
Vango Kit[®]

It's the water that makes the difference

**The cure for the
VW Bus "blues."**



According to Paul Hadley, owner of Hadley Engineering in Costa Mesa, Calif., VW bus owners have suffered enough. Lack of power and over-heating, not to mention exorbitant rebuild costs, can quickly take the pleasure out of owning a VW bus/van. But they're so damn useful size wise and can be a pleasure to drive when conditions are favorable — most often going down hill, according to Hadley.

Paul is no newcomer to this line of thinking. Back in 1971, he pioneered the Transvair conversion — a nifty kit for installing a Corvair engine in your bus, van or transporter. At that time, the thinking was the same — what to do about the VW's inherent lack of power.

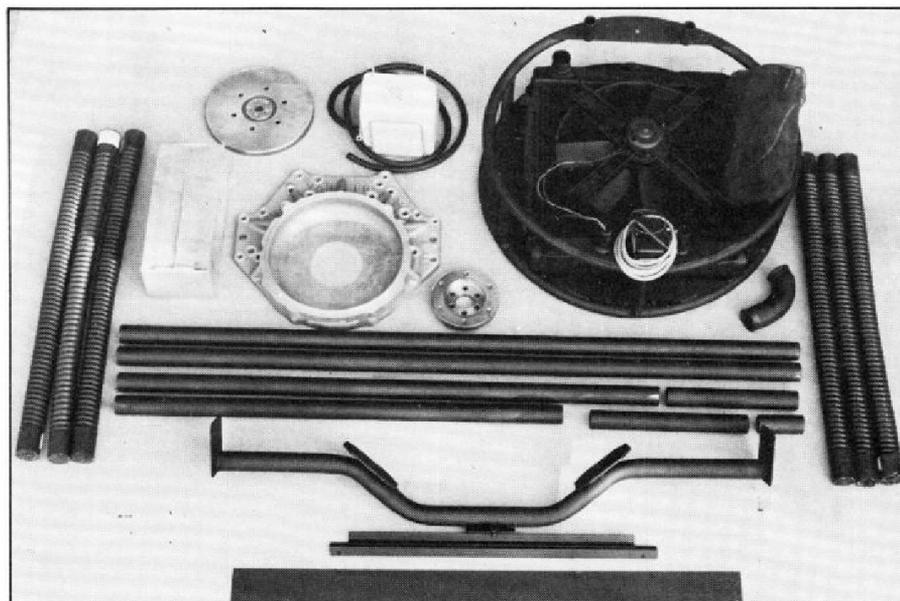
Like the Transvair conversion, the Vango H2O switch takes advantage of supply and demand. Corvairs are not easily found these days, but there is a huge supply of U.S.-built water pumpers now cluttering up the nation's junk yards. Because of the vast availability of these engines, the price is a big plus — engines with less than 30,000 miles on them can usually be picked up for under \$600. With this in mind, Hadley set about developing what you see here — the Vango H2O conversion.

The kit includes everything you need, except the engine; and to that end Paul has left us a wide selection of power options to choose from. The kit will take Ford's 2000cc inline 4 cylinder (early Pinto), 2300cc-4 ('73 later Pinto, Mustang, etc.), and 2600 and 2800cc 60° V6s (Pinto, Capri, Mustang, etc.); and from General Motors the 2500cc inline 4 cylinder

(Camaro, Firebird, Chevy II, Monza, Citation X-Car and Celebrity A-Car), 2800cc 60° V6 (S-10, Citation, Celebrity, Camaro, Firebird), 4.3-liter 90° V6 diesel (A-Cars), 3.8-liter 90° V6 (late model, rear wheel drive Chevy products), and the Buick 3.8-liter 90° V6 (found in four GM division cars). What a selection!

Kit components include rear cross member — accepts stock rubber mounts from engine of your choice; universal

engine adapter plate — common to all engines; crankshaft adapter flange — smaller of the two flanges, attaches between crankshaft and flywheel flange. A stock Type IV flywheel attaches to the opposite side of flywheel flange, bringing the combined weight of the two flywheels (approximately 20 lbs.) up to the approximate weight of the stock flywheels found on most of these engines. Extra flywheel weight enhances smoothness of engine



Hadley's Vango H2O kit includes all the bolts, fasteners, clamps, cables and electrical fittings, plus all the tubes, adapters and flanges, and the radiator and frame. Test vehicle, with 2500cc Chevy, has no problem with 4000 lb. boat and trailer in tow.

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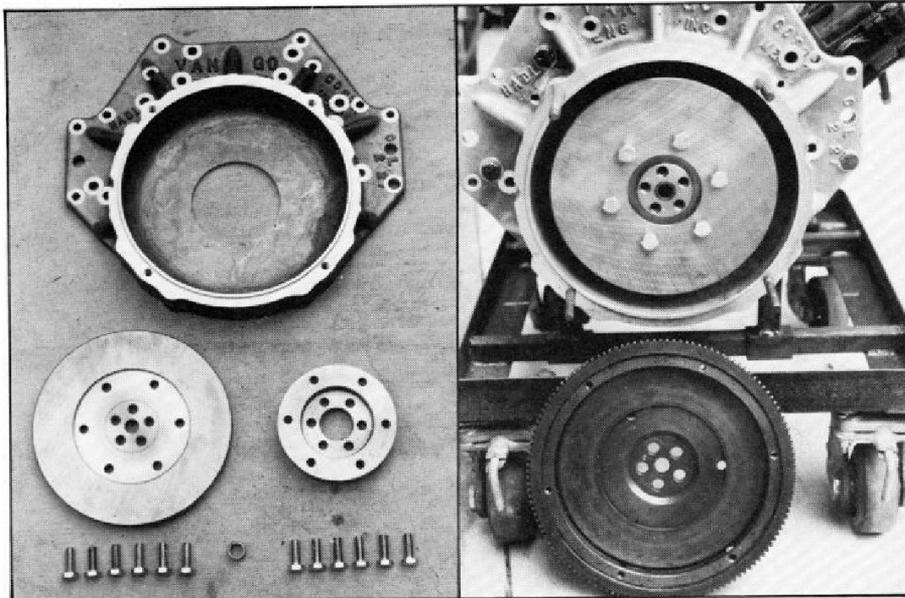
BY LANE EVANS

Vango H₂O Kit

CONVERSION KIT FOR INSTALLATION OF
U.S.-BUILT WATER-COOLED POWER
IN YOUR BUS



DUNE BUGGIES & HOT VWs



ABOVE LEFT, Vango adapter plate is drilled for all engine patterns, does not require replacement if different engine is used later. Small flange and rear motor mount are only major pieces not common to all engines. **ABOVE RIGHT,** adapter plate and flywheel assembly are bolted to engine, ready to receive original VW flywheel. Combined weight of both flywheels will approximate engine's original flywheel weight. **RIGHT,** Vango radiator assembly looks like spare tire.

and drivability because it requires less down-shifting. Kit also includes water tubes and hoses — all necessary plumbing to route coolant to and from engine and radiator; radiator — special heavy duty truck type (four-row high density model); cooling fan — 14-in. diameter fan with HD electric motor and adjustable thermostat control; radiator enclosure — round steel framework that attaches to front of bus, serves as protective covering for radiator and disguises assembly as a covered spare tire when dark screen cover is in place; throttle cable — includes extra-

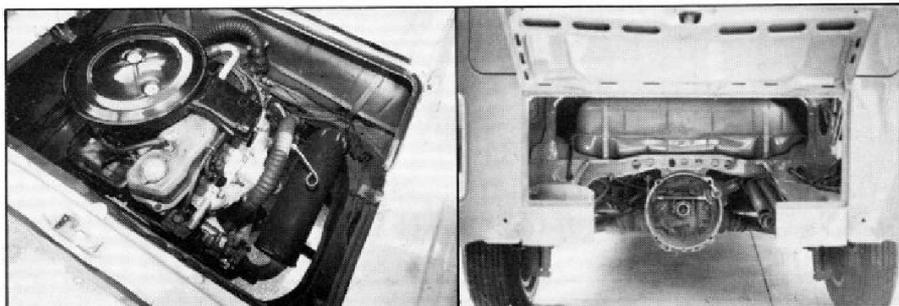


LEFT, front cooling unit comes assembled and painted. Only four holes need to be made in front of bus — two for radiator hoses and two for lower attachment of radiator framework. **RIGHT,** coolant tubes are routed through frame, hole cutter is provided with the Vango kit. Tubes do not interfere with air conditioning ducting.

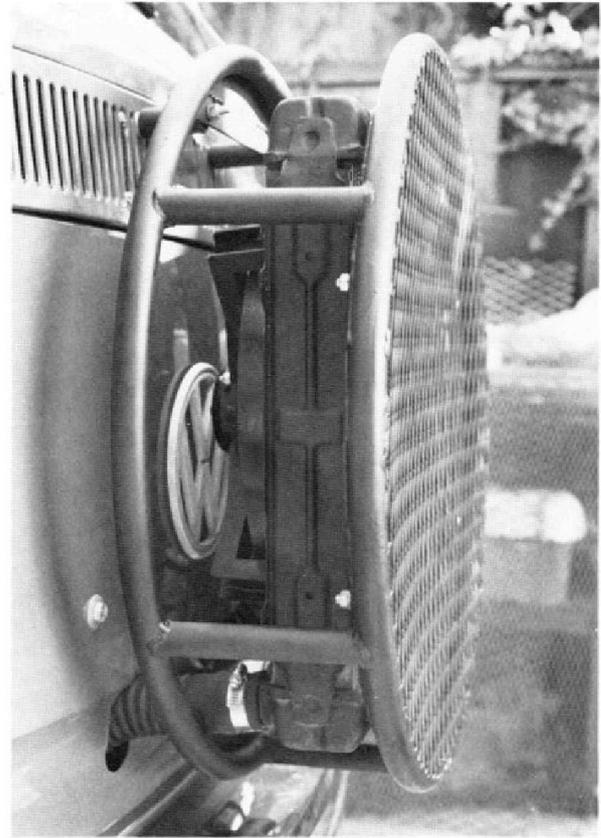
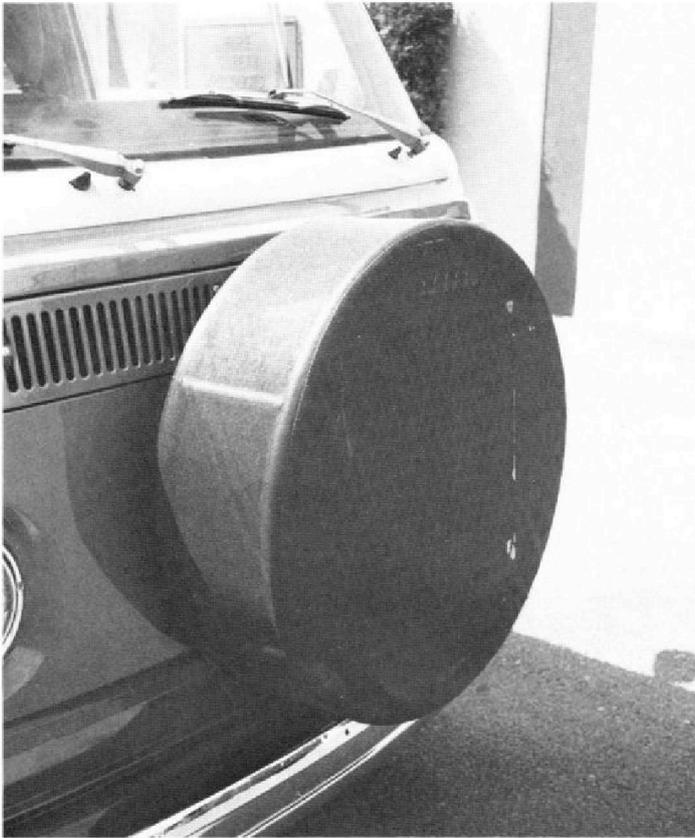
long stainless steel cable and flexible outer housing and attaching hardware; and electrical connections — includes wire and connectors for minor changes to stock VW wiring harness and tips on installing temperature gauge. As optional equipment, Hadley offers high capacity heater, muffler system and heavy duty trailer hitch.

Vehicle shown here is '75 Westfalia camper, with 2500cc Chevy inline four. During testing, the bus towed a 4,000 lb. boat and trailer over the infamous Cajon Pass in 118° California desert heat with no problems. Factory recommended towing capacity for Chevy's new S-10 pickup with the 2800cc engine is 5,000 lbs. Considering that a VW camper bus weighs 3 to 400 pounds more than an S-10, the Cajon Pass test showed that the converted test vehicle fell within those same limits. The average fuel consumption for a 3,000-mile cross country trip with the same 2500cc Chevy powered Westfalia netted 20 mpg.

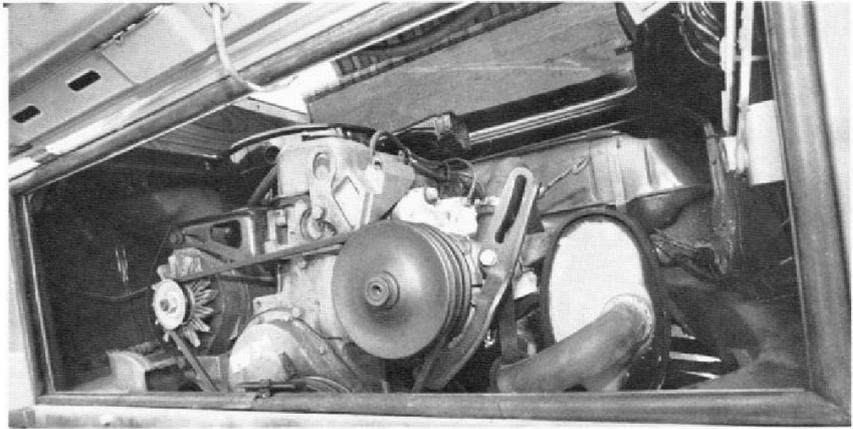
Introduction of the water-cooled '82 Vanagon Diesel and the future water-cooled pancake engined Vanagon now being tested in the U.S. seem to legitimize Hadley's thinking. Many performance enthusiasts are probably already thinking about the big 3.8-liter V6 Chevy or Buick — real neck snappers but the wiser choice for super reliability, quiet, and economical operation is probably the Ford 2.3 or GM 2.5 or 2.8-liter power. The nicest aspect about the Vango H2O conversion is that the choice is yours, with plenty to choose from. Detailed installation instructions are available for \$2.00, just write Hadley Engineering Inc., P.O. Box 10296, Costa Mesa, CA 92627.



