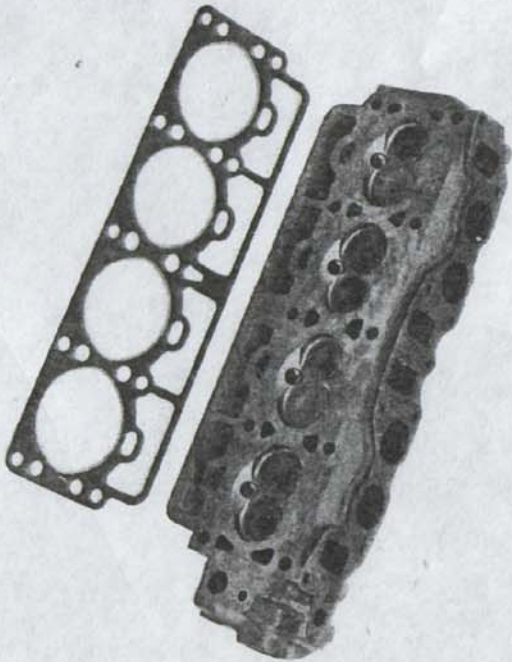
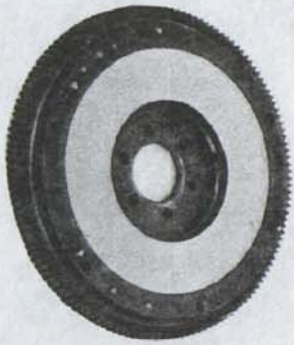


**PERFORMANCE TUNING  
B 18 SERIES VOLVOS**

**TO 1967 MODELS**



**VOLVO HIGH PERFORMANCE TUNING KIT**  
**PART NO. 419398**

## FORWARD

The B 18 engine in standard form is tuned to give maximum road performance with complete reliability. There are, however, continuous requests for information on increasing engine performance and improving handling, both for street use and for racing. The following pages list some of the modifications and equipment necessary to achieve these goals. All work should be done in accordance with the factory shop manuals and performed by experienced mechanics. Amateur speed tuning is often disastrous, and experimental work can be costly . . . and worthless.

The recommended tuning procedures and parts mentioned in this booklet have been proven in competition after many years of development by the factory competition department. They give worthwhile improvements while offering the utmost in reliability.

When considering modifications keep these thoughts in mind,

1. Pay meticulous attention to detail and cleanliness. Inspect every part for wear.
2. Never take shortcuts or put off repairs.
- 3- Never sacrifice reliability or safety for speed,
4. If you are planning to enter speed events, read the applicable rules and prepare your car accordingly. These regulations and the information in this booklet will help you prepare a safe, fast car.

VOLVO, Inc.

Volvo Drive

Rockleigh, N.J.

## **STREET TUNING**

## TUNING FOR INCREASED STREET PERFORMANCE

### ENGINE:

Increased compression of approximately 10.5:1 may be obtained by machining the standard head as follows:

.080" - B18D (1200, 1300, 2200 up to and including CH#225049, 216949, 44599 respectively)

.020" -B18B (1200, 1300, 2200 from CH #225050, 216950, 44600 respectively and onwards

.040" - B18B (1800 S up to chassis No. 6000)

.020" - B18B (1800 from No. 6001 onwards)

.020" - B18B (144 S, All)

It is not necessary to shim the rocker arm supports after the above machining operations.

The combustion chambers may be lightly polished, but care must be exercised not to remove excessive material, as they are already carefully machined at the factory. All sharp edges from machining should be smoothed. The ports should be polished taking care not to remove excessive material or adversely change the contours of the ports. The manifolds should be matched with the head ports; polishing the intake manifold and matching the carburetors to the manifold is beneficial as well. All parts that have been subjected to grinding or machining operations must be thoroughly washed.

The valves and valve seats must be carefully ground by machine, then lapped in by hand using valve-grinding compound. Head angle is 45°. Valve seat angle is 44.5°. Valve seat width in cylinder head is .055"

Because procedures for balancing, lightening, polishing and magnafluxing are well known to experienced engine tuners, we are omitting detailed instructions on these items. Caution must be exercised, however, with the cylinder head ports and combustion chambers. Remember, that polishing should only enhance the surface but not alter the contours of the ports or the capacity of the combustion chambers.

When assembling, use head gasket part no. 418990 and intake and exhaust manifold gasket no. 418870.

Do not use shims between the valve springs and the cylinder head. The latest valve springs, part no. 418737, are coded with a white paint daub. Install these springs, or replace if your engine has excessive miles on it.

