



PERFORMANCE TUNING B 18 SERIES VOLVOS

TO 1966 MODELS

FOREWORD

The B18 engines as delivered from the factory in standard form are tuned to give maximum road performance with complete reliability. There are, however, continuous requests for information on increasing the performance of this engine as well as on other improvements to the suspension, etc. Usually there are one or two purposes to be served, (1) tuning for increased street performance or (2) racing. On the following pages are listed some steps and equipment, which can be used to achieve these goals.

V O L V O, Inc
Volvo Drive
Rockleigh, N. J.

TUNING FOR INCREASED STREET PERFORMANCE

ENGINE :

A – CYLINDER HEAD, MANIFOLDS, CARBURETION

The standard cylinder head may be machined up to the values given below :

B 18 D (Sedans) .080"

B 18 B (1800 S, early up to CH No. 6000) .040"

B 18 B (1800 S, late, from CH No. 6001 onwards) .020"

These specifications will give a compression ratio of approximately 10.5:1. 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 ports; Polishing of 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 carefully washed.

The valves and valve seats must be carefully ground by machine. When this is completed they should be lapped in by hand using valve-grinding compound. Head seat angle is 45°. Valve seat angle is 44.5°. Valve seat width in cylinder head is .055" (1.4 mm).

NOTE: 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. Only such polishing should be done that enhances the surface and does not alter the contours of the ports or capacity of the combustion chamber.

When assembling, head gasket, part no. 418415; intake and exhaust manifold gasket, part no. 418870 must be used.

There must be no shims used between the valve springs and the cylinder head. The late type valve springs are coded with a white paint

daub on them. If your engine does not have them or if there is an excess of 15,000 miles on the engine, install new valve springs, part no. 418737.

The carburetors are maintained according to standard recommendations. Aside from *standard* "ZH" needles we can recommend "SA" needles. They can be obtained from Nisonger Corp., 125 Main St., New Rochelle, N. Y. A desirable addition would be Volvo's specially tuned, 4 branch, fabricated steel manifold, which has been alloy sprayed for appearance and heat distribution. This is carried under Volvo part no. 75007. An optional camshaft, part no. 418707, should also be installed. This cam will give good performance throughout the power range with no significant loss of low end torque. This camshaft is standard on 1800 S from CH no. 6001 onwards.

Tuning specs are as follows for the modifications mentioned.

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

TIMING – 17° – 19° B.T.D.C. @ 1500 R.P.M.

NOTE: SOME EARLIER ENGINES MAY HAVE A DISTRIBUTOR VACUUM ADVANCE. THE HOSE MUST BE DISCONNECTED AND THE HOLES PLUGGED. TIMING MUST BE SET WITH VACUUM ADVANCE DISCONNECTED.

DISTRIBUTOR DWELL ANGLE – 60°.

VALVES – INTAKE AND EXHAUST, SET AT .020" – .022", ENGINE HOT.

B – CLUTCH

Although the standard clutch on your car is entirely reliable for normal use, it is recommended that you install Volvo's optional diaphragm clutch for absolutely positive engagement under all conditions. In order to install this clutch, the flywheel must also be replaced to accommodate the pressure plate. The parts necessary are as follows: Flywheel, part no. 418932; Pressure Plate, part no. 418996; Clutch Disc, part no. 418871.

C – REAR AXLE

The standard rear axle is 4. 1:1 on Sedans and 1800 S without over-

drive, and 4. 56:1 on 1800 S with overdrive. It is suitable for most general purposes, however, a 4. 56:1 rear axle ratio (part no. 661518) and a 4. 88:1 ratio is available for model 27 rear axles. A model 27 rear axle can easily be identified by the fact there is no drain plug at the bottom of the housing.

A limited slip (anti-spin) is available for *model 27* rear axles and is well worth the cost. This is carried under part no. 279953. With a limited slip, the axle shaft end play *must* be adjusted to at least .012". We also recommend that a special lubricant be used, such as, G. M.'s positraction rear axle lube which is available through any G.M. dealer.

We recommend that the inner axle shaft oil seals be replaced in conjunction with any of these operations. Ensure that the seals are the late type, i.e. spring loaded neophrene rubber. These are necessary to prevent rear axle grease leakage under hard usage.