2500cc Chevy fits right in. By extending original service hatch, maintenance is super easy. A sabre saw will do the trick. Saw is also used to cut out rear panel below engine compartment door. This permits engine installation without removing trans. New removable panel comes with kit.



Dark screen cover conceals true identity of "spare tire" and keeps out bugs. Removed, you can see radiator and protective frame.



Good access from both top and rear make a Vango a cinch to work on. Note location of muffler alongside engine for ground clearance.



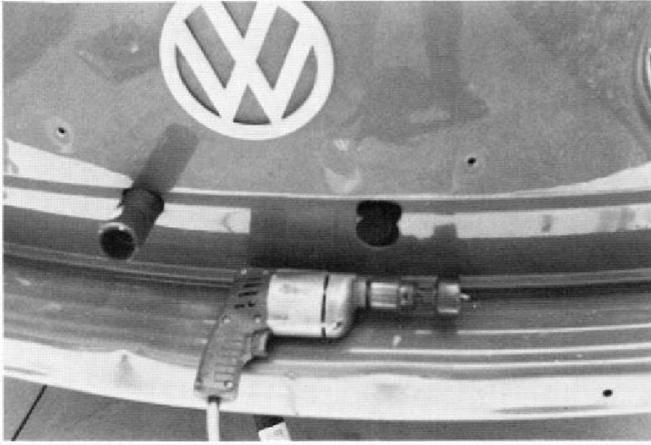
Optional exhaust system for 2500 Chevy 4. Muffler is located high in the engine compartment. Tail pipe exits behind right rear wheel to minimize vulnerability.

Hadley Engineering Policy

Every effort will be made to develop and expand Vango® products into the finest and most comprehensive line available for the VW Bus and Vanagon. We are dedicated to making the most useful vehicle on the market even more useful.