For B 18 D engines of 100 h.p. or less, install the higher performance "C" camshaft, part no. 418707. This cam will improve performance throughout the power range with no significant loss of low-end torque.

For all engines of 95 h.p. or less, replace the standard exhaust manifold with the special tuned extractor manifold, part no. 419381.

Late model cars with engines of 100 h.p. or more are equipped with an efficient one-piece combination intake and exhaust manifold. The difference in output between it and the extractor model is only about four horsepower, so we recommend you stay with the standard equipment.

## **TUNING SPECIFICATIONS FOR ENGINES MODIFIED AS DESCRIBED**

### SPARK PLUGS:

Bosch W225T1 or equivalent have been found to be the best all-around, gapped at .028"-

TIMING: 17° - 19° B.T.D.C. @ 1500 rpm.

Some earlier engines have a distributor vacuum advance. The hose must be disconnected and the holes plugged. Timing must be set with the vacuum advance disconnected.

DISTRIBUTOR DWELL ANGLE: 60°

### VALVES:

Intake and exhaust at .020"\* - .022", engine hot.

### CARBURETORS:

Carburetor needle recommendations can be taken from the following table:

| <u>Fuel</u>          | <u>Part</u> | <u>Cylinder Head</u> | <u>Camshaft</u> | <u>Manifolding</u> |
|----------------------|-------------|----------------------|-----------------|--------------------|
| <u>Needle</u>        | <u>No.</u>  | <u>Compression</u>   |                 |                    |
| ZH<br>aluminum       | 237221      | 10.5:1               | "C" #418707     | Silver,            |
| Alt. SM<br>manifold, | 237267      |                      |                 | intake             |
| exhaust              |             |                      |                 | standard           |
|                      |             |                      |                 | manifold           |

|             |        |        |             |   |
|-------------|--------|--------|-------------|---|
| KD<br>piece | 237248 | 10.5:1 | "C" #418707 | Black, one<br>intake,exhaust,<br>cast<br>iron |
|-------------|--------|--------|-------------|---|

|                 |        |        |             |                          |
|-----------------|--------|--------|-------------|--------------------------|
| KD<br>extractor | 237248 | 10.5:1 | "C" #418707 | Steel tube,<br>manifold. |
|-----------------|--------|--------|-------------|--------------------------|

#419381

These basic modifications will raise horsepower to about 118. For further output, we recommend the factory 135 horsepower tuning kit detailed in the competition section of this booklet.

This tuning kit gives excellent results for street use without requiring the extra preparation necessary for actual racing. However, we do recommend installation of an oil cooler, and a thorough examination of the engine if you plan to drive the car hard.

### CLUTCH

Although the single dry plate clutch on older models is entirely reliable for normal use, we recommend that you install the diaphragm type, now standard equipment, for absolutely positive engagement under all conditions. In order to install this clutch the flywheel also must be replaced. The parts needed are:

Flywheel part no. 418932; pressure plate, part no. 419426; clutch disc, part no. 418871; Throw-out bearing, part no. 672122

The diaphragm clutch assembly has been made standard as follows:

122 S 4-door - from chassis no. 225050 onwards

122 S 2-door - from chassis no. 216950 onwards

1800 S - from chassis no. 21000 onwards

144 S-all

### REAR AXLE

The standard ratio in all sedans and 1800 S without overdrive is 4.1:1.

Standard ratio in station wagons and 1800 S with overdrive is 4-56:1.

Alternate ratios of 4-56:1 and 4.88:1 are available for model 27 rear axles.

Part numbers are 661518 and 75877 respectively.

A 4,56:1 ratio also is available for model 30 rear axles. The part number is 384212.

Limited slip (positraction) also is available as follows:

Model 27 - part no. 279953

Model 30 - (Except 144 S) 279954

Model 30 - 144 S - Part No. 279952

A special lubricant should be used in the limited slip such as G.M.'s positraction lubricant.

Before ordering any rear axle parts, check with your dealer to find out which model rear axle you have.

We recommend that the inner axle shaft seals be inspected for leakage and replaced if the car is to be raced. Use the late type spring loaded neoprene rubber seals, part no. 192550.

## SUSPENSION

For normal road use we suggest retaining the standard coil springs and sway bar<sup>1</sup>. For semi-speed events install a heavier sway bar on the 122 S. The standard bar should be retained on 544 and 1800 S cars.

