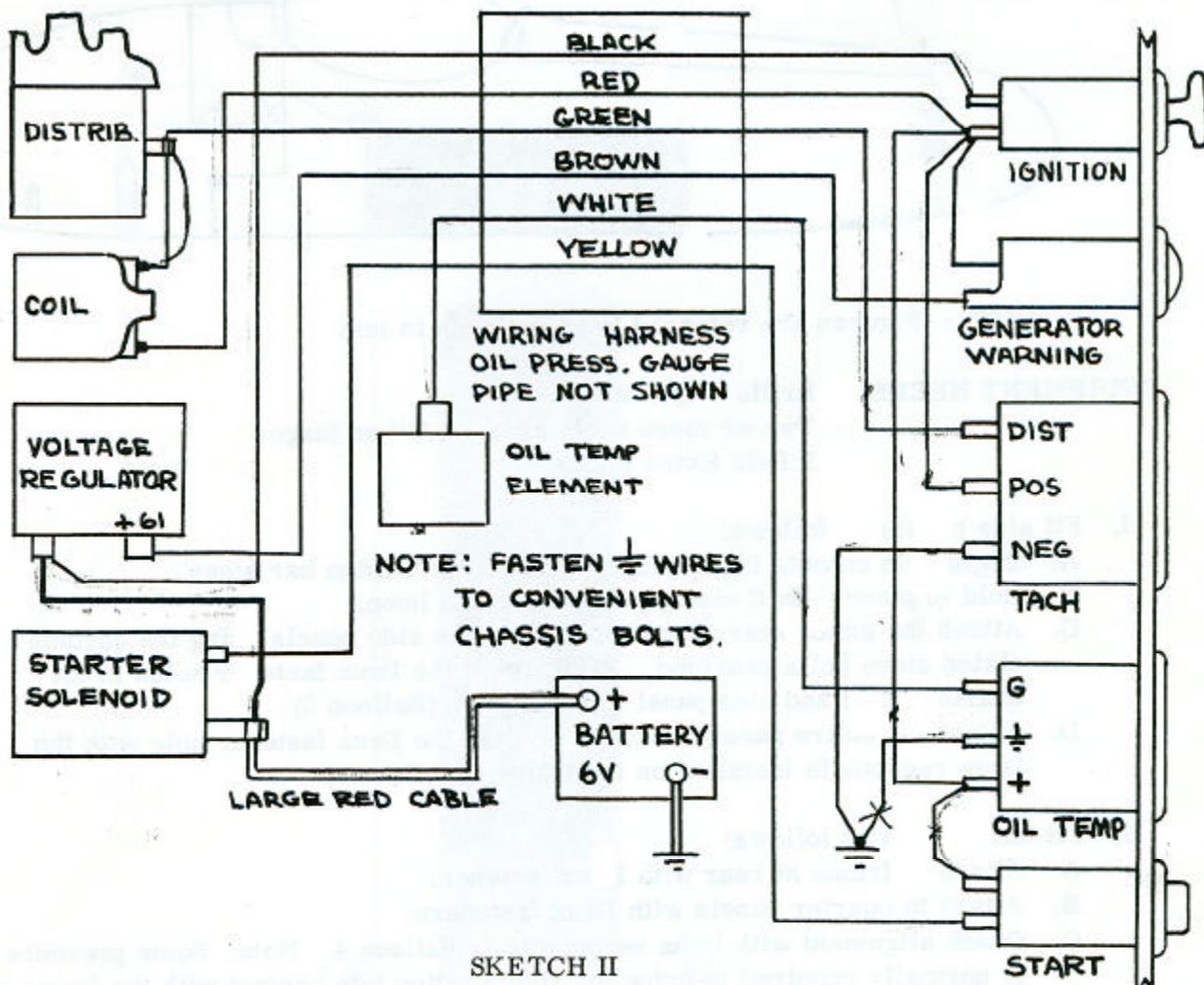
### INSTRUMENTS AND WIRING

The instruments are installed as shown in the sketch at the right. Note: This view is from the driver's side of the dash board.





A. Install the wiring harness along the upper right frame rail. Connect all wires as shown in Sketch II. It is imperative that the color code shown in Sketch II be adhered to. The wires are precut and terminated for installation according to the sketch.