HADLEY Engineering, Inc., P.O. Box 10296, Costa Mesa, CA 92627; (714) 548-1443

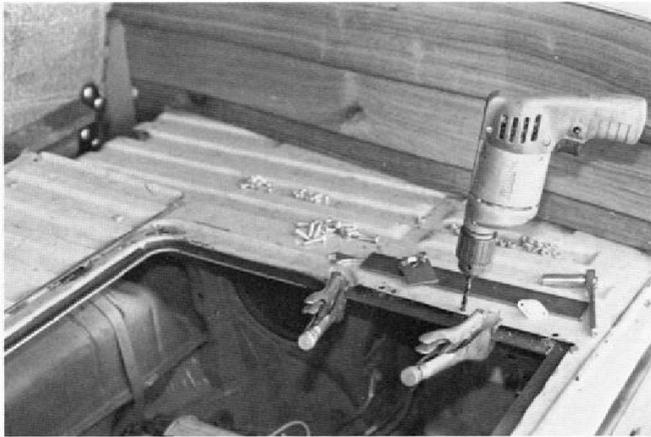
VANGO® INSTALLATION PHOTOS



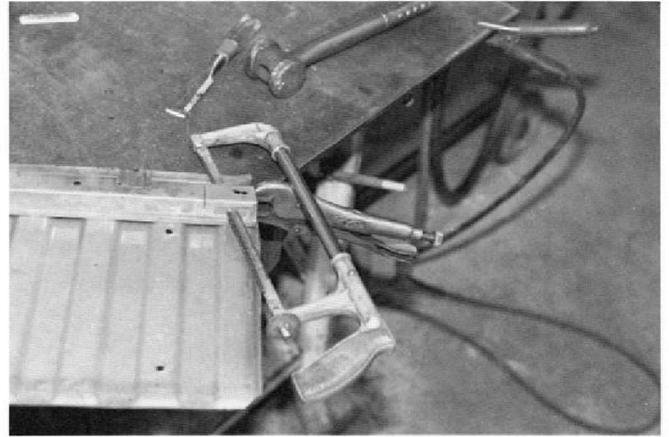
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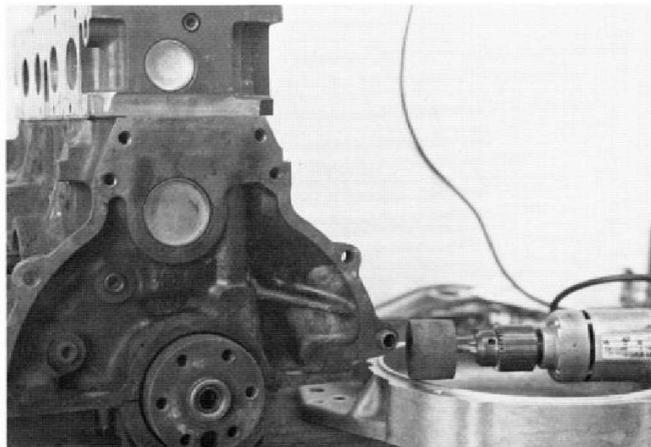
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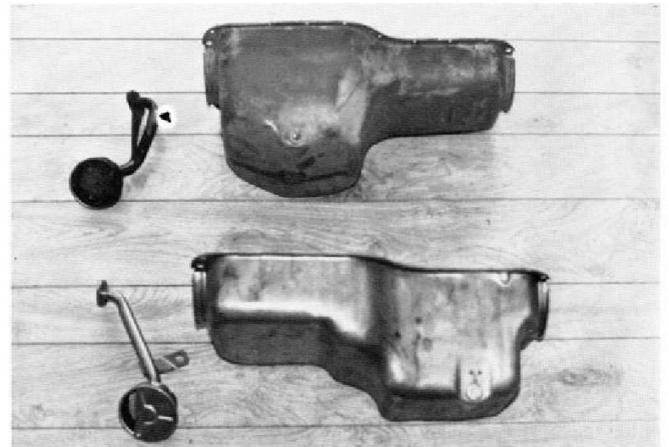
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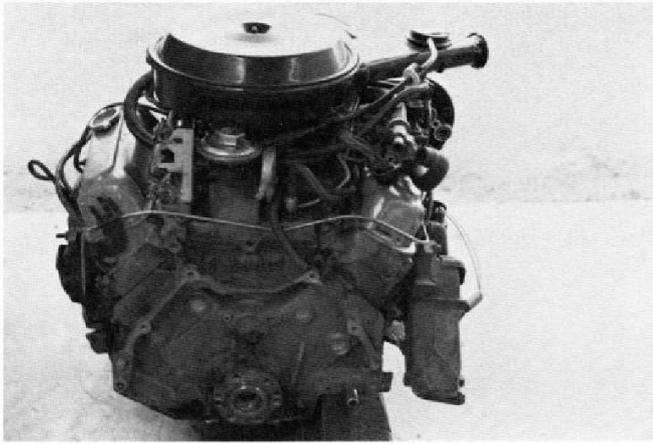
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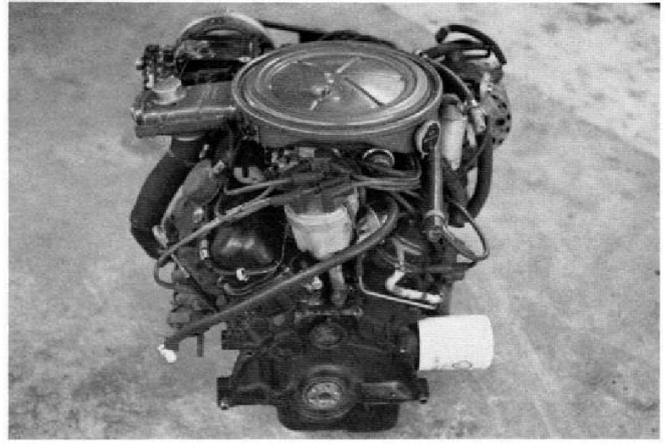
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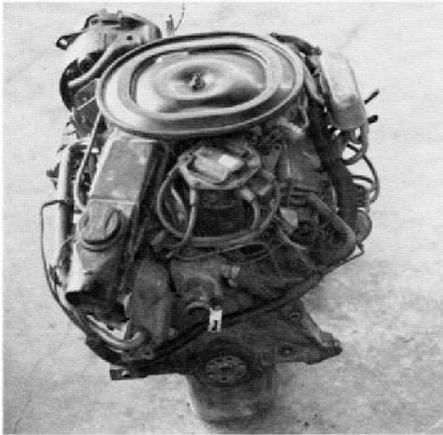
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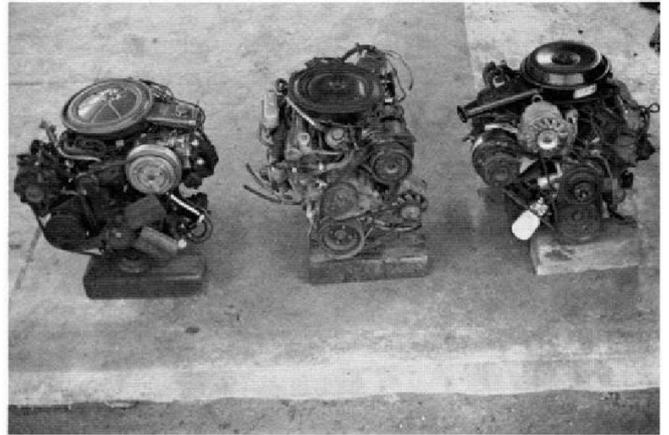
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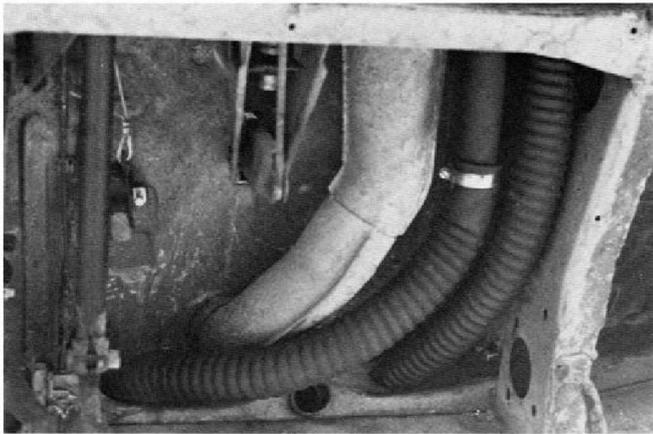
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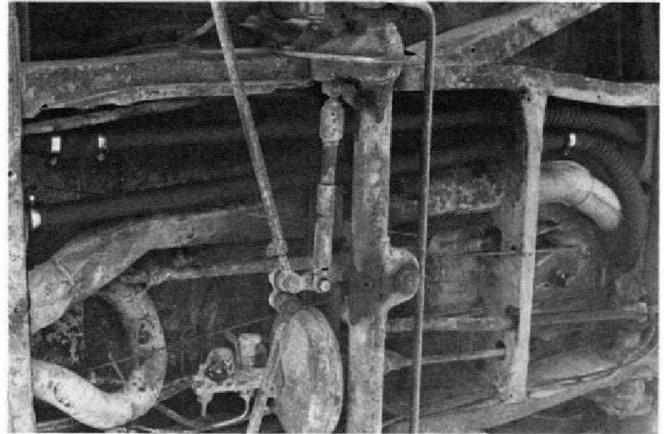
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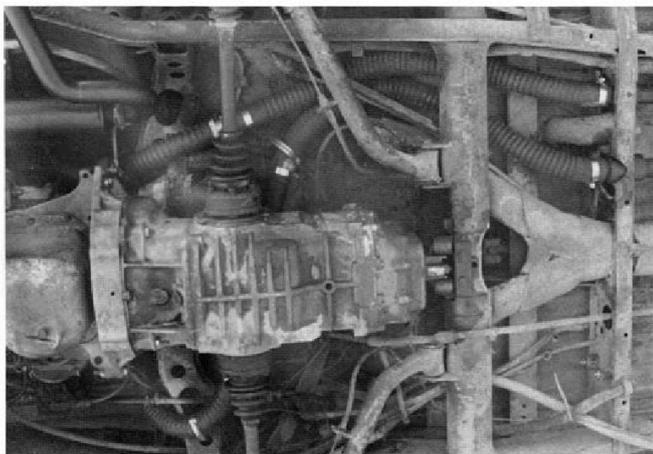
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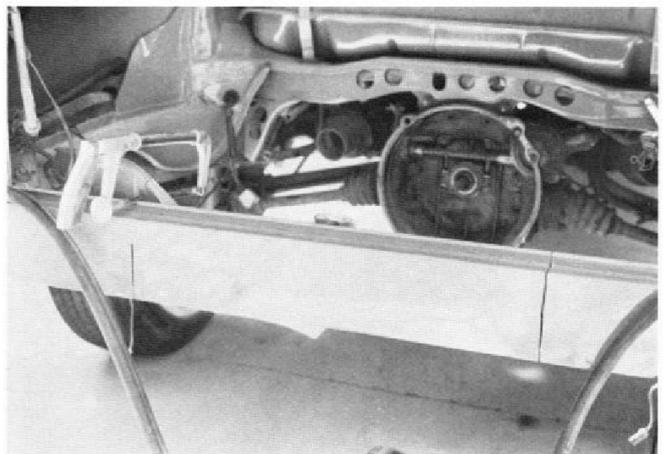
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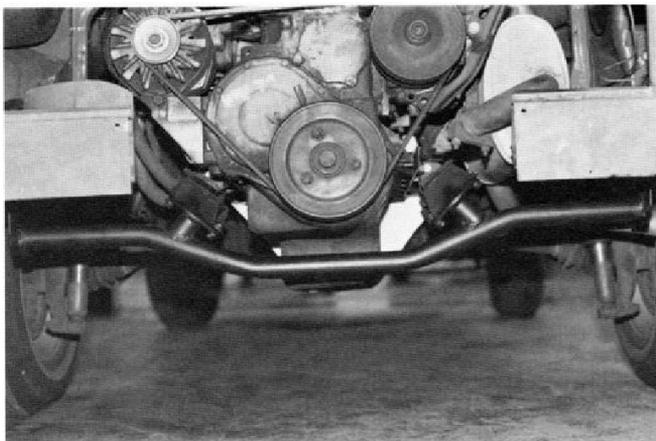
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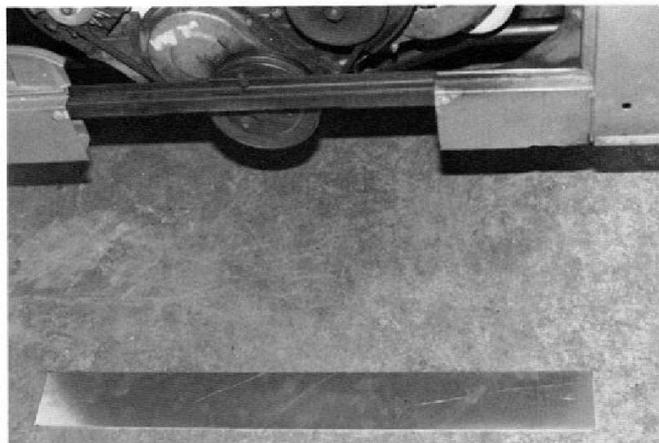
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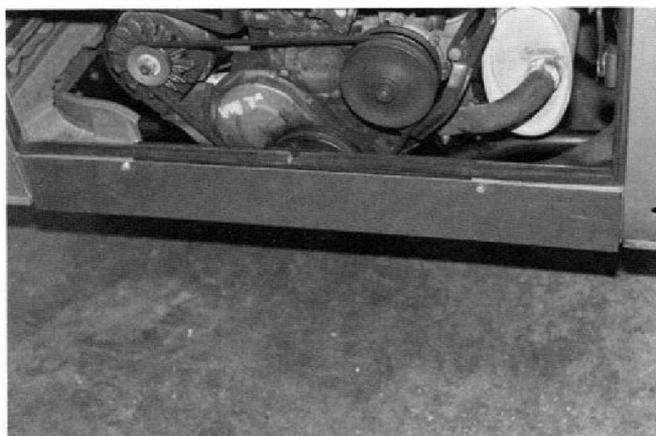
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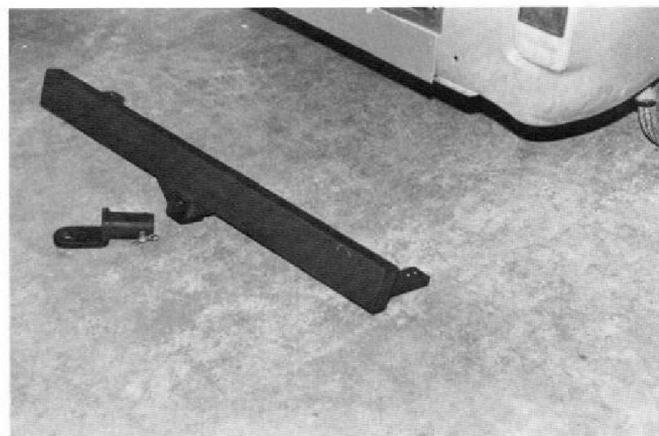
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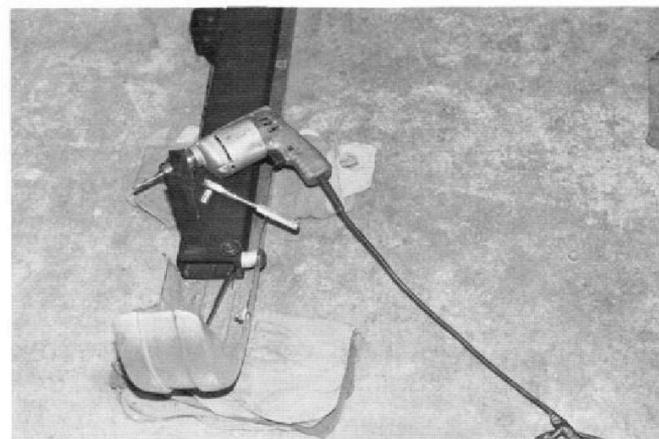
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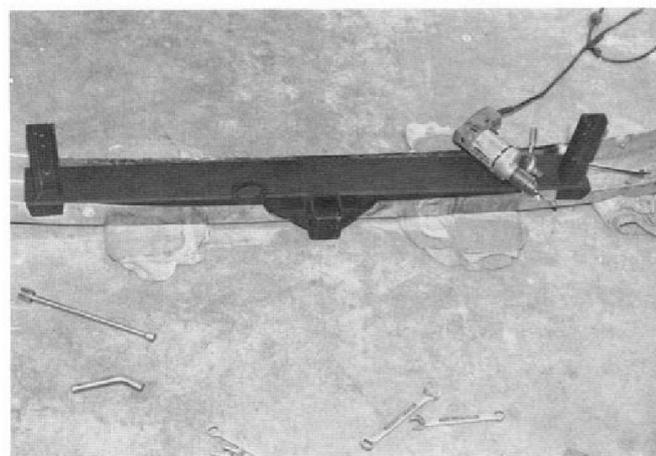
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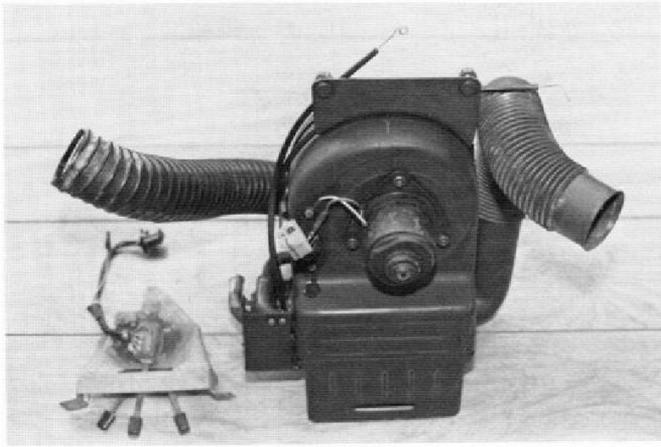
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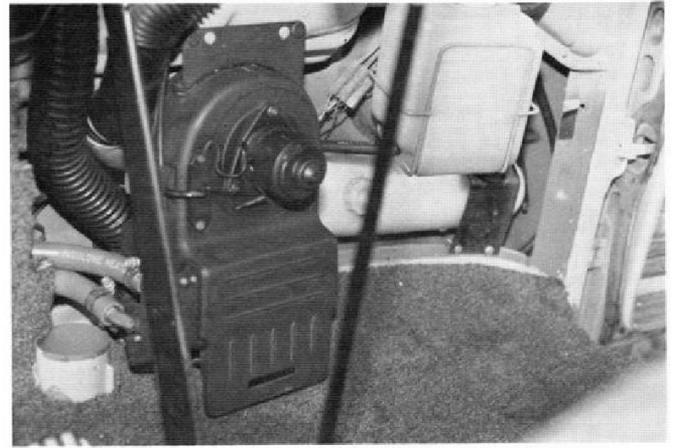
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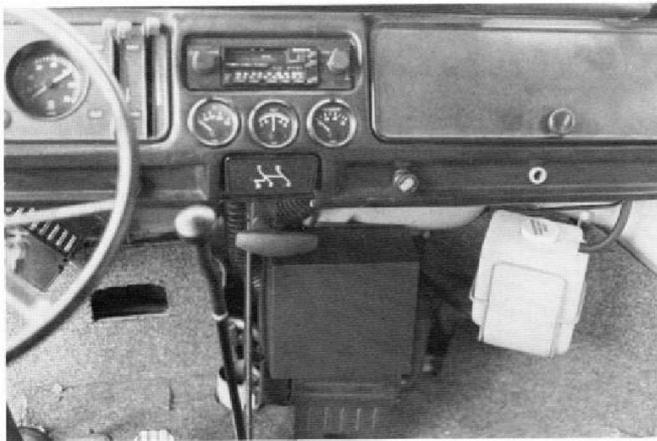
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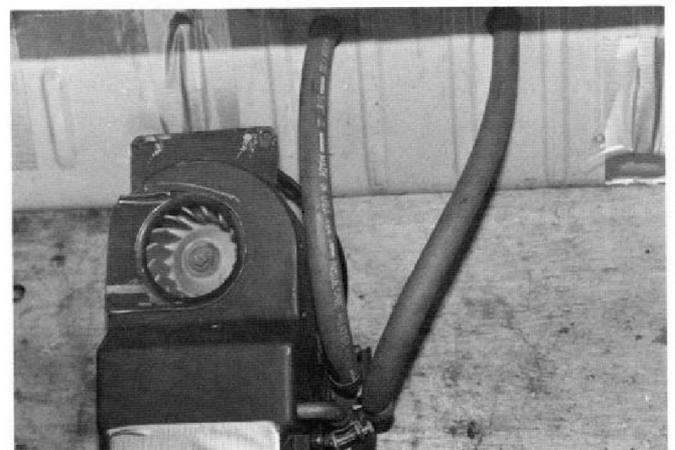
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Hadley Engineering, Inc.

(714) 548-1443

Established 1967

Mailing Address: P.O. Box 10296

Costa Mesa, California 92627

961-K West 17th Street

Costa Mesa, California 92627

VANGO PRICE LIST - Effective May 10, 1983

- Stock #VG 7279 - Complete Vango Kit for '72-'79 W Bus \$989.50
Includes one each: VR-110, VRF-120, VRC-130, VEF-140, VCT-150, (\$94.00 Savings)
VT-160, VH-170, VRP-180, VEM 7279 (specify engine)
VG-100 (specify engine). Uses your flywheel and clutch. (specify if automatic bus)
- Stock #VG 6817 - Complete Vango Kit for '68 thru '71 W Bus \$989.50
Includes same as above except VEM 6871 in place of VEM 7279 (\$94.00 Savings)
Requires ordering one VGT-15 for '68-'70 W bus unless using '71 or newer W bus bellhousing. Requires use of '72-'79 W bus flywheel and clutch.
Specify engine being used.
- Stock #VR-110 - Vango Special Radiator \$229.50
Super duty industrial grade radiator. Radiator core is four rows thick with extra close spacing between tubes.
- Stock #VRF-120 - Radiator Frame Kit \$189.50
Round tubular radiator frame. Attaches to nose of bus with 4 bolts. Disguises radiator as front mounted spare and offers protection from flying objects.
- Stock #VRC-130 - Dark Screen Cover \$29.50
Surrounds radiator frame and keeps out the bugs.
- Stock #VEF-140 - Electric Fan \$69.50
Heavy duty 14" thermostatically controlled electric fan with adjustable control.
- Stock #VCT-150 - Coolant Delivery Kit \$99.50
Includes six 30" lengths of reinforced flexible radiator hose, 25ft. (approx.) steel tubing cut to proper lengths, hose elbo and coupler hoses, hose clamps, fluid recovery system, hose reducer, hole saw and spindle.
- Stock #VT-160 - Throttle Cable Kit \$19.50
Includes two 15ft. 49 strand cables with clevis attached. Rear cable housing section with adjustable ends. Quick dis-connect ball socket for carb attachment, universal housing support strap and front lever extension.
- Stock #VH-170 - Vango Aluminum Hatch Kit \$49.50
Includes 33 1/2" X 24" aluminum cover, one inch aluminum angle reinforcing members, ten feet of high quality extra thick weather strip, six Dzus buttons with spring tabs and all pop rivets and fasteners.
- Stock #VRP-180 - Rear Panel Kit \$ 9.50
Includes aluminum panel and angle iron to finish area below engine compartment door.
- Stock #VEM-7279 - Rear Engine Mount Bar \$89.50
Heavy duty tubular cross member attaches to original motor mounts on engine and VW bus side rails. Please specify engine being used. This mount is used with '72 thru '79 bus only.

VANGO PRICE LIST - Effective May 10, 1983 (page two)

Stock #VEM 6871 - Rear Engine Mount Bar \$ 89.50
Heavy duty tubular cross member attaches to original motor mounts on engine and bolts to side rails of VW bus. Please specify engine being used. This mount is used with '68 thru '71 bus only.

Stock #VG-100 - Engine to Transaxle Adapter Kit \$298.00
Includes Vango universal adapter plate, flywheel adapter and crankshaft adapter flange. All fasteners and shaft support bearing included. Please specify engine being used. For use with '72-'79, VW bus flywheel and clutch.

Stock #VGS-228 - Clutch Adapter Kit \$ 39.50
Needed only when installing '76 or newer 228 mm (9" approx.) clutch in any VW transaxle except a '76 or newer VW bus bellhousing. Includes starter spacer, longer stud for adapter plate, starter shaft support bushing, clearancing gauge and instructions.