Use the standard sway bar as a sample, so that the heavier one may be patterned from it exactly. The two side stabilizer links are retained in stock condition, but you will have to modify the two large upper support rubber bushings to accommodate the larger diameter bar. Align the front wheels to specifications and balance all wheels.

To improve handling we recommend Koni fully adjustable shock absorbers, which are available from your Volvo dealer. The part numbers are:

### 144 S

Front    Rear

279942   279943

### 122S Sedans

Front    Rear

279945   279946

### 544

Front    Rear

279914   279915

### 2200 Wagon

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<sup>1</sup> This sway bar is not a Volvo stock item, but it can be made from 1-1/8" bar spring steel by any good spring shop at reasonable cost.

Front    Rear  
279945  279944  
1800S  
Front    Rear  
279965  279966

For normal use, install them as delivered. For heavy duty use, set them hard in front, medium in rear for the 122 S. For the 544 and 1800 S, set them medium front and rear.

### BRAKES

It is not necessary to modify the brakes for normal use or for semi-speed events. However, you can use heavy-duty linings and pads if you feel your braking requirements are severe enough to warrant them. For more information, see "Brakes" in the Competition section.

For 1966 and earlier 122 sedans with front disc brakes, we recommend installation of the servo power brake unit which is now standard equipment. Part nos. are 276457 for the unit and 276458 for a brake line kit which is needed to complete this installation.

### TIRES

Increased tire pressure will improve your car's handling. Start with 3 p.s.i, more than standard and work up to a pressure that suits you. Ideally, a radial tire mounted on a 4-1/2" rim should be used. Two choices of rims are available:

Slotted rims — part no. 668280

Solid disc rims — part no. 657838

The 144 S 4-1/2" wheels are not interchangeable with other Volvo models. P 1800 and 144 S models have 4-1/2" wheels as standard equipment,

If you drive on snow or ice you should consider studded snow tires, preferably radials. For maximum traction use them on all four wheels.

Make sure you deal with a firm experienced with studding tires.

*NOTE: Check with your Motor Vehicle Bureau to be sure that studded tires are approved in your state. Season Company, 286 Newtown Road, Plainview, N. Y., a well know Swedish stud manufacturer can answer any specific inquiries.*

We don't recommend using racing tires for normal road usage. They are not designed to be used on rough roads, gravel, or dirt and the sidewalls offer little protection to sharp objects. Also, there

may be no advantage to using racing tires in field trials or autocrosses because of the excellent adhesion of radial tires.

### INSTRUMENTS

Install a good quality tachometer and observe a red line of 6,000 r.p.m. Above that the torque and horsepower curves drop off rapidly. Continually exceeding 6,000 r.p.m. unnecessarily abuses the engine and decreases the life of the entire drive line.

If you install an oil pressure gauge, use one having a maximum reading of 100 p.s.i. When cold, a Volvo engine can register 100 p.s.i. so an 80 p.s.i. gauge may rupture. All oil pressure gauge installations must include a flexible oil line between the engine and the firewall.

We strongly urge you to buy a Volvo shop manual and carefully follow all assembly instructions and torque specification. They are available from Volvo dealers for \$15.00. Since you probably will be up-dating your car, order the latest edition for your model. All information on earlier production models will be included. Also, the next time you visit a Volvo dealer, ask him for an accessory booklet. It contains many useful items that may interest you.

This completes our general recommendations for improving the performance of your car for street and sports activities other than actual road racing.

## **COMPETITION PREPARATION**

The factory has produced a limited number of tuning kits, which bolt on to all B 18 engines to produce 135 h.p. at 6,000 r.p.m. and maximum torque of 125 foot pounds at 4,500 r.p.m.

This kit, which takes about 15 hours to install, is approved for sedan and sports car racing in the United States. It should be used only on engines in very good or new condition. Use a redline of 6,000 r.p.m. with occasional bursts to 6,500 r.p.m. when necessary. Although the interpretation will be strict, this kit is covered by our full factory warranty.

#### TUNING KIT, PART NO. 419398

1 - Cylinder head, complete with springs and oversize valves with combustion chambers and ports designed for increased volumetric efficiency and effective compression. Compression ratio in conjunction with a .040" overbore will be about 11.1: 1.

1 - Special cylinder head gasket.

1 - "D" high performance camshaft.

1 - Lightened and balanced diaphragm type flywheel.

1 - Special oil pump pickup - insures positive oil pickup necessary for hard cornering.

1 - Special timing gear cover complete with a positive double flange oil seal.

1 - Crankshaft pulley hub.

2 - Fuel metering needles - richer needles.

