

# Reference Manual



# BMW ALPINA B7



## Technical Training

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# BMW ALPINA B7

Model: E65

Production: from 11/2006 (2007 MY)

# OBJECTIVES

After completion of this module you will be able to:

- Identify a BMW ALPINA B7.
- Explain the differences between a conventional E65 and a B7.
- Know what additional service is required on the supercharger.

## Introduction

Committed to developing the best performing vehicles in the luxury market, BMW with ALPINA has created a special high performance version of BMW's 7 Series luxury sedan. The 2006 BMW ALPINA B7 brings together the luxury, pioneering design, and advanced technology of the 7 Series Sedan with the scintillating performance of a supercharged, 500hp V-8 engine.

To power the BMW ALPINA B7, ALPINA specially developed a higher-performance version of BMW's 4.4-liter, 90-degree V-8 engine and mated it to a 6-speed automatic transmission featuring steering wheel mounted shift controls.

The motor produces 500 horsepower at 5,500 rpm along with maximum torque of 516 lbs.-ft. at 4,250 rpm, and propels the B7 from 0-60 mph in a mere 4.8 seconds.

ALPINA 21-inch wheels carry Z-rated performance tires, while the sport-tuned suspension includes Active Roll Stabilization.

The B7 aerokit includes a rear spoiler to improve stability, handling, and performance at high speeds.

ALPINA was established in 1964 as an official and approved "ennobler" of BMW automobiles. Their tradition is to take production BMW vehicles and make them even more appealing to connoisseurs of automotive finery.

With this new model, BMW will raise the benchmark for the segment in terms of performance, refinement, technology, and luxury.



## Technical Data

General	
Curb weight, lb.	4476
Weight distribution, front/rear, %	51.0/49.0
Wheelbase, in.	117.7
Track, front/rear, in.	62.3/62.2
Length, in.	198.4
Width, in.	74.9
Height, in.	58.1
Body	
Type	4-door sedan
Drag coefficient (CD)	0.31
EPA size classification	Large
Engine & Electrical	
Engine type	DOHC 32-valve (4-cam) V-8
Engine features	Supercharged & intercooled, steplessly variable induction system, Valvetronic variable intake-valve lift & Double VANOS variable intake- & exhaust-valve timing
Cylinder block & heads	Aluminum
Bore x stroke, mm/in.	92.0 x 82.7/3.62 x 3.26
Displacement, cc/cu in.	4398/268
Compression ratio	9.0:1
Power @ rpm, hp	500 @ 5500
Torque @ rpm, lb-ft.	516 @ 4250
Engine-management system	Motronic ME 9.2.1
Fuel requirement	Premium unleaded
Fuel capacity, U.S. gal.	23.3
Battery capacity, amp-hr.	90
Generator output, amp./W	180/2520
Drivetrain	
Drive system	Front engine/rear drive
Automatic transmission	ZF 6 HP 26, 6-speed with external oil cooler, SWITCH-TRONIC shift system & modified internal components

Drivetrain (Cont.)	
Ratios:	
1st	4.17:1
2nd	2.34:1
3rd	1.52:1
4th	1.14:1
5th	0.87:1
6th	0.69:1
Reverse	3.40:1
Final drive ratio	3.64:1
Chassis	
Body/frame construction	Unitized all-steel structure with aluminum hood & front fenders
Front suspension	Strut-type in aluminum; double-pivot lower arms, coil springs, twin-tube gas-pressure arms, coil springs, twin-tube gas-pressure shock absorbers, Active Roll Stabilization, aluminum subframe; ALPINA sport calibration
Rear suspension	4-link Integral suspension in aluminum, coil springs, twin-tube gas-pressure shock absorbers, Active Roll Stabilization, aluminum subframe; ALPINA sport calibration
Steering type	Rack & pinion, vehicle-speed-sensitive power assist & variable ratio, with ALPINA oil cooler
Turning circle, ft.	39.7
4-wheel ventilated disc brakes: Diameter x thickness, mm/in.	374 x 36/14.7 x 1.42 front/ 370 x 24/14.6 x 0.94 rear
Wheels	Cast alloy, 21 x 9.0 front/21 x 10.5 rear
Tires	Performance, 245/35ZR-21 front / 285/30ZR-21 rear
Stability-enhancement system	Dynamic Stability Control (DSC), including Dynamic Traction Control, antilock braking (ABS), Dynamic Brake Control & cornering/braking stability enhancement
Performance Data	
Acceleration, 0-60 mph	4.8 sec.
Top speed	186 mph
EPA est. MPG, city/highway	15/23



## ALPINA History

ALPINA was founded by Burkhard Bovensiepen (1936 - present). His passion with performance vehicles began with the purchase of a used Fiat 1500. Not satisfied with the performance of the vehicle, he took it to a friend to give it a check-up and perform some tuning modifications.

Burkhard and his friend added a Weber carburetor, a more aggressive camshaft and opened up the muffler. This raised the horsepower from 67 bhp to 75 bhp. Shortly thereafter, a cloud of blue smoke began to follow the car and Burkhard decided to stop driving Fiat.