Stock #VGT-15 - Throwout Bearing Sleeve \$ 9.50
Converts any '70 and older VW transaxle to '71 and later design. Requires using '71 and later type throwout bearing cross shaft purchased new from dealer or from wrecking yard. New type throwout bearing also required.

Stock #VGB-76 - Starter Shaft Bushing \$ 9.50
Use only when installing rabbit diesel starter in place of '76 and newer VW bus starter and in '76 newer VW bus bellhousing only. All other 228mm clutch applications use VGS-228. Requires installing '76 newer VW bus starter gear on rabbit diesel starter.

Stock #TH-6871 - Vango Trailer Hitch (Photo #20) \$129.50
Super duty trailer hitch with removable ball extension. Attaches to original bumper bracket bolts. Fits '68 thru '71 VW bus.

Stock #TH-7279 - Vango Trailer Hitch (Photo #20) \$129.50
Same as above. Fits '72 thru '79 VW bus.

All exhaust systems attach to cast iron exhaust manifolds of engine being used. Please specify type and year of car engine came from when ordering exhaust. These systems are made of the highest quality materials and all mufflers are fully baffled type. The V6 systems use dual mufflers. Certain Buick V6 systems use one 2 1/4" pipe and muffler. This system, where the left manifold crosses over and enters the right cast iron manifold and then all gases exit a large opening at the rear of the right manifold (photo #9) is available as a large single system. The original cross over pipe must be used. The 4 cly. engines use a single system. Systems not available for turbocharged engines. Exhaust systems not legal for sale for highway use in California.

Stock #SX-1 - Single system for 4 cyl. Engines (specify) \$ 89.50

Stock #SV-6 - Single system for V6 Buick 2 1/4" capacity (Photo #9). . . \$ 99.50

Stock #DX-2 - Dual systems for V6 engines (specify) \$149.50

Allow 7 days to fill orders or call for current delivery schedule. All orders shipped UPS with 5 day delivery to farthest points. 50% deposit required. Send certified check or money order for fast service. Allow three weeks for personal check to clear bank before shipment. We ship balance and freight charges COD (cash or certified check only) if desired. VG-100, dual exhaust system or trailer hitch costs approximately \$13.00 to east coast. Shipping cost for complete Vango Kits (Stock #VG-7279 or #VG-6871) range from \$15.00 to \$65.00 within Continental United States. California residents add 6% sales tax. Any overpayment of prepaid freight charges promptly refunded.

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SHOULD I PUT A DIFFERENT ENGINE IN MY BUS?

Many people develop an attachment for the VW bus that doesn't allow them to see themselves driving any other vehicle. Most of these people are fully aware of the shortcomings of the VW bus but are willing to put up with them because no other vehicle offers the "compact versatility" of the VW bus. A Vango equipped bus does nothing to decrease these attributes and goes a long way in overcoming many of the faults of the VW bus. No longer will you have to wear three pairs of underwear to work in the winter or wonder if you'll get over the next hill before "she blows."

If you are facing rebuild time for your '72-'79 VW bus engine it isn't hard to justify a Vango installation. Don't wait until the VW engine goes before making the switch. Your VW bus pancake motor is worth more than you think because the demand is high due to other people's problems. The destructive force of the piston hitting the head of the valve if the valve snaps off is tremendous. The case and everything gets destroyed and you're looking at \$2,500 plus in many instances.

The bottom line in making a decision on Vango is the kind of vehicle you want to drive. If the VW bus is for you and you know the water cooled package is the way to go but you can't afford a 1984 Vanagon water boxer with a bolt on turbocharger kit, the decision is easy. The 1984 Vanagon engine is actually smaller, 1.9 litres vs. 2.0 litres, than the air cooled engine it replaces and has only 3 more ft. lbs. of torque than the air cooled engine. The Vango kits have been available since February '83. Thanks to over one hundred people who were "sick and tired and weren't going to take it anymore" it looks like Vango is starting to make some believers out there. By the end of summer maybe we should start a club and have a picnic next year.

What Vehicles Do Vango Kits Fit?

Although complete Vango kits are designed for use primarily with '68 and newer VW buses, many of the kit pieces can be applied to earlier buses and any vehicle using a VW transaxle. The '72 and newer VW bus flywheel and clutch must be used with all Vango kits. This permits the use of the largest clutches ever offered by VW and, in most cases, is as strong as the clutch used originally with the engine you are installing. Until Vango, installing different engines against VW transaxles has limited clutch sizes to those found in beetles or '71 and older buses which used 1600 cc. type beetle engines.

Will the Added Weight of the Bigger Engine Affect My Bus?

The most frequent question asked by people interested in repowering their bus is what effect the added weight of the engine is going to have on their bus. This weight difference will vary from 50 to 150 lbs. depending on the engine going in vs. the engine coming out. Have one or two people with a total weight of 150 lbs. sit back over the engine compartment and take a ride. You will see there is no apparent change and you will also have about 100 lbs. of radiator and water in the front to offset the rear weight and create a much better balance than a rear mounted radiator could offer. Many VW buses squat in the rear from the way the torsion bars were set at the factory or from fatigue over the years. Resetting the torsion bars on the

AS YOU READ THESE INSTRUCTIONS KEEP IN MIND, AS WITH ANY INSTRUCTIONS, THEY TAKE ON GREATER CLARITY WHEN THE PARTS ARE LAYING IN FRONT OF YOU.

bus is much easier than on a beetle and after studying a service manual some of you may want to do this if you tow a heavy trailer. The other method of raising the rear is through the use of air shocks and a dash mounted Coleman air shock inflator kit gives great versatility in ride height adjustment from the dash! You tall guys will be able to see out of the rear view mirror and the money you save on speeding tickets will pay for the kit!

Will I Finally Have Some Heat For My Rolling Ice Box?

Extensive testing of various heaters in a Vango equipped bus indicated the biggest weakness in the VW bus heating system, other than the air cooled engine, is the tube required to deliver the hot air from the rear to the front of the vehicle. The newer Vanagon uses a tube with three times the capacity of the '79 and earlier VW bus. This indicates the factory also recognized the problem. The highest capacity heaters available from any vehicle were used in testing and the loss in temperature and volume of air, when passed through that tube, were totally unacceptable. The most effective method of generating large quantities of hot air in a water cooled vehicle is to deliver the hot water to the area of the vehicle to be heated and at that point converting the hot water to hot air. Hot water can be routed anywhere in a vehicle with almost no loss in temperature or velocity with a simple length of heater hose.

Imported pickups offer a wide variety of compact and efficient heaters that can be mounted under rear seats (photos 31 and 32) and at the front of the bus (photos 26-29). One heater at the front and one under the rear seat is ideal for colder climates. The Ford Courier-Mazda pickups offer a very compact and efficient heater (photo 25) that will fit under the VW bus rear seats with no problem. It is also the easiest to mount and most compact at the front. Many Toyota and Datsun pickups use a similar heater. Don't forget to ask the wrecking yard for the water valve, defroster hoses and controls along with the heater (photo 25). The Chevy Luv takes up more foot room (photo 29) than the Courier-Mazda (photo 28) but there is still plenty and you can easily swing your legs around to get to the back easily.

Can I Keep My Air Conditioning?

When installing an engine in an air conditioned bus, use the air conditioning compressor and bracket factory designed for the engine being used. Simply have an air conditioning shop splice the hoses from the old compressor to the new compressor. The Vango coolant tubes can pass over the air conditioning fans mounted under the VW bus without any problems.

ENGINES APPLICABLE TO VANGO INSTALLATIONS

Ford 2000 Engine

This engine was in the Pinto from the introduction until '74. It was the optional engine for the early Pinto and a 1600 cc. push rod motor was standard. The Ford 2000 was standard in all Capris and Capri II's which were 4 pass 2 dr. coupes imported from Europe in the '70's and sold by Lincoln Mercury Division.

This engine was German built with overhead cam design and mechanical valve lifters. It is capable of very high rpm if equipped with a hot cam and more carburetion.

These modifications are not recommended for a bus application and the mechanical valve lifters require periodic adjustment. This engine in stock form is acceptable for

a bus but doesn't have the low end torque of the larger fours and sometimes feels rough in certain rpm ranges. If you have one in your possession use it but if you have other choices available at comparable prices choose another. The Vango rear motor mount requires the Capri 2000 oil pan and pickup tube. Specify if using Pinto or Capri motor mounts when ordering Vango rear mount.

Ford 2300 (Photo 7)

Although this engine looks very similar to the Ford 2000, they share few parts, and the 2300 is American built and has hydraulic valve adjusters which are quieter and require no adjustment. This engine is found in many cars of all sizes and is very plentiful and currently produced. The oil pan that is required with the Vango rear mount must have the deep section at the flywheel end of the engine. The pan and pickup tube from a rear sump engine will fit a front sump engine (photo 8). Get the main bearing bolt that the pickup tube attaches to while you're switching. These engines are standard in '74 and newer Pintos, '74 thru '78 Mustang II's, Ford Fairmonts, Ranger mini pickups, '79 and newer Mustangs and Capris and other Ford and Mercury products. The pre-'79 Mustangs and all Pintos have the wrong oil pan for the Vango rear mount. The '79 and newer Mustang and Capri have the correct oil pan.

Distinguishing Between a Ford 2000 and 2300 Engine

There are several easily identifiable differences between the two 4 cyl. Ford engines. The 2000 cc. has ribs stamped into the cam cover, the distributor is slightly in front of the fuel pump, the oil filter is right next to the fuel pump and the oil filler is at the front of the cam cover. The 2300 cc. has no ribs but the script Ford stamped into the cam cover, the distributor is slightly behind the fuel pump, the oil filter is toward the back of the engine and the oil filler is at the back of the cam cover.

Ford 2600 and 2800 60° V6 (Photo 10)

This compact and durable engine, built in Cologne, West Germany, has been available in the U.S. since the introduction of the Capri in the early '70's. It was upgraded in '75 to 2800 and was available in the Pinto as well as the imported Capri and Capri II. It was also available in the '74 thru '78 Mustang II. It was available in the '79 (current body style) Mustang and Capri until about '81 when they put the old in-line 6 back in as a cost-cutting move, I guess. I thought this engine was gone forever but Ford was forced to bring it back again from West Germany for the '83 Ranger pickup when Chevy started getting ahead in sales with the 2800 60° V6 S-10 pickup. The oil pans that will fit the Vango rear mount are the Capri (all years) and '79 and newer Mustang. Again, these pans and pickup tubes will interchange or can be purchased new from Ford. These engines are smooth, powerful and durable.

GM 2500 4 Cyl. (Photos in Hot VW Reprint)

This engine traces its roots to the '60's and started life as half of a Chevy V8. The engine plant was sent to Brazil for a few years but Pontiac Division re-introduced it in the late '70's and named it the "Iron Duke" and put it in the Chevy Monza and Pontiac Sunbird rear drive compact cars in '77 or '78. When the "X" car side winder front drive cars arrived as 1980 models in '79-1/2, the cylinder head was re-designed as a "cross flow" with the intake manifold on the opposite side from the exhaust manifold. This cross flow engine was used in the rear drive Monza Sunbird from '79-1/2 and newer as well as in the front drive X car Citation (or divisional equivalent), front drive A car Celebrity (or divisional equivalent) and '82 (current body style) and newer Camero-Firebird and some newer AMC Jeeps. It is necessary when

ordering your Vango kit to specify cross flow engine if the engine you are using is so equipped. All engines from front drive cars are cross flow and rear drive cars from about '79-1/2 are too. They changed the crankshaft pattern and bellhousing from the Chevy V8 and 90° V6 pattern to a new pattern when they went to a cross flow head. The 4 cyl. engines from front drive "side winder" cars have the upper water outlet at the flywheel end of the engine which requires a dent to be hammered into the center of the fuel tank of the VW bus. This is a very easy procedure and doesn't require removal of the tank. This engine has hydraulic valve lifters and is durable and powerful. The '82 Camero Firebird 4 cyl. motor mounts must be used with these engines for Vango applications.

The side mounted water pump on this engine, when from a front drive side winder application (photo 19), requires less rear door modification than the same engine from a rear wheel drive application with the water pump mounted on the end of the engine.

GM 2800 60° V6 (Photos 11 and 12 Center)

This engine was introduced with the introduction of the front drive "side winder" X car and now is offered in other (A car) side winder applications as well as rear wheel drive (S-10 and Camero-Firebird) vehicles. The engines from front wheel drive cross mounted (side winder) cars differ in some ways from those in rear wheel drive vehicles. The upper water outlet, which exits at the rear (flywheel end) of the intake manifold, will not clear the fuel tank in the VW bus. The intake manifold can be turned around putting the water outlet at the correct end of the engine. Grinding some metal from the water pump housing that contacts the new position of the intake manifold is necessary. This changes the carburetor and air cleaner locations and may require rework for air cleaner to distributor clearance and other clearance considerations. An alternative is the purchase of a rear wheel drive intake manifold and related parts. Rubber motor mounts for a rear wheel drive engine must be used along with an oil filter adapter for a rear wheel drive engine. This engine is fairly new but seems to be a very good one. These engines are equipped with hydraulic valve lifters. It will probably be the Chevy V8 of the future and there will be millions of them soon. Replacement parts and accessory equipment should be plentiful and inexpensive. This engine is very smooth and powerful. Specify if engine you are using is from front drive or rear drive when ordering.