D—SUSPENSION

For regular road usage or occasional field trial type events, we suggest leaving the coil springs and sway bar in stock condition. If you should like to proceed further, the order should be shocks, sway bar, springs. The most desirable change initially is as follows:

Koni fully adjustable shock absorbers are available through Volvo dealers and while they are somewhat expensive you will find they are more than worth it due to their excellent reliability and adaptability to various conditions. They are available according to part numbers.

<u>PV 544</u>		<u>122S Sedans</u>		<u>1800 S</u>	
Front	Rear	Front	Rear	Front	Rear
279914	279915	279945	279946	279965	279966

The shock absorbers should be adjusted as follows: 122 S hard in front, medium in rear. PV 544 and 1800 S medium in front, medium in rear.

If you are running some high speed field trials or auto crosses, it is recommended you install a heavier duty sway bar. Please note that the sway bar change is only applicable to the 122 S Sedans. The standard sway bar should be retained on the PV 544 and 1800 S.

The sway bar should be made up of an 1 1/8" bar spring steel. This is not a Volvo stock item, but can be made up easily by any good

spring shop at reasonable cost. Use your 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, however, the two large upper support rubber bushings will have to be modified to a larger diameter to accommodate the sway bar.

The coil springs may be shortened to stiffen the suspension and lower the center of gravity. This should be done only if the car is to be used for road racing. Then the springs are cut 2" in front and 3" in the rear. The modification must be made by an experienced spring shop. We do not recommend heating the springs to collapse them the proper amount. The rear axle limiting straps should then be shortened a corresponding amount. Volvo optional variable rate springs are available under part nos. 525060 and 525061, front and rear respectively, on special order. These springs are used primarily in Europe under the adverse conditions of rallies run there. After spring modifications the front wheels should be carefully aligned according to specifications and all wheels balanced.

E - BRAKES

It is not generally necessary to make extensive modifications to the brake linings, drums, or discs for usage on the road or activities such as auto crosses and similar events. A useful recommended installation is the Servo Power Brake unit which is carried by Volvo as an option, under part no. 276457 and the Brake Piping Kit, part no. 276458, which is needed to complete this installation. Please note that this kit is available only for 122 S models, which are equipped with disc brakes. Those wishing to modify their brakes further, should refer to paragraph "Brakes" under Competition Preparation. It is acceptable to use the heavy duty brake pads for general use, and you may find them desirable depending on the way you drive your car.

F - TIRES

Tires and tire pressure are up to the individual's preference. Generally a 3 P.S.I. increase from standard tire pressure front and rear is a good place to start. Ideally for fast touring or field events, a radial or belt type tire such as Michelin X, Dunlop SP, Continental or Pirelli should be used. These should be mounted on a 4½" width rim as used on the Volvo 1800 S. Specify to your dealer whether you want slotted or solid disc rims. Slotted wheel, part no. 668280; Solid wheel, no. 657838.

If you are a rally enthusiast and participate under snow or ice conditions or even for normal driving under the same conditions, you should consider studded snow tires. To be proper, all four tires should be studded for winter use. These are an excellent safety feature and should be seriously considered. Scason Company, Inc., 17 Barstow Road, Great Neck, Long Island, N. Y., which is a well known *Swedish* manufacturer of studs, can answer any specific inquiries. Most tire companies both domestic and imported, supply tires made for studding. That is, the tires have premolded holes necessitating only having the studs installed.

G – INSTRUMENTS

Here again, it is strictly up to individual preference whether to install supplementary gauges, however, it is recommended for serious driving. One cautionary note; if an oil pressure gauge is installed, one having a maximum reading of 100 P.S.I. *must* be chosen; *not* 80 P.S.I. The Volvo with a cold engine can register 100 P.S.I. An 80 P.S.I. gauge may rupture. *All oil pressure gauge installations must be made with a flex line between engine and firewall.* We definitely recommend the purchase of a good quality tachometer. Observe a red line of 6000 R.P.M., as after that the torque and horsepower curve drops off rapidly. All that is accomplished by continually exceeding 6000 R.P.M. would be abusing the engine and decreasing the life of the entire drive line.