Bovensiepen had always been interested in BMW cars, and when BMW introduced the 1800 in 1963, which was more powerful than the 1500, the customers who had recently purchased a 1500 were disappointed; he saw an opportunity.

The BMW four-cylinder engine had four well-designed intake ports and only one small carburetor, so he recognized that he could improve the performance of the car with modification to its intake system. And with that, the first BMW-ALPINA tuning kit was created. The tuning kits costed 980 DM including installation and raised performance of the 1500 to parity with the newer 1800.

BMW's research and development department tested the ALPINA kit and they found nothing wrong with ALPINA's work, so ALPINA got support from the factory which was invaluable. That support made the company's products more desirable to BMW enthusiasts, but it also meant that installation of an ALPINA system did not void the BMW warranty.

ALPINA did not receive immediate acclaim from the press. Auto motor und Sport said that ALPINA's engine modifications would have a bad effect on longevity and reliability. Bovensiepen asked Auto motor und Sport to test the car instead of just commenting on the concept of BMW tuning.

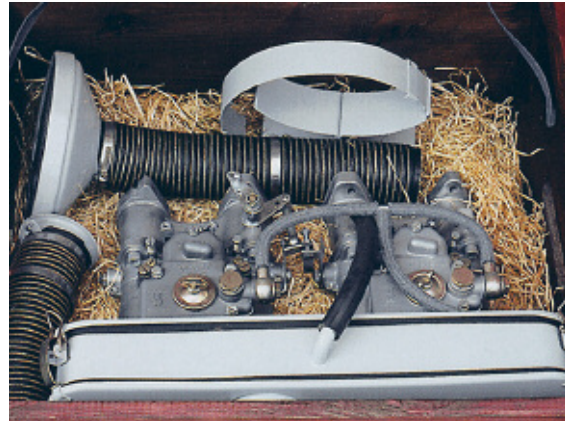
That test showed that the ALPINA-1500 was equal in terms of performance of the 1800 model. The ALPINA car showed no signs of stress or fragility. Auto motor und Sport were clearly enthusiastic about the ALPINA's performance. They also noted that the quality of the car's fit and finish was such that it appeared to have come directly from BMW.

BMW was very impressed and when the higher-performance 1800 ti was introduced, it was fitted with engine components identical to those developed by ALPINA.

Today, the ALPINA headquarters and factory is located in Buchloe, Germany.

## 1961

Derek Bell, Harald Ertl, Niki Lauda and Brian Muir win the European Touring Car Championship for ALPINA and BMW. Niki Lauda sets an absolute Touring Car record for the six-hour race on the Nurburgring, driving the BMW ALPINA Lightweight Coupé. The oil crisis rocks the motor industry. ALPINA works through this difficult time without layoffs. Two factors have a hand in this: the good reputation of the company, as well as the flexible reaction to market needs by a team of employees who were, already then, unusually bound to their firm. ALPINA develops engines that run on regular gas – engines that are at once frugal and powerful



## 1964

Produced in his father's fine mechanical factory by the young business and engineering student, the engines produced with ALPINA dual-carburetor's receive praise not only from the automotive press, but also from BMW and its legendary sales boss, Paul G. Hahnemann. BMW certify the exceptional quality of these ALPINA products by awarding BMW vehicles with the ALPINA system the full factory guarantee



## 1965

ALPINA Burkard Bovenziepen KG is established on the 1st of January in Kaufbeuren. The firm has eight employees



## 1967

The name ALPINA is augmented in its profile by the unmistakable, newly-created company logo – trademark & seal of quality in one





## 1968

ALPINA engages Touring Car Motorsport – the beginning of an incomparable success story. Pilots such as Derek Bell, Harald Ertl, James Hunt, Jacky Ickx, Niki Lauda, Brian Muir and Hans Stuck are found on ALPINA's payroll between 1968 and 1973



## 1970

ALPINA wins the European Touring Car Championship, the 24 Hours of Spa-Francorchamps, as well as all major German Championships: Road Course, Hill-Climb and Rallye



## 1971

ALPINA convinces BMW that a lightweight version of the BMW 3.0 CS is needed to continue to be successful in Touring Car racing. BMW tasks ALPINA with the project leadership for the lightweight BMW 3.0 CSL Coupé. The ALPINA CLASSIC wheels in 20-spoke design were the visual hallmarks of ALPINA's participation in a sports machine officially offered by BMW



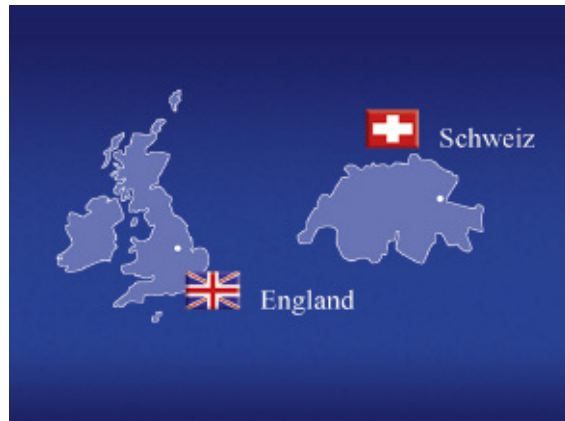
## 1973

Derek Bell, Harald Ertl, Niki Lauda and Brian Muir win the European Touring Car Championship for ALPINA and BMW. Niki Lauda sets an absolute Touring Car record for the six-hour race on the Nurburgring, driving the BMW ALPINA Lightweight Coupé. The oil crisis rocks the motor industry. ALPINA works through this difficult time without layoffs. Two factors have a hand in this: the good reputation of the company, as well as the flexible reaction to market needs by a team of employees who were, already then, unusually bound to their firm. ALPINA develops engines that run on regular gas – engines that are at once frugal and powerful