Buick V6 90° (Photos 9 and 12 Right)

This engine can trace its roots to the early '60's too. It was used in Buick and Olds compact cars originally and the entire engine plant was later sold to Kaiser Corp. because they were buying the engine and using it in the Jeep, and GM couldn't give compacts away in the late '60's. When Kaiser sold Jeep to AMC the engine plant was part of the deal but AMC had their own straight 6 and V8 engine so they shut the V6 plant down. When the energy crunch hit in '73, GM made a quick call to AMC and bought it back. It's not hard to understand why AMC went broke with decisions like that. The only guys dumber than AMC are the guys from France. The engine was again offered by GM in '75 and underwent its most significant improvement in '77-1/2 when they changed (splayed) the crankshaft rod journal locations and created the "even fire" engine. This gives equal spacing between the firing pulses of the engine. All 60° V6 engines have natural equal spacing. You can identify an even fire from an odd fire by the plastic bolt on timing mark on the front cover by the crank pulley. The pre- '77-1/2 odd fire engines use a timing mark that is cast into the aluminum front cover of the engine. The even fire is the most desirable but a good odd fire is okay; they just sound like they are missing at low rpm. All Buick V6 engines have their distributor at the front or water pump end of the

engine and all Chevy V6 engines, both 60° and 90° versions, have their distributors at the rear or flywheel end. The Buick V6 is a very good engine and if you decide to use one, buy a book to help you identify the various displacements and horsepower ratings offered. It is currently offered in 3 litre side winder form in Buick A cars and 3.8 natural and turbo versions in many mid-size rear wheel drive cars as well as a 4.1 4-barrel carburetor version in some larger GM cars. It is also used in front drive Rivieras. This engine has been used by all five GM car divisions.

Chevy 90° V6

This engine is not sold in California (California Chevys have Buick V6 engines) and I am not familiar with it. Six cylinders of a Chevy V8 can't be bad though. This engine is sometimes confused with the Buick because they each make a 3.8 litre version. The Buick is actually a 231 cu. in. and the Chevy is a 229 cu. in. A Chevy turbo charged car will have a Buick or if the Chevy was originally sold in California, it will have a Buick V6. Again, if the distributor is at the flywheel end, it's a Chevy. You can even buy an aluminum block and heads from your Chevy dealer for this engine to save about 100 lbs. weight. This will only cost you about \$25 a pound! Many wrecking yards don't really understand the difference between a 60° 2.8 litre V6 Chevy and a 90° 3.8 (229 cu. in.) V6 Chevy so be careful. Until '82, 2.8 engines came only in front drive and 3.8 came only in rear drive. Now, with the Camero-Firebird and S-10-GMC truck rear wheel drive 2.8 applications you must be more careful. Both have the distributor at the flywheel end but beyond that they are totally different. The 60° head and valve covers are closer together because of the angle of the heads on the block. The oil filter and fuel pump of the 60° are at the left (driver's side rear wheel drive) front and I imagine the Chevy 90° V6 is like the Chevy V8 with the fuel pump at the right front and the oil filter at the left rear. These big 3.8 motors are really no larger in exterior dimensions when you get the tape measure out but they look bigger.

The 3.8 motors will probably give 1 to 2 mpg less than the smaller motors and they won't overburden the very fine VW bus transaxle if driven with reasonable self control.

4.3 Litre Olds Diesel 90° V6

We have no experience with this engine and it was only mentioned in the Hot VW's article because it is installed in the front drive side winder GM "A" cars and will probably fit in the VW bus engine compartment. Several serious questions remain as to the suitability of this engine for the VW bus. It doesn't do much better fuel consumption-wise than the standard 2500 4 cyl. gas engine in the A car and probably requires very high gear ratios to do that. Many gas 3.8 litre Vango applications require using a Rabbit diesel starter for good cranking power. Who knows what it would take to crank the diesel some cold morning.

1.8 and 2 Litre GM 4 Cyl.

This all new 4 cyl. was introduced in the '82 GM J car (Cavalier) as a 1.8 litre engine and increased to 2 litres for '83. I imagine it is the same engine used in the non-California version of the 4 cyl. Chevy S-10 pickup. This engine has the same bell-housing and crankshaft bolt pattern as the GM 2800 V6 and we will probably offer a Vango kit for this engine using rear wheel drive motor mounts in the future. The water outlet in the J car side winder application looks like it will interfere with the VW bus gas tank however. The S-10 engines should be fine.

General Engine Information

The economics of the auto wrecking business are a little strange as are some of the people that run them. Many times you can purchase a relatively new low mileage

engine for little more than some tired old core missing half the accessories. This is because if the particular model engine hasn't been on the market a long time the demand for it from the repair shops and the rebuilders hasn't fully developed yet. If the wrecker hasn't received calls over the hot line for it and he thinks he may have it awhile, he might be willing to make a fast nickel instead of a slow dollar. I said he was strange but not necessarily stupid. Try to get your engine complete with all accessories including air conditioning compressor if necessary. He can keep the power steering pump and the starter if he will deduct for them. He can even keep the fan if he will forget the sales tax. Try to get all the ignition parts including the coil if it isn't integral in the distributor and the voltage regulator if it isn't integral in the alternator. You need nothing beyond the back of the block and crankshaft bolt surface (photos 7, 9, 10 and 11) and the engines can be from stick or automatic vehicles.

The choice of engine for use in your Vango depends mainly on your personality with your wallet coming in a close second. The little 60° 2800 cc V6's from Ford and GM offer the best compromise between economy, smoothness and performance. The Ford 2300 cc 4 cyl. and GM 2500 cc 4 cyl. have excellent torque curves and if your personality allows you to up-shift before you have used up everything in the gear you are presently in and you are willing to drive at reasonable speeds you will find these 4 cyl. engines willing, able and economical even for heavy trailer towing applications. The nice feature of the Vango kit is that you can change from one engine to another for the price of the small crankshaft flange and a rear cross-member. The big 3.8 litre Chev and Buick 90° V6 motors are kind of an overkill but if you are willing to give up a couple miles per gallon there is no question you will be king of the hill. I'm not talking about other vans, I'm talking about taking on big block pickups.

Some '80 and newer engines have electronic controls for the carburetor and a few control the distributor advance electronically. If the distributor has no vacuum advance diaphragm it could mean it is electronically controlled. The carburetor will have electrical connections at the float bowl if it is electronic. Some brave souls will wire the computer from the original car into the VW bus while others will find carburetors and distributors from earlier engines to replace these. Remember, an odd Fire '77-1/2 or earlier Buick V6 distributor won't work in an even fire engine. Accel and Mallory advertise in Hot Rod Magazine every month and their distributors are available nationally.

Holly offers a "Performance Parts Catalog" that is a great help in providing carburetor information for these engines and they also make intake manifolds to match their carburetors. Engines with fuel injection will need the original computer or could be converted to carburetion.

Holly also offers a new electronic carburetor with a dash controlled lean-rich knob! I wonder if that dash unit would work with the electronic carburetor on your engine? See Page 37 of the '83 Holly high performance catalog for details.

This little dash mounted black box with a rich-lean knob is called a D.C. Generator or signal generator. It sends a signal to the electric selenoid in the carburetor float bowl that acts like a variable main jet. This little D.C. Signal Generator and wire harness, available separately from the rest of the Holly carburetor kit known as "Mile Dial," could possibly turn an electronic carburetor into a very desirable unit. Electronic carburetors will usually run without any wires to them but they will get poor mileage because without any signal they are too rich all the time. Ask your auto parts store about replacement parts for the "Mile Dial" kit. The two items mentioned should run under \$50.00.

I tried the Holly D.C. Signal Generator with a GM carburetor and it works! What more could a man ask for than a dash controlled variable main jet in his carburetor and his best girl beside him crusin' down the road? If you get a bad tank of gas (but it was only 97¢ a gal.) and she starts pinging just dial in a little rich. If you're on level ground and you want to try for a new mileage record, dial it lean till she pings a little and back off a bit. Don't tell anybody about this till you get one for yourself. If everybody finds out about it they will be out of stock at the local parts house when you want yours. Note: This Holly generator seems to be a way of using an electronic carburetor if the engine you select has one. On the other hand I don't mean to imply it is necessarily superior to a good old manual carburetor with proper jetting.

Vango Vanagon Kit

We are developing the Vango kit for the '80 and newer VW Vanagon at this time. It should be available by November '83. We have one customer in Northern California who found a '82 Vanagon diesel that had been hit in the side and he is already running around in his '80 "Vango Vanagon" with a 1983 Buick 3.8 with 3,000 miles on the clock when it volunteered itself for a "transplant." All Vanagons have the large cavity above the spare tire for radiator mounting and the Vanagon water cooled grill is available over the counter at the dealer. Just cut the hole with a sabre saw and you're ready. Our kit will have a larger capacity radiator than the factory unit and will consist of the same basic hardware of the pre-'80 Vango kit minus the round radiator frame. A raised section in the middle of the stock Vanagon hatch will be all the modification necessary at the rear.

WARNING: IF YOU OWN A '72 OR NEWER VW BUS YOU DO NOT HAVE TO READ THE FOLLOWING PARAGRAPH. JUST BOLT THE FLYWHEEL AND CLUTCH FROM YOUR '72 THRU '79 VW BUS TO THE VANGO FLYWHEEL, BOLT THE ENGINE TO YOUR TRANSAXLE AND DRIVE AWAY.

What VW Transaxles Will the Vango Adapter Fit?

The VW bellhousing-flywheel-starter design has undergone very few changes over the years. With only two optional adapter pieces any VW transaxle from any year air cooled VW vehicle can be used with the Vango adapter plate and flywheel. By designing the Vango adapter to accept the '72 and newer VW bus flywheel and clutch you are able to use the largest clutches ever offered by VW. Following is a brief history of the changes over the years in the hopes of clarifying what is needed to prepare your transaxle for a Vango kit. In 1966 VW went from a 6 volt to a 12 volt electrical system and changed the teeth on the starter and flywheel. All that is necessary to use any 12 V flywheel in a 6V transaxle is the removal of a small amount of aluminum where the 12V flywheel teeth will contact the bellhousing of the 6V transaxle. In '71 VW installed a different throwout bearing design in all model transaxles. This newer throwout bearing allowed the use of the diaphragm clutches which most other cars including Porsche had been using for years. In '72 VW introduced the new type engine in the bus which they had used in the short lived 411-412 series VW car and in the 914 Porsche. This new engine uses a five bolt method of attaching the flywheel to the crankshaft instead of the old fashioned and unreliable method of using dowel pins. Luckily they retained the same 12V starter and flywheel diameter and tooth pattern. This allows the '72 and newer bus flywheels, with their big clutches, '72-'73 210 mm (approx. 8-1/4") '74-'75 215 mm (approx. 8-1/2"), to be used inside any VW transaxle. The last change took place in 1976 to the VW bus. The largest clutch the factory engineers could put in the VW bellhousing, without the pressure plate hitting the starter bendix spring, which is directly behind the starter gear, was 215 mm (8-1/2" approx). To go to 228 mm (9" approx.), which they did in '76, they moved the starter

back from the flywheel and put a longer gear on the starter so the bendix spring won't contact the pressure plate when the starter gear engages the flywheel gear. There were slight clearance problems between the 228 mm pressure plate and bellhousing as well. They introduced a new bellhousing with the new starter location and additional pressure plate to bellhousing clearance. This bellhousing will bolt to any '68 and newer VW bus transaxle.

Since this would be of no help to anyone wanting to put a 228 mm clutch in a beetle type transaxle (the non-bus and pre-'68 bus transaxles don't have a separately cast bellhousing), we were fortunate to find an easy way of altering your beetle type bellhousing to accept this 228 mm clutch. This bellhousing alteration works equally as well on the pre-'76 bus bellhousing and saves the cost of a new bellhousing. This method doesn't require the '76 bus starter, just use the long gear from the '76 starter which you can put on the earlier starter or the rabbit diesel starter, whichever you are using. This kit (VGS228), which consists of a starter housing spacer, starter shaft extension bushing and bellhousing clearancing gauge with instructions, is needed only if you are installing a '76-newer 228 mm (9" approx.) flywheel and clutch in a non-bus transaxle or a pre-'76 bus bellhousing. A small power grinder is necessary to perform the clearancing inside the bellhousing. It is not necessary to remove the input shaft from the transaxle to grind the necessary reliefs. This kit is not necessary for installation of the '72-'75 clutches and flywheels in any VW transaxle. If you own a '72-'75 bus I wouldn't spend the money to change over to the biggest possible clutch ('76 and newer) even if very heavy trailer towing is involved. The '72-'75 clutches are very strong. If you have a '71 or earlier bus or a different vehicle such as a kit car, dune buggy or baja bug the largest 228 mm clutch and flywheel is nice but is harder to find in a wrecking yard than the '72-'75 clutch and flywheels. If you are purchasing a new clutch and flywheel from a dealer I would recommend buying the largest possible ('76 newer 228 mm) because the price difference is very little.

Another item available from us for the VW transaxle is a collar to allow the installation of the '71 and newer throwout bearing in any '70 or older VW transaxle. This is necessary when using any '72 and newer bus clutch and flywheel. A '71 or newer type throwout bearing cross shaft must also be installed in your '70 or earlier transaxle. Purchasing this special collar from us and the throwout bearing cross shaft new from the VW dealer is usually easier and less expensive than trying to get a '71 or newer bus bellhousing from a wrecking yard. If you are installing a Vango against a non-bus pre-'71 transaxle the collar is the only alternative.