2 - Springs for vacuum plunger - for high performance use.

4 - Spark plugs - Bosch W280T135 - cold plugs, only for hard driving.

1 - High capacity Bosch Ignition coil with integral resistor.

4 - Spark plugs - Bosch W240T1 - for more or less normal driving and occasional wide open throttle driving.

Tuning notes with this kit are:

A. Spark plug gap - .028"

B<sup>2</sup>. Distributor dwell 60° ± 3°

C. Valve clearance:

intake and exhaust

warm engine - .016" — .018"

D. Ignition timing

17° - 19° @ 1500 R.P.M.

100 octane fuel

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<sup>2</sup> NOTE: The distributor, Volvo part #240208, Bosch designation 0 231 153 003 must be used with the tuning kit.

All standard Volvo engines producing 100 h.p. or more are equipped with an efficient one-piece, cast iron intake and exhaust manifold. For street use, this manifold is quite satisfactory to use with the tuning kit.

For racing, however, we recommend a special steel tube extractor exhaust manifold, part no. 419381. It produces about four extra horsepower and also saves weight. If you decide to use this exhaust manifold in place of the one-piece intake-exhaust unit, remember that you'll also need an aluminum intake manifold, plus the associated linkage.

The tuning kit should be supplemented with the following modifications and parts to complete your racing engine.

The cylinder block should be bored to at least  $-.040$ " oversize and a piston clearance of  $.003$ " -  $.0035$ " used. Use late model short skirt pistons which are available in overbore sizes to  $.050$ ".

After machining, be sure that the block is thoroughly washed with detergent and warm water and that all passages are carefully blown out.

B 18 D engines use normal lead babbitt main bearings, which are fine for street use. For racing, however, replace them with indium coated lead bronze bearings, which are standard in B 18 B engines. The part no, for a set of these bearings, standard size, is 276698.

It isn't necessary to use more than standard bearing clearances. Nor is it necessary to drill extra oil gallery holes or groove the Journals.

An oil cooler is essential for racing. The cooler is standard on the 1800 S model with B 18 B engine and is directly interchangeable to sedans. In addition to installing the special oil pump pickup included in the tuning kit, we recommend baffling the oil pan to eliminate any chance of oil starvation during hard cornering.

Keep the engine oil level at or slightly below the maximum mark on the dipstick. Overfilling can cause cavitations of the oil pump.

For maximum performance, be sure to match the carburetor bores with the intake manifold and the intake manifold with the cylinder head intake ports. Use SAE 5 engine oil in the carburetor piston dampers. Experiment to find the best carburetor needles for your engine. Race track and engine conditions vary so much that you will probably wish to experiment further to find the best carburetor needles to suit your purposes.

The high capacity coil in the tuning kit does not have the armored cable, which is standard on all Volvos except the 144 S. For simple installation we recommend:

1. Leave the standard coil where it is,
2. Transfer the primary and secondary wires to the tuning kit coil.
3. Connect the tuning kit coil to a separate switch for ignition. (A simple push-pull switch mounted under the dashboard).
4. Connect the resistor (which must be used with the tuning kit coil) in series between the coil and the push-pull switch.
5. Use the standard ignition switch for the starting and accessory circuits.

On the 144 S, simply exchange the coils.

### CLUTCH

It's essential that you use the diaphragm type disc and pressure plate for racing. In fact, no other type will mate to the light flywheel in the tuning kit. Check the chassis number of your car against the chart in the Clutch section under Street Tuning. If your car isn't equipped with this type clutch you'll have to buy it. Part nos. are 419426 for the pressure plate; 418871 for the disc, and 672122 for the related throw-out bearing.

### REAR AXLE

See information in Street Tuning section. Also, as a safety precaution we recommend magnafluxing the axle shafts after about ten hours of competition.

Track test your car before installing a limited slips. With your suspension set up right and with the latest racing tires, you shouldn't need it.

### SUSPENSION

See Street Tuning section for information on shock absorbers and sway bars.

As for the coil springs, they can be shortened to stiffen the suspension and lower the center of gravity. Don't heat the springs to collapse them.

Cut them 2" in front and 3" in the rear, but only if your car will be used primarily for road racing. Remember to shorten the rear axle limiting straps a corresponding amount. The spring modifications should be done by someone experienced.

Although suspension tuning depends upon track conditions and how you drive the car, here is a basic set of alignment specs:

Camber:  $-3/4^{\circ}$

Caster:  $+1/2$

Toe-in: 0 to V16"

Note that negative camber is necessary to minimize tire wear and maintain correct wheel geometry during hard cornering.