1975

With selected partners from amongst the BMW dealer body, ALPINA begin the development of a German dealer network. At the same time, importerships in England and Switzerland are established



1977

Dieter Quester is European Touring Car champion in a BMW ALPINA 3,5 CSL, after exciting battles with the heavily-favored Jaguar-Coupés. At the end of this successful season, ALPINA steps out of Touring Car racing for a period of ten years, to dedicate all efforts to the development of fascinating road-going automobiles



1978

To wide press acclaim, ALPINA presents three automobiles at Lago di Garda in Italy, each completely developed at ALPINA. The BMW ALPINA B6 2,8 is a 3-Series BMW with six-cylinder engine, at a time when BMW only sold 3-Series with four-cylinder engines. Such high displacement in a relatively light car creates a whole new level of driving ease. The BMW ALPINA B7 Turbo, based on the 5-Series BMW, is the fastest saloon in the world. With 300 horsepower, the B7 Turbo Coupé establishes itself amongst the most powerful Coupés. Each of these new-generation ALPINA engines have a fully-electronic computer ignition, unique at the time in the automotive world



1979

Burkard Bovensiepen incorporates a new business endeavor, the ALPINA wine importership. In an impressively-short span of time, ALPINA wins over nearly all of Germany's top restauranters as clients, as well as many wine lovers. The ALPINA importership to Japan is opened, and a successful partnership begins – in 2001 ALPINA delivered the 2000th BMW ALPINA to Japan



1981

"Auto motor und Sport" organizes the Shell Kilometer Marathon, a fuel-saving challenge. The 80 mpg-car was not yet a topic, yet a BMW ALPINA 318i wins in class with fuel economy of 105.72 miles per Imperial gallon



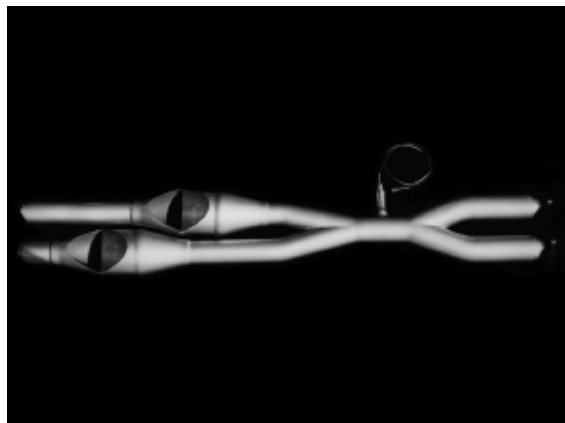
1983

ALPINA is officially registered as an automobile manufacturer by the German Ministry of Transport, the Kraftfahrtbundesamt



1985

ALPINA converts its entire automotive production to engines with catalytic converters. What's special about that? Instead of installing the more commonly used ceramic catalytic converters standard in the automotive industry, ALPINA are the first manufacturer to exclusively install metal catalytic converters, using EMITEC technology. Not until years later will this concept be found in other high-tech automobiles



1987

The International German Touring Car Championship enjoys great public interest, thanks in part to new rules decisively influenced by Burkard Bovensiepen. Ellen Lohr, Andy Bovensiepen, Fabien Giroix, Peter Oberndorfer and Christian Danner, driving the BMW ALPINA M3 Gruppe A, earn multiple victories, along with many good placings. ALPINA are also pioneers in terms of the environment impact of racing cars – the metal catalyst debuts in the BMW ALPINA M3 Gruppe A and becomes standard equipment in every DTM race car



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BMW ALPINA B7



1988

Due to capacity constraints, priorities have to be drawn. The decision is taken in favor of the development and production of new BMW ALPINA automobiles. As a result, ALPINA withdraw at season's end from racing



1989

ALPINA create a highlight in presenting the B10 Bi-Turbo. Paul Frère, the well-known journalist and racing driver, writes in Road & Track about this automobile: "For me this is the car ... I think this is the best 4-door in the world "



1990

ALPINA expand. The number of employees has grown in the meantime to 120, necessitating the construction of a new, generously-dimensioned building for administration and production



1992

With the advent of the BMW ALPINA B12 5,7 Coupé, ALPINA is the first automobile manufacturer to realize an electronic clutch management system termed ALPINA SHIFT-TRONIC. Foregoing use of the clutch is a breeze in light of the six-speed gearbox' dynamic driving characteristics