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

We specifically would like to refer you to the "FINAL NOTES" section found at the end of Competition Preparations.

The Volvo *accessories* booklet contains many useful items you may be interested in. If you do not have one, your dealer will be happy to oblige.

COMPETITION
PREPARATION

The factory has produced a *tuning kit* that offers considerably better performance than had previously been offered as optional equipment. The tuning set when used in conjunction with additional modifications to the engine will increase the engine output to over 135 SAE horsepower. It will be offered as a kit only for several reasons, (1) the various parts compliment each other and are carefully machined to exacting specifications, (2) it is possible for Volvo to offer the kit at a more reasonable cost as compared to individual items. We have listed below the contents of the kit.

TUNING KIT, PART No. 419398

- 1 – Cylinder head, complete with springs, oversize valves, combustion chambers and ports, which are designed for increased volumetric efficiency and effective compression. Compression ratio in conjunction with a .040" overbore will exceed 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 when cornering hard in turns.
- 1 – Special timing gear cover complete with a positive Double Flange Oil Seal.
- 1 – Crankshaft pulley hub.
- 1 – Extractor type tuned exhaust manifold.
- 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 type driving and occasional wide open throttle driving.

Tuning notes with this kit are :

- Spark plug gap – .028"
- x) Distributor dwell – $60^{\circ} \pm 3^{\circ}$
 - Valve clearance
 - intake and exhaust
 - warm engine – .020" – .022"
- x) Ignition timing
 - 100 octane fuel – $17^{\circ} - 19^{\circ} @ 1500$ R.P.M.
- x) NOTE : For earlier B 18D engines (Sedan) than engine nos. 76575, 7845 and B 18B engines (1800S) engine no. 1998, the Volvo Distributor part no. 240208 must be used. The advance curve is different.

SAE 5 engine oil must be used in carburetor piston dampeners.

Due to varying local conditions, the competitor will wish to experiment further with fuel needles, and we will therefore leave that to individual preference.

The tuning kit must be supplemented with the following operations and parts in order to complete your racing package.

The cylinder block should be bored to at least .040" oversize and a piston clearance of .003" – .0035" observed. The largest oversize piston Volvo stocks is .050". The cylinder block must be carefully and thoroughly washed after machining with a warm solution of water and detergent. All channels in the cylinder block must be thoroughly blown through.

The Sedan engines (B18D) use normal lead babbitt main bearings, which are very reliable for normal usage, however, they must be replaced with 1800S (B18B) type main bearings for racing. These bearings consist of lead-bronze with an indium coating and are considered one of the finest in the world today. The main bearing kit complete is listed under part no. 276698, standard size. It has not been found necessary to provide extra bearing clearances other than standard. The same holds true for drilling extra oil gallery holes or grooving the journals. The crankshaft oil-feed holes must be blown through thoroughly.

An oil cooler is a definite requirement. It is standard part on 1800S (B18B) engines and is directly interchangeable between the two model engines when utilizing all the necessary parts.

As a further precautionary measure in addition to the special oil pump pick-up, it is advantageous to baffle the oil pan to ensure against oil surging away from the bottom of the oil pan under hard cornering.

The oil level *must* be kept *at* or slightly *below* the maximum mark on the dipstick. If overfilled, cavitation of the oil pump can occur and result in oil starvation to the engine.

Referring back to the cylinder head for a moment, it is important that the intake manifold is correctly aligned to the ports and the carburetor aligned to the manifold.

CLUTCH

The diaphragm pressure plate part no. 418996 and disc, part no. 418871 must be used in conjunction with the special flywheel.

REAR AXLE

See Street performance sheet.

SUSPENSION

All suggestions made under "Street Performance" are applicable.

Wheel alignment recommendations are as follows :

CAMBER - ($-3/4^\circ$)
CASTER - ($+1/2$)
TOE-IN - (0 to $1/16''$)

Wheel alignment again will be subject to personal preference. We must point out that negative camber is necessary to minimize tire wear and maintain nearly correct wheel geometry to the outside wheel during hard cornering.