The VW Bus Transaxle

Generally speaking, the newer the VW bus the higher (numerically lower) the gear ratio will be. All '68 and newer VW buses have a much stronger transaxle than the VW beetle and there should be no problems with pre-mature failure due to the added torque of any of these engines unless you punish it unmercifully. Don't go bigger than 3000 cc with an automatic. Many of the gears and bearings found in the VW bus transaxle are larger than those found in a Corvair transaxle. The Corvair was factory equipped with a 2800 cc engine. Almost all off-road racers have switched from bug transaxles to '68 and newer bus transaxles because of their greater strength. If you are ever hunting around a wrecking yard for a replacement for your transaxle the most desirable is the '76 and newer unit which will have a "CP" or "CT" number stamped on the case. The tooth count on the ring and pinion in most of these '76 and newer transaxles is 7-32 (4.57 to 1) which is the highest (numerically lowest) ratio for the VW bus. The fourth gear in most bus transaxles is .85 to 1 which drops the overall gear ratio into the threes. Higher fourth gears from the Vanagon can change the fourth gear cruise ratio even more for the real big motors if

desired. Taller tires, usually requiring a fender flair cut, is another alternative for high road speed applications. Unless your present transaxle needs replacement it isn't worth changing gears now.

The second most desirable is the '74-'75 model with a "CM" or "CN" stamp. These transaxles have a 7-34 (4.86 to 1) ratio. These letters are usually stamped on the bottom toward the front of the transaxle. All '68-'79 bus transaxles will interchange into any other '68-'79 bus. The bellhousing and front motor mount are the only areas of incompatibility. In '71 they changed to the new throwout bearing design that is needed with a Vango installation. In '72 they changed the front motor mount but the '68-'71 and '72-'79 front mounts will interchange. In '72 they also cast two ears on the top of the bellhousing for a center mount. These ears are necessary if you are installing the transaxle in a '72-'79 bus. In '76 they re-designed the bellhousing to accept the 228 mm (9 in. dia.) clutch. I think the '80-'82 Vanagon transaxle is the same except rear mount and bellhousing.

Supporting Engine During Installation

If a hydraulic boom "cherry picker" is not available when installing the engine there are a couple of alternatives. A hydraulic floor jack with wheels and a large base can be substituted. To achieve stability of the engine on the jack remove the oil pan and pickup tube. Do this by first standing the engine on the bellhousing end after you have drained the oil. Remove the pan and pickup tube and build the wooden stand to fit before tilting the engine onto the stand. Build a wooden platform from 2 x 4's and plywood. Lay 2 x 4's along each side of the crank on the block until you are below the level of the crank. Usually this will take two layers. Span across, under the crank with thick plywood and nail it to the 2 x 4's. Nail additional 2 x 4's under the plywood for clearance to roll the jack under and for the adapter plate. This will give you a large flat surface to achieve the proper balance point for safe engine installation. Never lay under the vehicle in a position that would allow the engine to fall on you if it slipped off the jack unless you can bench press over 350 lbs. It is also recommended to have the rear tires on for insurance against the vehicle falling unless you can bench press 2,000 lbs. That should stop most of the big guys.

When using a "cherry picker" the attaching chain must be long enough to be attached to the engine in a position that will allow the boom to be high over the engine so it permits the engine to be lowered to the floor under the bus without the boom striking the rear of the engine hatch opening. The chain must also be bolted to the engine in a position to permit the engine to move rearward from the transaxle without the chain hitting the rear of the hatch opening.

Installing While You Drive

Many customers continue to drive their buses while they are installing the Vango kit. You can install the entire cooling system, cut and install the engine hatch and lower panel, install gauges and wires and get your new engine ready while you are driving your bus daily. You wouldn't have to be without the bus for more than a few hours if you planned it well!

Vango Engine Adapters for Vehicles Other Than the VW Bus

All VW cars, with the exception of a stock bodied VW beetle, lend themselves very well to a water cooled transplant. They all have a long engine compartment enclosure and room in front for a radiator and electric fan. Thick wall 1" x 2" rectangular tubing with short round end pieces welded on is the best way to get the coolant from front to rear. Attach the tubing under the floor pan. The 1" depth of the tubing gives good ground clearance and the thick wall resists

crushing. The VW models that hang the rear of the engine with a cross bar and motor mount can use the Vango rear mounts for the bus with minor alterations to the mount of the outer ends.

Baja bugs are a natural because they are wide open at the rear and have more room up front than a stock bug. Porsche 914's also can use the Vango kit and are a natural. Many kit cars have enough engine compartment room also.

The VW Variant type III fast back and notch back models have a huge engine compartment and the station wagon squareback model has the same if you raise the hatch lid in the floor to clear the carburetor. The Karman Ghia doesn't have as much as the Variant but most engines will clear the deck lid top and rear. The front grill treatment can be as varied as the grills hanging in the salvage yard. How about a '53 De Sote grill from a lead sled? Well, maybe not. How about the new Vanagon diesel grill?

Adapting the Rabbit Diesel Starter

The starter on a stick shift Rabbit diesel is about as big as the engine. It has the same gear and throw as any 12 volt air cooled VW starter except the '76 and newer VW bus starter. The only difference is the spacing of the two mounting ears. Take a rotary file or drill bit and carve the aluminum from the inward or bottom portion of the upper hole only. This is the one next to the selenoid. You should now have an elongated upper hole with the elongation facing directly towards the center of the shaft. This is important because the hole has to line up with the nut relief cast into the housing by the hole. Find a standard American 3/8" nut which will have a 9/16" hex. Tap this nut to 10 mm x 1.5 pitch. This will give you a nut that will clear the selenoid housing if you use a 9/16" open end wrench to install it. Remove the stud from the lower starter hole and install the starter. Depending on the upper stud length it may be necessary to start the upper nut before the starter is completely seated in the bellhousing. Sometimes a short handle 9/16" open end is necessary to reach the nut. Go ahead and cut the handle off your wrench, just make sure it's not a snap on. Drill a 1/4" hole through the lower starter mounting ear to one side of the original hole and install a 1/4 x 1-3/4" high grade bolt and washer and nut the other side. You now have a gorilla starter that will crank anything including a high compression Chevy V8. The Bosch rebuild number for this starter is SR92X. Check your wrecking yard first.

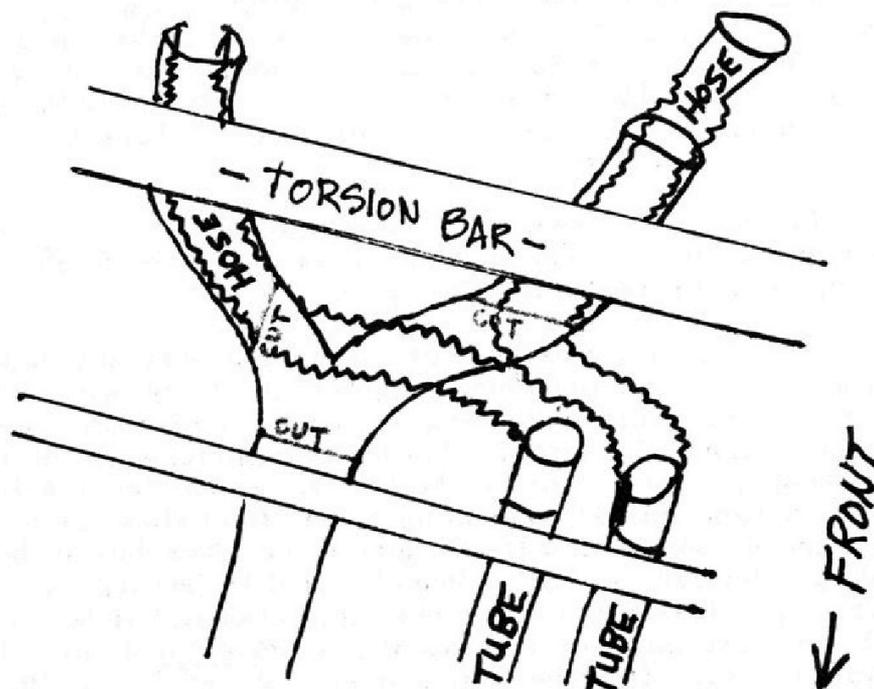
Special note: There may be some instances, because of casting variations, where a small amount of transaxle ribbing may have to be relieved to clear this starter. The later transaxles have thicker ribs but I have found that although the starter rests against the ribs they are not holding the starter in mis-alignment to the hole. There is a small section of metal that must be cut from the over-bellhousing support on the '72-'79 bus to clear the selenoid housing of the diesel starter. This cut can be most easily made before the engine is installed if you anticipate ever installing this starter. It could be done later but would require a cutting torch. Simply remove the two bolts holding the bellhousing up and allow it to hang out of the way. Make two vertical cuts through the holes in the support member directly above the starter hole in the bellhousing. Now cut across between the two vertical cuts and remove this 2" section. Keep the outside cut as close to the rubber mount as possible. Do not cut any material from the hangar bracket that is rubber mounted. Only cut the metal directly attached to the body. You may also hammer the floor above the starter slightly to gain clearance for the selenoid. It misses without doing this but only by 1/4". When installing the diesel starter in a '76 or newer bus it is necessary to install the gear only from hour original starter on the diesel starter and get a specialbushing from Hadley Engineering to support the end of the starter shaft in the bellhousing. This is necessary on the '76 and newer bus only. Only the over 3 litre motors should need this starter but it's great to know a high capacity starter is available if you need it.

I would recommend everyone make the simple support modification while the engine is out in case you want this starter later. This starter will adapt to any VW transaxle with a 12 volt flywheel.

VANGO COOLING SYSTEM INSTALLATION INSTRUCTIONS

The Vango cooling system is designed to allow some variation in the routing of tubes and hoses, depending on the year and model of your VW bus. Air conditioning units mounted beneath the bus need not be relocated to accommodate the collant tubes, simply cut the holes high enough to allow the tubes to clear the electric fan motors at the top of the air conditioning unit. Both tubes should be routed to the right of center to stay away from all steering and brake linkage. You may want to cross over with one of the tubes at the rear of the bus, however. Six 30-inch lengths of flexible hose are provided to service those areas that require flexibility. Two short sections of hose are provided to couple the four lengths of tubing that run under the mid-section of the bus. They also allow the slight directional change necessary at mid point. A 90° elbow is provided for the top radiator inlet. By basing the system on six equal length, equal diameter hoses, one spare hose can handle almost any replacement need you may have.

On most models, the area under the rear of the bus, between the torsion bar tube and the floor of the bus, provides enough room to squeeze two hoses through on the passenger (right side (photo 15)). The '68-71 buses offer less room to route the hoses between the floor and the torsion bar tube than the later model buses. Fortunately these models have larger heater tubes passing over the torsion bars and are ideal for routing the hoses inside. Since it is difficult to position a saw to cut the "Y" section out to gain access to these tubes I would go to a muffler shop while your bus is still running and have them quickly torch cut this "Y" section out. First determine if the hoses will pass through by removing the connector between the air cooled engine and the tube and passing a 1-1/2" flexible hose through the tube. The later model buses have tubes that are squeezed almost flat as they pass over the torsion bar housing but these models have ample room to get between the floor and the torsion housing outside the tubes (photo 15). Another feature of opening the heater tube is being able to route the heater hoses forward through the center tube. You can pull them through with a plumbers snake and bring them up through the front right into the cab. It also keeps them warmer and protected.



A third alternative method of routing the hoses at this point is to cut two holes in the floor on the right side directly in front of the torsion tube and run the hoses up through these and out two more 2" holes under and behind the rear seat through the angled metal panel. This will put your hoses right on top of the transaxle. Note: Drill small pilot holes first to check if this is exactly where you want your larger hole. If you are drilling a hole to attach a hanger bracket to support a cross-over tube, remember you have a fuel tank above this area! Use silicone rubber caulk in large tube form that fits a caulking gun to re-seal the passenger compartment around the four holes under the rear seat. If yours is a camper, routing the hoses this way takes up very little under seat storage.

Attach the radiator frame to the nose of the bus with the upper bolts only. Remove fresh air grill and put bolts through grill slots at appropriate position to align with the frame. Rotate until bolts will face directly forward. Re-install the air grill on bus. Slip frame over bolts and hold in desired position and mark around lower attaching struts. Remove the frame and drill the lower holes. Install the lower bolts with large washers on both sides of the hole and first nut. Additional washers can be used on lower bolts to achieve desired angle of "spare tire" relative to the nose of the bus. Slip the frame over the four bolts and determine location for the lower radiator hose hole. Because of the angle the hoses must exit the nose holes, it is necessary to cut two overlapping holes, one on top of the other with the sides trimmed with a sabre saw (photos 1 and 2). The upper edge of the upper hole should be about even with the crease line that runs across the nose of the bus. The distance from center for the lower (right) hose is determined by the location of the lower radiator outlet. The left or "upper" hose hole can be the same distance from center or slightly closer to center to help hide it from view. Remove the splash pan from under the nose of bus (photo 13). To align companion holes to nose holes in panel under bus, use a small drill bit and drill through the lower vertical panel found directly below and in front of the front floor area. Drill at the approximate location from center as the nose holes by observing bit location through large hole just cut in nose of bus. After proper alignment, hole saw lower holes with one round cut. The left hose should be fed through the nose hole farther than the right and the longer section of the two sections of forward tubes should serve the left or "return" side. Wear gloves while cutting holes to protect hands.

Note: When separating or installing the lower radiator hose onto the radiator it is easier to loosen the radiator and frame from the nose of the bus and pull away or toward the hose than to try to pull or push the radiator hose onto the lower radiator outlet. Feed the small overflow hose to the recovery bottle through the right hole and seal around inside of nose hole with clear silicone. Feed copper tube to fan control through left hole and seal.

Two holes must be cut at the rear of the area covered by the splash pan found under the front of the bus. Both of these holes should be to the right of the heater tube running down the center (photo 14).