1993

ALPINA SWITCH-TRONIC opens a new, sporty automatic driving dimension. The combination of manual gear selection coupled to the traditional ease of driving an automatic convinces many died-in-the-wool stick-shift drivers to make the move to this modern automatic system. One of the merits of ALPINA's SWITCH-TRONIC is the ability to shift the gears using buttons on the back of the steering wheel, much like Formula racing drivers shift their semi-automatic gearboxes



1995

ALPINA is the first automobile manufacturer to introduce into series production the SUPER-CAT, an electrically heated, metal catalytic converter, as found in the BMW ALPINA B12 5.7 E-KAT. This joint project with BMW and EMITEC represents the use of a completely new emissions control technology, undercutting the 1996 European emission standard by 80% with regard to HC, NOx and CO, respectively



1999

A new era begins: ALPINA presents a diesel automobile for the first time in its 35-year history, the BMW ALPINA D10 BITURBO at the Geneva Salon d'Automobile - the most powerful diesel saloon in the world. The engineering development of the super-diesel is a co-operative project between BMW and ALPINA



2002

Based on the BMW Z8, ALPINA build the BMW ALPINA ROADSTER V8 with SWITCH-TRONIC for friends of luxurious and comfortable open motoring. A limited series of 555 automobiles world-wide, this exclusive model leads ALPINA to officially enter the North American market, where the ROADSTER V8 is an immediate success with 450 sales. The balance of 105 found homes in Japan and Europe, warming the hearts of their owners



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2003

With the advent of the BMW ALPINA B7, ALPINA realize a new engine concept, a mechanically-driven radial compressor – combining for the first time ever charging and VALVETRONIC – this leading to very low fuel consumption on this 500-horsepower automobile



# Body

## Exterior

The exterior of the BMW ALPINA B7 is essentially the same as the standard production E65. The chassis remains untouched but further refinements have been made in the following areas:

- Front bumper cover
- Rear bumper cover
- Rear lid spoiler
- Wheels
- Signature ALPINA pinstripes and hood/trunk badges



## Spoilers

Due to the higher speeds that the BMW ALPINA B7 is capable of compared to the standard production variant, extra aerodynamical elements needed to be added for stability at high speeds.

### ■ Front

The front bumper cover is made of two individual sections bonded together. The original bumper cover is still utilized but modified on the lower section in order to bond the signature ALPINA lower bumper cover.

This serves not only to identify the vehicle as an ALPINA version of the E65, but allows extra airflow to the cooling module assembly and increases the downforce to the front of the vehicle that is needed for increased stability at high speeds.



### ■ Rear

The rear bumper cover has been taken directly from the E65 standard production vehicle. Only a small portion where the exhaust pipe protrudes had to be modified. A finishing trim piece is then bonded and riveted on to give it a finished look.





■ The Rear Lid

The rear deck lid has a spoiler attached to aid in the aerodynamics at higher speeds.



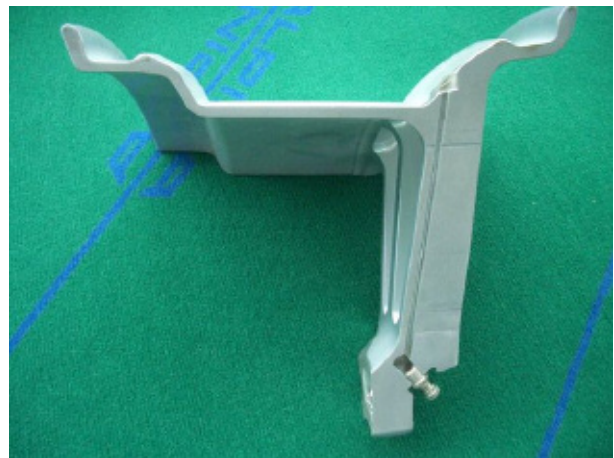
Wheels

The BMW ALPINA B7 is equipped with 21" 20 spoke wheels.

The valve stem is concealed behind the anti-theft equipped center hub cap. The air is channeled through a hollowed out spoke on the rim.

The tire dimensions are as follow:

	Wheel	Tires
Front	9" x 21"	245/35 ZR21
Rear	10.5" x 21"	285/30 ZR21



Valve Stem Location

## ■ Wheel Locks

The BMW ALPINA B7 comes with a mechanically locking center hub cap for the wheels. In order to remove the center cap, a mechanical key is needed. A set of keys is delivered to the customer upon delivery. All wheel locks for the vehicle are keyed the same.



### Wheel Lock Unlocking Procedure



1. Center cap in normal position



2. Press cap inward on "P"



3. While pressing cap inward rotate



4. Make certain tumbler is exposed



5. Remove finger



6. Insert Key and Remove Cap



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## Interior

The interior of the vehicle will be the same as offered in the regular production E65. The ALPINA specific components will be:

- Steering Wheel
- Floor Mats
- BMW ALPINA plaque on overhead console
- Door sills trim piece

### Steering Wheel

The steering wheel on the BMW ALPINA B7 is derived from the E60 steering wheel.

The factory steering wheel is modified by ALPINA in Buchloe, Germany and adds functional microswitches located behind the steering wheel that can be used for shifting the transmission without ever taking your hands off the steering wheel (SWITCH TRONIC).