BRAKES

In addition to the Servo Power Brake unit, it is necessary to install Volvo's optional cerametallic brake pads on both front and rear. Testing for proper long-lasting, no-fade brake material has been extensive and results have proved to be extremely satisfactory under the most severe conditions. The part nos. and quantities are listed as follows :

PV 544	122 S Sedans / 1800 S
4 of no. 75980	2 of no. 75980 - each kit contains 6 pads.
	2 of no. 75981 - each kit contains 2 pads.

NOTE : Part no. 75980. Three pads should be mounted on each shoe; one pad in the middle, one pad on each end where the standard lining ends. Care must be exercised when riveting the pads, as any undue amount of pressure will cause the pads to crack. The new pads should be carefully broken in so that proper seating will take place.

A reduction valve supplied by Volvo for 122S Sedans and 1800S as an option should be mounted. This unit results in a suitable distribution of braking force between the front and rear wheels. In other words it prevents the rear wheels from locking up under hard braking. This is available only for disc brake cars and for P 1300 Sedans upto chassis no. 143999 and 1800S chassis no. 16499.

The required parts and nos. are as follows :

122S SEDANS

1 – valve no. 671894
2 – washers no. 941906
2 – bolts no. 958244
1 – brakeline no. 672047
1 – brakeline no. 672049

1800S

1 – valve no. 671894
1 – brakeline no. 677053
1 – brakeline no. 672054
2 – washers no. 941906
2 – bolts no. 958244

With the 122S Sedans the valve is fitted on the rear of the reinforcing plate of the left seat support and with the 1800S on the rear of the left front side member. The valve is attached with 1/4" selftapping screws for which 3/16" holes are drilled.

TIRES

In addition to the tires mentioned in the preceding chapter, we can mention that Goodyear Blue Streak T-6 or T-7 have given excellent results on Volvo. The recommended Goodyear size is 590 x 15".

The various imported tires are available in 165mm x 15", which is the suitable size for Volvo.

These tires will perform best mounted on 5 1/2" wheels, which are available on *special order* from your Volvo dealer, or you may obtain 15" Chrysler product wheels on the domestic market, which are suitable.

INSTRUMENTS

Our minimum recommendations for instrumentation includes tachometer, oil pressure (100 P.S.I. maximum) and water temperature gauge.

A maximum of 6000 R.P.M. should be observed with occasional burst of 6500 R.P.M. allowable. Volvo does not supply gauges or instrument panels as an option.

BODY

The car should be lightened as much as allowable according to the rules of the organization, who is sanctioning the event. For your information the official weight of the P 1300 Sedan as per the latest F.I.A. Homologation papers is 1013 kg or 2234 lbs.

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 418996
- *1 – Clutch plate 418871
- *1 – Gasket for exhaust /inlet manifold 418870

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

SAFETY NOTES

1. Insure that ALL equipment is in top condition, tightened and adjusted properly, I.E. Tires, Wheels, Brakes, Etc.
2. Make sure the interior of the car is clean and with no loose objects lying around.
3. Make sure you can see adequately through the glass and mirrors.
4. Lock your doors from inside to insure against accidental opening from outside.
5. Last step before taking off . . .

Buckle your *Properly Adjusted* Volvo three point seat belt.

The Volvo three point seat belt will give you *50% more protection than* the conventional lap belt.

A loose belt will not give you the proper protection.
Volvo provides you with this insurance. **USE IT!**

FINAL NOTES

1. It will be your responsibility to check *all regulations* pertaining to modifications of your car according to the organization under which you are running and who has sanctioned the event.
2. It is of the utmost importance that *all work* performed is carried out with care and meticulous attention to detail, otherwise all your work will prove to be of little value and you will end up on the score card as a "D.N.F."
3. We strongly recommend you purchase a Volvo shop manual and adhere to all assembly instructions and torque specifications. It is available through any Volvo dealer for \$15.00. Please specify year and model when ordering.
4. Any customer who wishes further information or advice regarding the extent of modifications to suit his particular purposes or needs should write to Volvo, Inc. outlining, of course, just what the car will be used for.
5. Homologation forms are available for Sedans.

V O L V O, Inc.