B. Install the engine by dropping it into the chassis and bolting to the transmission. Complete the wiring installation by making all connections on the engine. Note: The accelerator cable loops behind the engine and enters the cooling fan cowl as shown in Figure II.

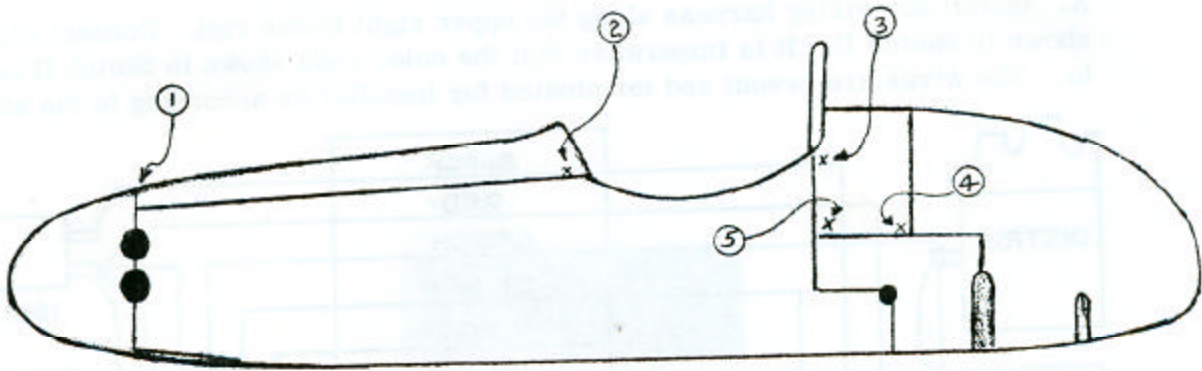
#### INSTALLATION OF FUEL TANK

The fuel tank is installed as seen in Frontpiece. The mounting brackets of the tank will match mounting brackets on the frame. The fuel line is then installed and routed along the right side of the frame to the fuel pump.

DIRECTIONS FOR INSTALLATION OF THE SEAT, STEERING WHEEL, AND OTHER COMPONENTS IS OMITTED HERE AS IT IS FELT THAT SUCH INSTALLATION IS STRAIGHTFORWARD AND CAN BE CARRIED OUT WITHOUT SPECIFIC INSTRUCTION.



## INSTALLATION OF BODY PANELS



NOTE: Figures are referred to as balloons in text

EQUIPMENT NEEDED: Drills - 1/4" and 3/16"  
Two or more C clamps, 1 1/2" or larger  
1 Pair Extra Hands

### I. Fit side panels as follows:

- A. Begin with cutouts fitted snugly to the front torsion bar tubes.
- B. Hold in place with C clamps at the firewall hoop.
- C. Attach the small rear quarter panels to the side panels using the chrome plated stove bolts provided. Ensure that the Dzuz fastener holes in the quarter panel and side panel are lined up, (Balloon 5).
- D. Adjust the entire panel assembly to align the Dzuz fastener hole with the Dzuz receptacle installed on the frame, (Balloon 4).

### II. Fit tail section as follows:

- A. Attach to frame at rear with Dzuz fastener.
- B. Attach to quarter panels with Dzuz fasteners.
- C. Check alignment with Dzuz receptacle at Balloon 4. Note: Some pressure is normally required to bring the rear section into contact with the frame at this point.

### III. Attach engine cover

### IV. Install nose and hood as follows:

- A. Install hood, attaching only the two rear fasteners, (Balloon 2).
- B. Lift nose piece into place - with battery installed - as follows:
  1. Lift hood to allow nose to clear hood fasteners.
  2. Press in firmly on sides of nose piece in order to clear the frame bracket and fit nose in place. Note: Side panels are outside of nose piece flange at the top, and inside nose flange at the bottom.
- C. Attach the balance of the hood fasteners.
- D. Drill and countersink 1/4" hole in nose piece and support at Balloon 1 as follows:



1. Utilize the spare hands to hold nose while removing hood. Be careful not to disturb the position of the nose while removing hood.
  2. Clamp the nose to the support and drill.
  3. Install the 1/4" x 3/4" flathead bolt furnished with the body.
  4. Reinstall hood.
- V. Attach side panels and nose section to belly pan with 1/4" Hex Head bolts supplied as follows.
- A. Hold panel in and snugly against the belly pan while drilling.
  - B. Holes should be drilled first in the center of the panel, and the bolts installed immediately after drilling. Work from the center towards each end, installing bolts as the holes are drilled.
  - C. CAUTION: Install the washer against the fiberglass panel.
- VI. Drill and bolt the side panels to the brackets on cowl hoop and fire wall hoop, using the 3/16" flathead bolts provided:
- A. Remove engine cover. Hold hood and side panel against the cowl bracket and drill and bolt rear of panel at Balloon 3.
  - B. Remove hood and repeat operation at the cowl hoop, Balloon 2.

#### MAINTENANCE AND HELPFUL HINTS

The instructions given above have been proven in work at Formcar. However, because of slight warpage and manufacturing tolerances, it may not be entirely possible to follow them in the precise sequence given. With a little patience, fitting of the body will not prove to be too difficult a task.

If the lower rear fastener (Balloon 4) on the engine cover is difficult to extract, lift the tail piece slightly.

If any fastener on the hood proves difficult to fasten, try a different sequence, starting with a different fastener.

Brillo pads are excellent for cleaning unpainted bodies.

If the body is to be painted, sand it THOROUGHLY with 320 or 400 grit wet or dry paper to break the surface gloss. Primer should be used.

Should the body be damaged, it may be repaired using any of the good quality epoxy or polyester fiberglass patching kits found in most department store automotive sections or at parts houses.

All body and belly pan fasteners other than Dzuz must be kept tight by use of lock washers, self locking nuts, or liquid lock.



## FINISHING TOUCHES

When you have completed assembly it will be necessary that the front and rear wheels be properly adjusted. It may be simpler to take the car to a VW dealer and have him set up the geometry with their equipment. If you are fitting a used front end, the following precautions should be taken. The front wheel bearings should be removed, then set up to VW specifications. The Torsion Arm Link Pins should be checked to see that they are properly tight and that the right number of shims are in place.

### FRONT SUSPENSION

**Camber Angle** - This is not adjustable. It should read  $0^{\circ}$  plus or minus  $30'$  if the Torsion Arm Link Pins are in good condition.

**Caster** - VW standard is  $2^{\circ}$  plus or minus  $15'$ . This can be adjusted by shimming the axle tube mounting brackets, making certain that the center fastening bolt is properly shimmed in order that no undue bending moment is exerted due to the mounting bracket not resting firmly on a shim at this point. Shimming out at the bottom increases the caster.

**Toe-in** - Should not exceed  $1/8$  inch unladen or  $1/16$  inch laden.

### REAR SUSPENSION

The camber of the rear suspension is determined by the preload of the coil springs.  $0^{\circ}$  to  $2^{\circ}$  negative camber is satisfactory. In order to increase the spring preload, it is necessary to remove the shock absorber and coil assembly and place shims under the lower end of the spring. Increasing the spring preload reduces the camber.

**Toe-In** - This is controlled by regulation of the Radius Arms. They should be removed from the axle tubes, the clamping collar loosened, and then rotated to make this adjustment. Toe-in or toe-out should not exceed  $5'$ . It is extremely important that the rear axles are perpendicular to the fore and aft axis of the frame. We believe a toe-in of  $5'$  is preferable to toe-out.

### ENGINE

It has been found that oil HD SAE viscosity 50 works very well for racing. Add a half can of STP if you are so minded. Oil level should be carried approximately  $1/4$  inch above "Full" mark to prevent loss of pressure on turns. For Autocrosses and the like, it might be better to run SAE 30. Engine RPM can safely be run to 5200. We have done so for two years with no ill effect.

The valves should be set at  $.004$  cold, both intake and exhaust. Check them after the first hard go, and at reasonable intervals thereafter. Timing should be VW Standard. ( $10^{\circ}$  BTDC) The mark is on the main shaft pulley.

### BRAKES

Be sure BOTH RESERVOIRS of master cylinder are filled before bleeding and adjusting brakes.