# Electronics

The electronic system on the BMW ALPINA B7 corresponds to that of the regular production E65.

Minor changes have been made in the programming and coding of the vehicle to account for ALPINA specific functions.

Example: *The steering wheel electronics control unit has been modified to identify the upshift/downshift button on the steering wheel.*

*The transmission shift points have been changed.*

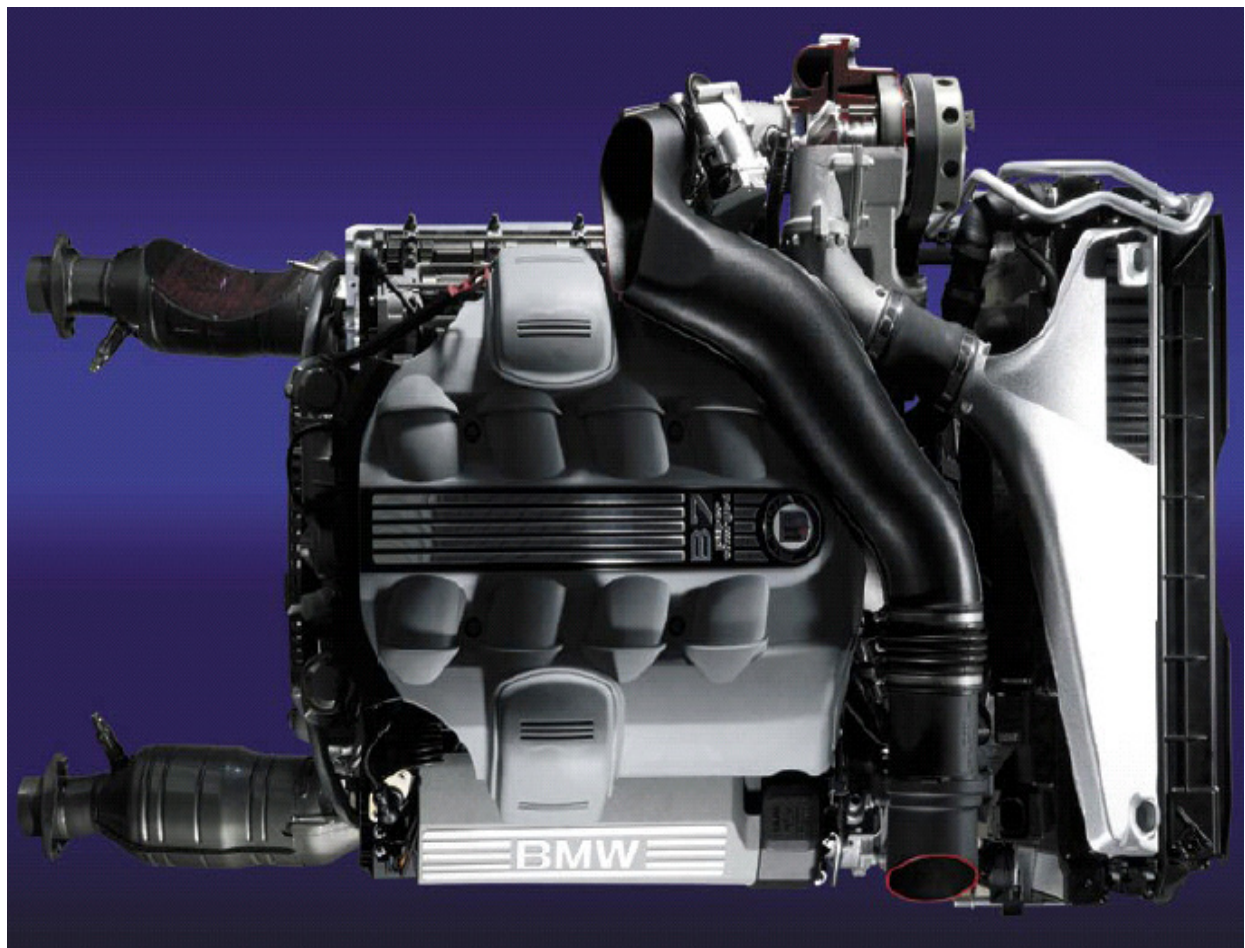
# Drivetrain

## Engine

The BMW ALPINA B7 is equipped with a modified N62B44 engine. The engine is entirely assembled at the ALPINA facility in Buchloe Germany to include higher performance components such as entire piston assemblies and front timing case covers (for super-charger mounting/oil supply).



The entire engine is assembled in approximately one day. The same Master Technician that starts the assembly process sees it to conclusion. The final process for the technician is to stamp the identification number on the block by hand.