Small lengths of slit open radiator hose can be placed over any tube section that is resting (metal to metal) in any hole. Tighten all clamps with a small socket wrench instead of a screw driver to assure a tight connection. Silicone can be used between connections if desired. Silicone is especially useful when installing the fan thermo-couple sensor. Install the copper sensor between the left front flex hose and the short tube section connecting to the final elbow at the top of the radiator. Installing the sensor at this location allows the black box to be inside the vehicle (photo 2). Be sure sensor is installed in left "return" hose for accurate temperature reading. Install fan wires per instructions, but be sure the hot wire is connected to the fuse block on a terminal that does not go off with the key. The fan must be able to work after the engine is shut off as this is the time uncirculated

water can reach its highest temperatures. The fan will automatically shut down when the water temperature reaches a normal level in a couple of minutes so don't worry about running your battery down. Under normal conditions your fan will seldom, if ever, come on even in heavy traffic. You may wish to make final attachment of coolant hoses at the engine with the original hoses for your engine because of their molded bends or you may wish to use a length of flexible hose at the outlet with a smaller diameter and step up at the first connection to the 1-1/2" diameter of the Vango hoses. A coupler is provided with the coolant hose kit for this purpose. Attaching the upper hose and sometimes the lower hose to the underside of the floor, along the perimeter of the hatch opening, is a sanitary way of keeping the hoses off the engine and away from the exhaust. Larger hose clamps attached to the underside of the engine compartment floor and then passed around the hose is one method of holding the hose up in place. A long section of tubing that can be hack sawed to the required lengths for your particular engine is provided. These special lengths can be cut by the installer and placed between the four 30-in. sections of hose provided for the rear (photo 15).

It is essential to a proper cooling system installation that the fluid recovery system be used. Steam pockets could form in a cooling system that didn't allow for expansion and the replenishment with liquid when the maximum amount of expansion is not needed. A recovery system does just that. Mounting the bottle within view of the driver allows a quick visual check of the system (photo 27). Use good quality rubber hose and clamps between the radiator cap and the bottom of the bottle and between the bottle overflow and the outside dump tube. Always use antifreeze in your system.

VANGO HEATER INSTALLATION INSTRUCTIONS

The Ford Courier-Mazda heater is the easiest to mount at the front of the bus and even has a built-in water valve. If you decide on the Ford Courier-Mazda heater, simply cut the two bolts from the original mounting bracket on the heater and drill two holes in the bracket. Now drill two smaller holes in the fresh air box at the front of the bus and sheet metal screw the heater in place. Mount the heater above the floor approximately 1/2 inch to allow the defrost-heat door to fully open. If you wish to cover the front of your heater to hide motors and controls, the aluminum electronics chassis of various dimensions are useful and can be cut to fit and then sprayed with a crackle finish from a spray can for a nice effect (photos 27, 28 and 29). They are available in various sizes at your local electronics store.

The safest location for the heater controls is up on the dash, and the lip at the bottom of the dash offers a good mounting surface to bolt the heater controls to if you don't want to attach to the original VW controls.

The easiest way to adjust for increased distance between the new mounting position of controls to heater, if needed, is a choke or hood release cable from your auto parts store. Purchase one cable long enough to make new cable lengths for all of your controls, usually two. Remove the inner wire and cut the outer flexible housing as needed. Reinstall and cut inner wire to required lengths leaving enough tail to curl ends with needle nose pliers if required.

Attach the original defroster hoses from the heater you are using to the defroster manifolds under the dash of the VW bus (photo 30). Remove the "Y" tube from the defroster manifolds by snapping the manifolds out of their receptacles under the dash with your hand. You can now separate the "Y" tube from the manifolds. Determine the length and diameter of defroster hose necessary to slip over the original defroster hoses from your heater and a diameter that will fit inside the VW bus manifolds. Splice these sections together with grey duct tape and snap the

manifolds back into place under the dash and connect the remaining hoses together. It is usually easier to work under the dash after removing the glove compartment cardboard.

When installing one heater at the front and one at the rear, the water hoses can be routed by two methods. Running them in series does not require any "Y" junctions or a second water valve control for the rear unit. Since you need no control for defrost at the rear, all that is necessary for controls for the rear heater is the electric fan switch wires. Bring the heater inlet hose from the engine forward to the water valve at the front mounted heater. Take the outlet hose to the rear heater inlet. Take the outlet hose from the rear heater back to the return fitting at the engine. The temperature of the water passing through the rear heater won't be quite as hot as the water passing through the front heater by this method of installation but it is less complicated than parallel and will be very adequate for most applications even in Alaska. Two heaters in the Vango bus are not necessary in most climates but it's nice to know it can be done if necessary. It may be necessary to change the size of the water inlets and outlets at the engine or heater depending on heater and engine used. Brass or plastic hose barbs and fittings to accomplish this are available at auto parts stores if you can't cheat the two together with silicone and careful clamping.

The Ford Courier--Mazda heater fits easily under the back seat of any model VW bus and can be mounted near the center of the non-camper models to evenly distribute heat right and left without using the defroster hoses (photo 32). Just fix the door in the open position and leave the cardboard facia plate off the legs of the seat. Mount the heater at one end of the under-seat compartment in a camper and use the defroster hose to distribute air evenly left and right by fixing heater door in defrost position (photo 31). This method of distribution can be used on the non-camper models as well if desired.

Heaters from other mini pickups may adapt as easily as the Courier-Mazda units. If you come up with a good adaptation send us a black and white photo so we can use it in future instructions. Most heaters have a fresh air and recirculation method of operation. The recirculation mode provides greater heat capability because the air entering the fan is from inside the vehicle and has already been warmed. Because of the difficulty of tapping the system into outside air we recommend using the recirculation mode only. Never mount a heater where the fan could draw contaminated (carbon monoxide) air and pass this air into the vehicle. As long as the air being drawn into the fan is air from within the vehicle, or air from the front of the vehicle there is little danger of it being contaminated. The original fresh air system can be used to mix with the heater air if desired. The original fresh air system will now provide slightly pre-warmed air because of the proximity of the radiator to the air intake.

This is a very comfortable form of fresh air about ten months of the year. In July and August keeping the system closed and bringing outside air through the wind wings is more satisfactory if you don't have air conditioning in your bus. Blocking the center half of the intake grills will still allow plenty of air flow through the system and keep some of the air that has passed through the radiator from entering the system if desired. The amount and position of blocking can vary depending on the climate where you live. In cooler climates you will probably prefer an unrestricted grill and will prefer the new air temperature to the old.

Never attempt to tap into the water system with the heater hoses other than at the original positions on the engine. These positions allow the pre-heated water to flow before the thermostat opens for quicker heat and allows the returning water to bypass the radiator water and not be cooled any more than necessary.

ALTERATIONS TO ENGINE COMPARTMENT REAR DOOR

None of the previously mentioned engines have any problem with the crank pulley clearing the Vango aluminum panel below the engine compartment rear door. Some water pump pulleys require removing the door from its hinges, laying it face down on a cloth and removing some of the inner structure with an abrasive metal cutting blade in a circular (skill) saw. This method of cutting is also the fastest way to make the hatch cut and the cuts below the rear door. You may also use this blade to cut the end from the water pump shaft if necessary. This shaft extension was used to locate the fan which is no longer necessary. You can also replace the small studs holding the water pump pulley to the shaft with cap screws, if necessary. The water pump pulley is usually right behind the license plate. Some air conditioning clutches protrude beyond the pulley line and if the location of the compressor is within the recessed license plate area it may be necessary to "bubble" the panel in this one spot. Hood "hold down" pins from your local auto parts store can be used at the lower corners if it is necessary to remove the original latch. You can leave the latch to fill the hole but it may be necessary to cut off the inner portion. These door alterations will not be necessary with most engines. The 2500 Chevy 4 rear wheel drive is the longest engine. The front wheel drive version is used in the brochure photos and requires no inner door modification.

CUTTING THE REAR PANEL OF THE '72-'79 BUS

The rear panel below the engine compartment door must be removed to allow easy installation of the engine. A hack saw or sabre saw can be used for this task but a metal cutting abrasive blade in a skill saw is much faster and easier. Cut a 27-1/2" section from the middle of this panel. Find the center and measure 13-3/4" in each direction. The installation photos show a narrower opening which required removal of engine accessories and held no advantage. Don't worry about cutting the ID number because it is only a duplication of the dash attached number which is the official location prescribed by law. If you feel you should retain the number simply make a horizontal cut below the number instead of continuing your vertical cut and fold the remaining sheet metal with the number back out of the way. You no longer need sealing of the engine compartment door, the rubber is only needed for proper door spacing and tensioning and can be cut off at the lower corners. File any burrs flat that are left from the cutting process.

Lay the angle iron (photo 18) in position inside the openings at each end of the cut and vise grip the angle iron to the inner surface of the remaining panel with one angle iron surface facing up and the other facing out. Drill a 1/4" hole about one inch outboard from the cut on each side through the outer panel and the angle iron. Remove the vise grips and lay the aluminum panel (photo 19) against the angle iron aligning the upper edges. Drill 1/4" holes through the aluminum to align with the previous drilled holes. Install 1/4" bolts through all three surfaces and attach lock washers and nuts on the back side of the angle iron. The panel can be painted flat black or the color of the bus. If the original bumper or Vango trailer hitch with original rear bumper over it is used, the upper edge of the bumper conceals all but the upper 1/2" of the panel. The short section of angle iron provided can be drilled and bolted to the long section to provide a striker plate for the door latch. Washers are furnished to provide spacing between the two sections of angle iron (photo 19) for proper striker positioning.

Top Hatch

Why VW didn't start installing a hatch at the factory in 1952 I'll never know. If your beetle won't start you open the engine lid, pull the air cleaner and work the throttle. You can tell if you're out of gas or if you should look at the points. With a bus you borrow your wife's compact mirror and crawl into the engine compartment with a flashlight. Throttle cable replacement is another story to tell your grandkids. In '65 they put a nice big hatch in the variant station wagon and when they re-designed the bus in '68 they still didn't use the hatch even though they had it in stock from the Variant. In '73 they decided a hatch would be nice but instead of using the one already designed for the variant they designed a new half hatch to tease you a little. The Vango kit finally provides you with a real, honest to gosh, full size hatch like a Vanagon has!

The instruction photos (3, 4, 5 and 6) were printed before we decided to quit messing around with a cumbersome two piece hatch arrangement. We now provide a new aluminum (no rust, easy to work with) panel that replaces the original hatch (if your bus is so equipped) and also covers the additional floor section that must be removed for proper access to carburetor, oil filler, spark plugs, water hoses, valve adjustment, distributor and most importantly to show everybody what you have done. Thick high quality weather strip for the complete perimeter is also included. The Vango hatch uses spring loaded, quarter turn aircraft fasteners called "Dzus buttons" around the perimeter. These are flush with the panel and are opened with a screwdriver or the edge of a dime. They self eject and are retained in the panel so you can't lose them. They are identical to the six pictured in Photo 6 if your eyes are real good. I recommend putting a hatch in your bus now even if you can't swing a Vango kit right now. It's an hour or two well spent. The original procedure that altered the original panel proved too time consuming to install, offered a less effective seal and the support across the center contacted some of the stock air cleaners.

Use an abrasive metal cutting wheel in a hand held circular saw to cut this opening "quickly." The dimensions of the opening are slightly less than in the photos so read the instructions closer than you look at the pictures.

Pre- '73 hatch instructions

The following instructions are for those buses with no original hatch: Cut the opening to a width (left to right) of 26" and a depth (front to rear) of 21". Mark your rear cut line 2" in front of the rib that forms the divider surface between the floor and the latch striker. Measure out 13" from center to each side. Be sure the striker is in the center on your bus, if you use it for a center reference; it isn't on the later ('72 or '73) buses. Make another line 26" across from left to right 21" toward the front of the bus from the rear line. Drill the corners with a 1/4" drill and make your cuts. If using a circular (skill) saw you must hold the blade guard back until the blade penetrates the surface of the metal. Hold the front of the saw against the metal surface and let the rear of the saw come down to the cutting surface as the blade penetrates deeper into the cut. After you make your first cut you will see it isn't as bad as you thought. Be sure there are no electrical wires under the floor. If there are any fuel tank canister lines running across they may be cut and rubber hose should be used to re-route and re-connect them. File the perimeter to smooth any burrs from the cutting. Center the hatch panel over the opening and mark a reference line around the perimeter. Leave equal overhang on the sides and one inch in front and two inches at the rear. Install the two steel strips at the front of the hatch panel with the 3/16" pop rivets provided. Install these strips on the bottom of the panel. Be certain the pop rivets are positioned far enough back so the underside of the rivets don't interfere with the surface beneath or the weather strip seal. Space the strips so they lay in two "valleys" of the ribbed

floor and pop rivet the two flat metal straps across the valleys to hold down the two hatch straps. Some bending of the hatch straps may be necessary to get a tight weather strip seal after you're done. This will provide the same hinging method as the later model buses use with their hatch which provides quick removal and provides the proper geometry to not tear the weather strip. Attach the front section of weather strip to the bottom of the hatch and pass the weather strip over the two metal straps pop riveted to the hatch without interrupting the seal line. Remove the weather strip backing paper and attach the rubber to the bottom of the hatch to line up with the "valleys" down the sides. The rubber is thick enough to deform sufficiently going across the ribs so don't interrupt the front and rear strips by cutting short sections. Cut all the sections slightly longer than necessary and after sticking one end right against the other corner section to completely seal one corner stick the remaining length in place and re-cut the other end to the exact length when you get there. These strips will not stretch to fit.