### BRAKES

Besides the servo power brake unit (see Street Tuning section), we recommend using cerametallic brake pads. They will assure long lasting, fade free braking under the most severe conditions. Here are the part numbers:



Lighten your car as much as you can within the rules of the organization sanctioning your races. For your information here are the latest F.I.A. and S.C.C.A. official registered weights for our cars:

| F.I.A.            |             | S.C.C.A.          |
|-------------------|-------------|-------------------|
| 544               | - 2140 lbs. |                   |
| 122S 2-door       | - 2234 lbs. |                   |
| 1800S             | - 2382 lbs. | 1800S - 2283 lbs. |
| 1800S (overdrive) | - 2416 lbs. |                   |
| 144S              | - 2454 lbs. |                   |

The S.C.C.A. permits a weight tolerance of minus 5% for the F production 1800S. For sedans, the weight of the car as raced less fuel and driver must meet or exceed these official weights.

### MORE INFORMATION

If you want further information or advice about modifying your Volvo, write to the Volvo Competition Department, Rockleigh, New Jersey 07647.

Outline your plans and exactly how you propose to use your car. F.I. A. homologation forms also are available.

The stocking and pricing of all parts is the responsibility of the Volvo area distributor. If your dealer cannot help you, contact your distributor for information.

### TUNING KIT. No- 419398

#### PART LIST by PART Nos

- 1 - Cylinder head, complete 419351
- 4 - Inlet valves 419315
- 4 - Exhaust valves 419316
- 8 - Valve springs 418737
- 8 - Washers for valve springs 403500
- 8 - Protective rings 405357
- 16 - Keys for washers 403315
- 4 - Guide sleeves for inlet valves 419378
- 4 - Guide sleeves for exhaust valves 403390
- 1 - Cylinder head gasket 419393
- 1 - Camshaft 419258

- 1 - Flywheel, complete 419392
- 1 - Cover for oil pump, complete 419395
- 1 - Timing gear cover, complete with seal 418693
- 1 - Timing gear cover seal 418668
- 1 - Pulley hub 418264
- 1 - Exhaust manifold, complete 419381
- 2 - Fuel metering needles 237241, marked KC
- 2 - Springs for vacuum plunger, carburetor 237242 marked blue
- 4 - Spark plugs 240571
- 1 - Ignition coil 239499
- 4 - Spark plugs 238624
- 1\* - Distributor 240208
- 1\*- Clutch 419426
- 1\*- Clutch disc 418871
- 1\* - T.O. bearing 672122
- 1\* - Gasket for exhaust,inlet manifold 418870

*\*Not included in kit, but listed here as a reference for a spare parts replacement.*

**Below are listed some of the more commonly asked questions and their subsequent answers.**

**Do you recommend nitrate hardening of crankshaft, cam, tappets, etc.?**

No, if oil parts meet factory specs., it is not necessary.

**Do you recommend micro-polishing crankshaft Journals?**

No, follow factory specs, for clearances.

**Do you recommend using air filters? Ram pipes?**

For street use air filters; for racing, no to both questions.

**Should the thermostat be used? Which one? Can the fan be modified or removed?**

A thermostat should be used under all circumstances. Outside temperatures should determine which one to use. We recommend using a fan in all instances. The standard four blade fan can be modified to a TWO blade type, the remaining two blades may be shortened an even amount on each blade, should conditions allow. Be sure the fan is balanced after being modified.

**Do you recommend fitting an electric fuel pump?**

No. A stock fuel pump in good condition is fine for oil applications.

**Should transistor ignition be added?**

We have found no distinct advantages using this system.

**Should shrouding be added around the radiator?**

No, the standard radiator has proved satisfactory under oil applications.

**How about a larger or finned sump?**

Not necessary.

**What exhaust system gives the best results for racing?**

A pipe the size of which can be accommodated to fit over the header pipe and routed to exit just in front of the right rear wheel. The curve should be as smooth as possible and oil hangers should have a secondary type retainer in the event the primary hanger breaks.

A piece of heavy wire or welding rod would suffice and should be looped loosely over pipe and fastened through the floor board.

**What weight and type engine and gear oil is recommended for racing?**

Outside temperatures are all important. Use a straight HD oil as recommended by the factory according to prevailing temperatures. Do not use o multi-viscosity type oil. Follow factory specs regarding transmission and rear axle oils.

**What is the widest wheel size that can be used? Sedans and 1800?**

5-1/2" for all models.

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