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## Supercharger

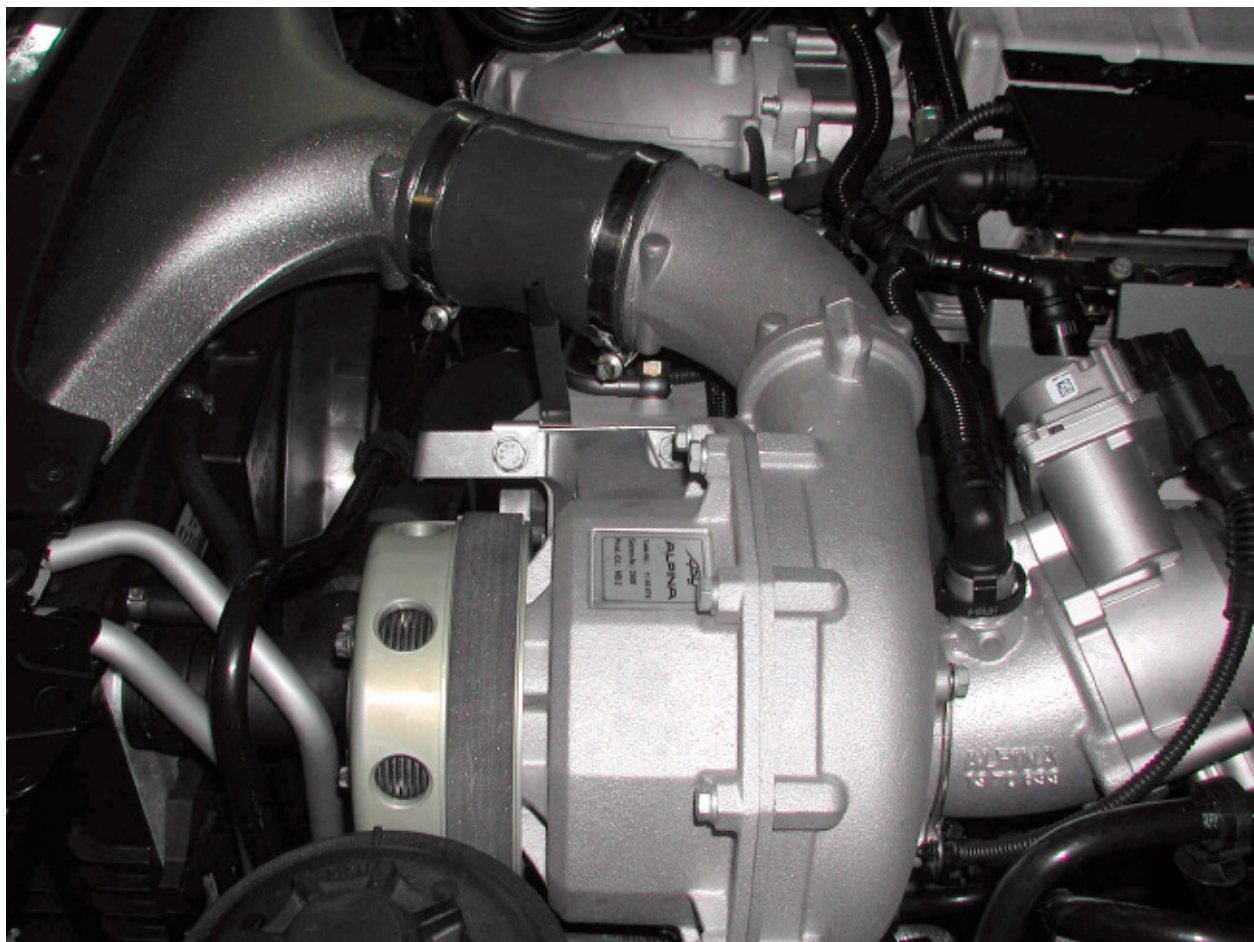
The main advantage of the ALPINA modified N62B44 engine is the use of a planetary gear driven supercharger that drives a Nautilus or Radial impeller.

The ratio of the supercharger gears is 17.5:1. This indicates that with a speed of 6,000 rpm, the supercharger is capable of rotating at a speed of 105,000 rpm.

Because of these extreme characteristics, the tolerances on the mechanical elements of the supercharger are imperative.

The design/concept of the supercharger was originally developed and patented by ZF. ZF was unsuccessful in utilizing the design in production because of reliability issues due to the metals used.