Attach the aluminum angle strips (provided) to the underside of the aluminum hatch with the 3/16" pop rivets (provided). Position the strips around the perimeter to stiffen the hatch. Leave room between the opening and the rear and side strips to locate the Dzus buttons between the strips and the edge of the opening. Position the strips to miss the air cleaner also but part of the downward facing angle near the air cleaner could be trimmed slightly with a hack saw to clear if necessary. A strip down the middle instead of on one side might be used on a 4 cyl. engine with the air cleaner to one side. All but the big V6 motors with high air cleaners have a lot of clearance however. I prefer making a new flat aluminum lid for the stock air cleaner, on the tall air cleaner engines, to buying a speed shop type. Simply cut a 3/16" piece of flat aluminum into a circle with a sabre saw and shorten the hold down stud. Auto parts stores will have a shallower filter element with the same diameter as the original and unless the element gets real dirty there is plenty of volume. Turbo charged Buick motors will require a raised section installed in the middle of this hatch. Some guys can't get enough power, maybe they were taken from their mom too early or something?

Vise grip the Dzus tab to the floor section at each rear corner with the hole and cross spring of the tab hanging over the edge into the opening and drill one hole through the tab and the floor beneath. Install the screw and lock nut (provided) through the hole. Remove the hatch and measure the distance from the perimeter reference line to the center of the tab hole with the cross spring. Mark the perimeter line at a point straight out from the hole also. Replace the hatch and drill a 1/4" pilot hole for the Dzus button. See if the pilot hole lines with the tab hole. If it doesn't, pivot the tab or relocate the first tab hole to re-align and then drill a second tab hole and attach tab with two screws and lock nuts. Drill the hatch hole out from 1/4" to 1/2" and install Dzus button with 1/8" pop rivets provided. Repeat this procedure for the remaining Dzus buttons. Space one Dzus button midway on each side and two more across the back between the rear corner buttons. Adjust the rubber compression by lowering or raising the spring tabs with the flat washers (provided). Dense foam rubber glued to the bottom of the hatch is a good idea.

'73-'79 Hatch Instructions

The hatch instructions for the later buses are the same with the following exceptions. The front half of the opening is already 30-1/2 inches wide. Use this opening to determine center for cutting the rear half to a 26" width. Don't use the door striker because it isn't in the center. Use the actual original weather strip lip (edge) to measure the 21" overall depth (front to rear) of the new opening. Engage the hatch strips in the original hinge receptacles before marking your perimeter line when determining your Dzus button placement. Attach the rubber weatherstrip to the bottom of the hatch to follow the curve halfway down the sides to stay in the "valley." Don't use the original front weather strip slot, keep the rubber seal line on even ground.

Vango Adapter Plate and Flywheel Installation Instructions

Install the Vango adapter plate before installing any flywheel flange. Always be sure the adapter plate can lay flat on the surface of the engine block. The Ford 2000 pan must be hammered or ground slightly around the rear seal area to allow the adapter plate to fit flush. Some Ford 2000 and 2300 cylinder heads must be ground slightly at the rear to allow the top of the adapter plate to lay flush with the block (photo 7). There is plenty of metal thickness in this area so don't worry about removing from this surface. A grinding wheel on the end of a power drill will work if you don't have a disc grinder. It is not necessary to remove the head from the block. If you are concerned about the thickness you can remove the freeze plug and use your finger to gauge the thickness. Always install a new freeze plug if you do this. An alternate is to remove aluminum from the adapter plate at this point but the aluminum will load a grinder very quickly.

Two small bushings must be used in the dowel holes of the Vango adapter only when using the Ford 2000 engine. These bushings are installed when the adapter is ordered for the Ford 2000 engine but are available if the adapter is later used with this engine. Use fasteners provided with the adapter to attach to the engine.

A mounting ear at the back of the left head of the Ford V6 must be ground down before the adapter plate installation. This mounting ear would never be used unless you used the left head on the right side so if you overhaul remember to put the heads back on the same side they came off.

Most engines use 6 smaller bolts (10 mm) to attach the Vango crank flange to the crank. Use the bolts provided with the Vango kit and torque to 50 ft. lbs. Never use washers under these bolts and make sure all rust is removed from crankshaft end to assure the Vango flange seats flat on the crankshaft. Most Buick V6, Chevy V6 90° and early Chevy Pontiac 4 engines use larger 7/16" bolts at the crankshaft. These can be torqued to 80 ft. lbs.

Important: Never use lock washers under the bolts used to attach a flywheel to an engine. Always tighten flywheel bolts to prescribed torque specifications with a cross sequence. The six bolts (12 mm) (1.5 fine thread) provided to attach the two halves of the Vango flywheel together require 80 ft. lbs. of torque. The five Special VW flywheel bolts that originally held the VW flywheel to the VW engine should be used to attach the VW flywheel to the Vango flywheel. Use the small 5 hole plate found on the original VW flywheel if possible. Hold the VW flywheel against the Vango flywheel with one hand and run the 5 bolts in all the way finger-tight with the other hand. This assures the flywheel is laying flat against the small mounting surface before tightening. Tighten the five bolts in progressive cross sequence to 80 ft. lbs. of torque also. Install the four studs provided in the adapter plate with the longer of the four studs in the upper passenger side for starter attachment. Use 2 lock washers per side on the upper studs after installing the bellhousing and starter. If the long upper stud is too long to start the nut above the starter, simply loosen the lower starter nut and allow the starter to move back until the upper nut will start.

Vango Engine Mount Installation Instructions '72-'79 (Photo 17)

Late model VW buses ('72-'79) have a five point mounting system for the engine transaxle assembly. The entire weight of the engine and transaxle is designed to rest on the two engine mounts and the bellhousing bracket that is attached to two more rubber mounts. The rubber mount at the front of the transaxle below the shift rod is designed to carry no load. Its purpose is to limit torque reaction only. It is attached to the case of the transaxle by two long studs that pass through two slots cast into the mount bracket. By loosening the nuts the studs can move up and down in the slots to take any load off of the front mount depending on the positioning of the rear engine mount. Attach the Vango engine mount to the rubber engine mounts. Individual instructions for the attaching method to your particular engine are included with the Vango engine mounts. Loosen the upper and lower adjusting nuts at the front transaxle mount. Place a block of wood under the pan of the engine but not contacting the Vango engine mount. Jack the engine up until the studs are at the bottom of their slots in the front mount. Re-tighten the nut of the lower stud to hold the stud at the bottom of the slot. Give the jack another pump or two to relieve the bellhousing bracket rubber mounts. Mark the side flanges of the Vango engine mount through the side rail mounting holes. (All Vango engine mount side flanges align with at least one original hole per side.) Remove Vango engine mount and drill one engine mount side flange hole per side to 1/2" size. Re-install the Vango engine mount and place the jack under the Vango engine mount to keep it from twisting because there is only one bolt per side attaching the mount. Loosen the nut at the front transaxle mount. This will allow the engine transaxle assembly to rest on the four rear mounts and you should be able to wiggle the front mount with your hand and the studs should not be bottomed or topped out in their slots. Drill a second hole through the side rail and engine mount side flange and attach with bolts washers and nuts (provided). Re-tighten upper and lower transaxle front mount nuts. Note: Washers can be placed between the small gap between the Vango engine mount side flanges and the side rails of the bus when installing mounting bolts for the final time. This gap allows for any difference (left to right) between your bus and any variation in engine mounting positions.

Vango Engine Mount installation Instructions '68-'71 VW Bus

These year buses use a three point mounting system. A single mount at the nose of the transaxle and two at the rear of the engine. The nose mount is retained with the Vango system and the original rubber mounts used with the particular engine you are using are used instead of the original VW bus mounts at the rear. This gives better isolation because the rear mounts are designed for the weight and vibration characteristics of the engine being used. Attach Vango engine mount to the original rubber mounts at the engine. Individual instructions for each engine type are included with each Vango engine mount. Place a piece of wood under the pan but not contacting the Vango engine mount and jack the engine up into position. In the case of engines with high air cleaners I would recommend altering the air cleaner to clear the hatch rather than trying to mount the engine lower than it should be for good ground clearance. Determine and mark hole positions to attach the engine mount side flanges to the bus side rails and drill side rail holes to 7/16" through both sides of frame rails. Enlarge the inner side holes and insert the Vango crush sleeve into the frame rail through the inside hole and insert the 7/16" bolt through the outside hole and through the crush sleeve. This sleeve allows the bolt to be tightened against the frame rail without crushing the rail sides together. Determine engine mount side flange hole positions by inserting bolts through side rails until they meet side flanges. Remove Vango engine mount and drill holes in side flanges. Re-install engine mount and use washers provided to space engine in center of compartment.

Vango Throttle Cable Installation Instructions

The Vango throttle cable kit consists of a extra long braided cable to reach any carburetor mounted on any engine in any position. Bolt the cable clevis to the VW bus accelerator pedal arm with the 1/4" bolt provided. Put the clevis between the head of the bolt and the first nut and allow space for the clevis to pivot easily between them. Install the bolt through the pedal arm and install second nut and lock washer. Pass cable through guide tube to rear after slipping rubber boot on cable. A long flexible housing is provided which fits over the cable starting where the cable exits the guide tube under the bus and extends to a position near the carburetor where it can be attached in alignment to the carburetor linkage. An adjustable housing end is provided for the carburetor end and another fixed end is provided to insert in the end of the VW guide tube to retain the housing where the cable exits the tube. If your engine doesn't have a bracket where the original throttle cable housing was attached near the carb linkage a section of steel strap is provided to make one. Find a mounting bolt to attach the bracket to which will align with the carb. The distance from the carb isn't as important as the pull angle. Determine this by holding the cable in various positions and working the carb linkage. Don't be too anxious to cut the excess material from the strap until you have tried it. You can drill several holes and make different bends in a vise with a hammer until you get it right. The Vango throttle cable kit also includes a ball socket with a set screw in the end to retain the end of the braided cable. Usually the original attaching point used by the factory is the best position for correct throttle geometry and the ball socket can be installed there by drilling the original attaching devise out and installing the ball socket in its place. Always use the entire length of housing even if it seems too long. This will allow very gradual bends (change of direction) and will create less friction between the cable and housing for a smooth throttle and return spring action. Small adjustments in cable length can be made at the cable housing end by threading the end in or out of the attaching bracket with the two adjusting nuts like adjusting a bicycle hand brake. If you ever need to replace the cable housing or the ends see your Schwinn dealer! If the cable would ever break at the ball socket you may cut a short section from the housing and get another chance. A second braided cable and clevis is included with each kit just in case it breaks farther forward so keep it in the vehicle and not on your work bench. You should keep a spare clutch cable too unless you enjoy walking.

Hose and Electrical Connections

The only hoses any engine needs for basic function is a vacuum hose for distributor advance, one for the PCV crankcase valve and one to the fuel pump for gas. '71 and newer buses have vacuum assisted disc brakes and need the one way valve located near the end of the original hose at the back. Most engines you will use come from cars with power disc brakes and all manifolds or carburetor bases have pipe thread openings. If the right stuff isn't on your engine it's available in the brass section of your parts store. Many additional hoses are on the modern engine such as water valves that only allow vacuum to flow after warm up etc. Most of these are emission related. Use your own discretion.

Most modern alternators have the voltage regulator built inside them. This simplifies the hookup. The large terminal on the alternator is connected directly to the positive battery terminal and the two smaller ones go to the idiot light wire and a lead from the coil wire. You can install the oil pressure sending switch from your VW engine and just use the idiot light wire if you wish. You will have a ground wire in the loom that activated the heater fan at the rear on the '72 and newer bus. This brown wire could be used for a temperature guage sending unit hookup if you don't wish to run any new wires to the rear. I would leave most of the original wires in place, they aren't hurting anybody. Even the fuel injection stuff, unless it's in the way. Maybe you can sell it to a video game freak or something. If you

are installing gauges in the dash (photo 27) use a 2" hole saw for a 2-1/16" gauge face. Then file the steel hole under the plastic cover to 2-1/16". If you don't, the lip of the gauge may not cover the plastic completely. A VDO 7000 RPM tack fits nicely in the original bus (right) clock hole if you make your own retainer ring (photo 27). I prefer voltmeter guages to ampmeter guages. They are easier to hook up and give a better picture of your overall electrical system condition. More detailed electrical information for your particular charging and electrical system for the engine you are using is probably available in a repair book for that car or at your local auto electric man. Most late model distributors have the coil inside the cap (GM) or have an electronic box and coil mounted somewhere in the engine compartment. Get these when you buy the engine if possible. Mallory and Accel usually have better prices on replacement distributors than the dealer has.

Vango Trailer Hitch (Photos 20-24)

Many Vango converts may discover towing a boat or trailer can be fun instead of putting sweat on your palms. We now offer a trailer hitch to handle the new found capacity of your VW bus. It takes the place of the original bumper brackets and bolts directly to the frame rails in place of the bumper brackets. The original bumper attaches over the hitch with four bolts at the open ends of the hitch member. Plastic caps for the heads of the bolts, like the ones over the bolts on the front bumper of the '73 and newer buses, are provided to give your bumper a finished look. This Vango hitch also provides much greater protection for the engine in a rear end collision.

Guarantee of Vango Kit

We have made every effort to eliminate any item from our kit that would be a specialty item not available nationally through your VW dealer or the dealer of the particular engine you are using. There are no parts in the Vango kit that are subjected to frictional wear (flywheel, clutch, throwout bearing and starter gear) that are not available through normal channels of distribution at your VW dealer or parts store. This is important when seeking service away from home and adds to the peace of mind of traveling in your Vango bus. Even the coolant tubes are available at any muffler shop at very reasonable prices. All parts of the Vango kit are guaranteed against faulty materials and workmanship for a period of one year.

Thank you for your interest in the Vango kit.


PAUL HADLEY