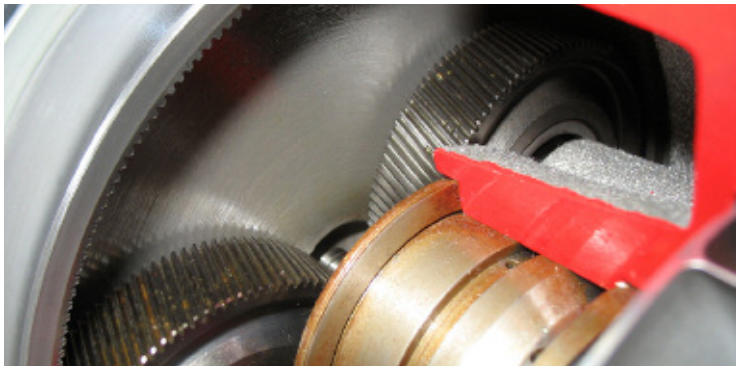
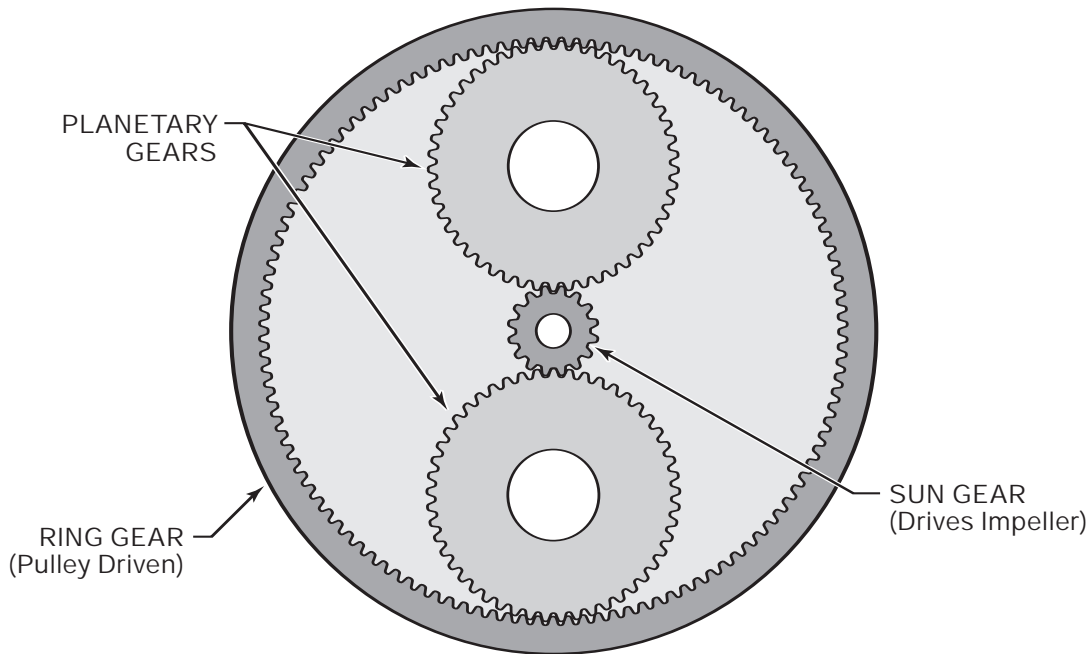
ALPINA has perfected the design and materials utilized, thus allowing this type of supercharger to be utilized. ALPINA has been very successful with the design of the supercharger.



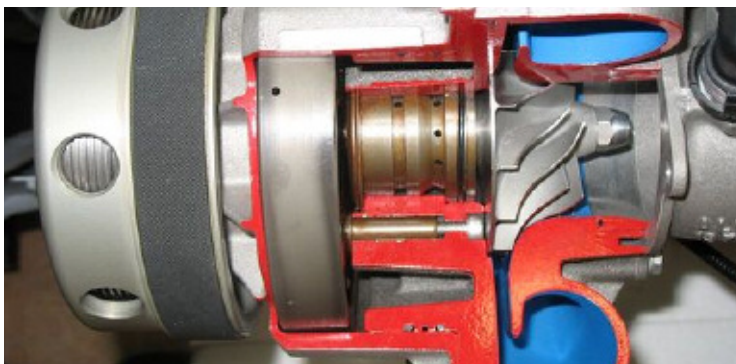
■ Design

The supercharger uses a planetary gearset to multiply the speed from the pulley. The ratio between the input speed and the output speed is 17.5:1 (105,000 rpm @ 6,000 engine rpm!).

The ring gear is driven whenever the drive clutch is engaged. The ring gear then drives the planetary gears that are meshed to the center sun gear.



Close-up View of Supercharger Gears



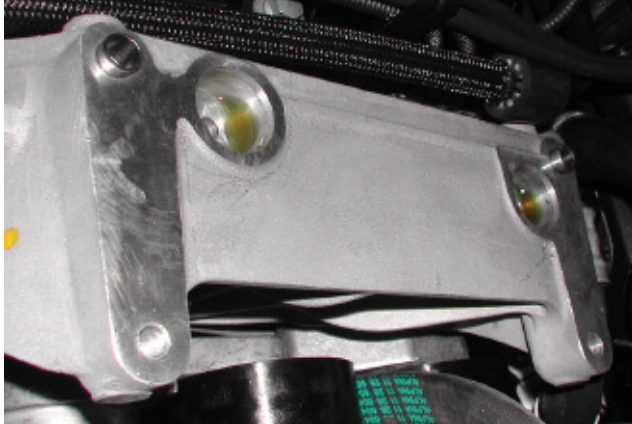
Cutaway View of Supercharger



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The supercharger utilizes the engine oil supply as its cooling and lubrication system.

In order for the oil to be transferred to the center assembly of the supercharger, the upper timing case cover on the 2<sup>nd</sup> bank (cylinders 5-8) had to be modified to include an oil passage. This passage allows oil to flow through it and over to the Supercharger mounting bracket.



Supercharger Mounting Bracket  
(Oil Passage Exposed)

Note: It is extremely important that the two alignment dowel pins are installed on the support bracket. Failure to do so will result in damage to the supercharger.

The supercharger has an oil restricting orifice on the bottom mounting area. It is crucial that this restricting orifice is installed before mounting otherwise it would result in low engine oil pressure.



Supercharger - Oil Restricting Orifice (Right)

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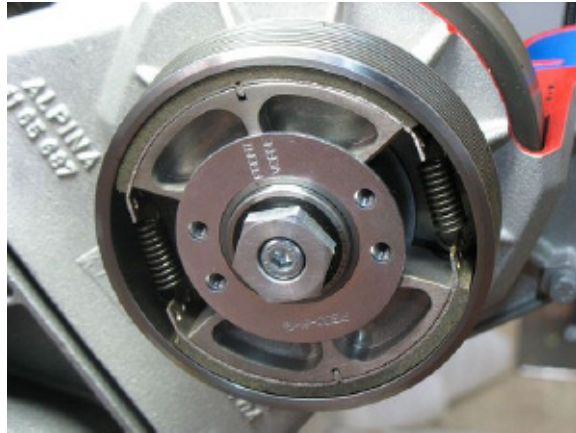
■ Clutch

The supercharger is not engaged while the vehicle is idling. In order to make this possible, a centrifugally engaged clutch is utilized. The clutch is fully engaged at an engine rpm of greater than 1,100 rpm.

Because of the de-coupling of the supercharger at low rpm, the idle quality and fuel economy of the BMW ALPINA B7 is improved.



Bell Housing/Pulley Installed



Bell Housing/Pulley Removed  
(Clutch Exposed)

■ Service

The clutch friction material has to be checked every 60,000 miles for wear. The minimum thickness is 2 mm.



Clutch Material with Springs and Weights

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### Boost Regulator / Secondary Throttle

One major concern during the development of the engine was to combine the Valvetronic with a supercharging system. The Valvetronic operates with an almost neutral pressure in the intake system (no throttle losses but 50mbar vacuum pressure to realize the crankcase ventilation).

As soon as you have a charger (it is irrelevant which system), the valvetronic won't operate any more to save fuel.

The radial compressor of the B7 runs from approximately 1,100 rpm together with the engine and provides an air flow which would increase the intake manifold pressure slowly until the final pressure of 0.8 bar (overpressure).



As mentioned before, the system does not work fuel savingly with more than 50 mbar at parts load. To counteract this, the boost pressure regulator (throttle in front of the supercharger) reduces the air flow to the supercharger and still keeps the vacuum pressure of 50 mbar in the intake system.

As soon as full power is indicated by the driver, the boost pressure regulator opens and lets the full air flow into the engine.

*"The opportunity we have is to close the regulator like you can put your hand on a fan - the air spins around, the charger needs no power and nothing will be damaged. No measured air has to be blown off like when you use a wastegate.*

*In other words, only the fuel which matches the measured air will be given into the combusting compartment and burned. That's why the B7 is economical and powerful together."*

*- Axel Rimpler - ALPINA Burkard Bovensiepen GmbH + Co. KG*

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## Pressure Sensor

An additional pressure sensor is located before the main throttle housing (before intake manifold) and is used to determine the boost pressure created by the supercharger.

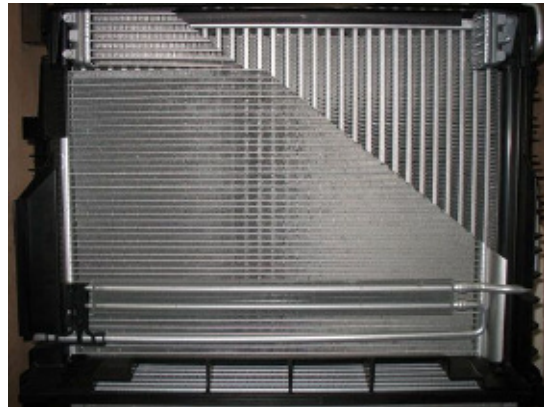


## Cooling Module

The cooling module is made up of six different coolers and is mounted in the front of the vehicle.

The six coolers are:

- Air Intercooler
- Engine Coolant Radiator
- Engine Oil Cooler
- Transmission Fluid Cooler
- Power Steering Fluid Cooler
- Air Conditioning Condenser



All of the cooling modules are prepared and assembled in the ALPINA plant in Buchloe Germany and shipped to the BMW manufacturing plant in Dingolfing. The installation of the module is completely integrated into the manufacturing process.

# Chassis

## Suspension

The BMW ALPINA B7 utilizes the existing 7 Series chassis but modified the hardware to match the higher performance level of the B7.

The ARS system is standard equipment and the springs and absorbers have been tuned by a joint collaboration between BMW, ALPINA, and Michelin to make the calibration firmer.

## Brakes

The brakes have been upgraded to match the equipment on the middle eastern version 760i. These are of a larger size than on the present US version 750i.

Brake Measurement Comparison (B7 vs. 750i)				
Model	B7	750i	B7	750i
Front	374 mm	348 mm	36 mm	30 mm
Rear	370 mm	345 mm	24 mm	24 mm

## Differential

The BMW ALPINA B7 uses the same differential as the 760i.

This differential, although being used in the production of the 760i, includes "ALPINA engineered" strengthening modifications.

The modifications have been integrated into the BMW line.

