TECHNICAL DESCRIPTION

LIBERTY B4

SUBARU
ALL-WHEEL DRIVE

CONTENTS

I N T R O D U C T I O N

Key mechanical changes in the Liberty B4 are: -

- 190 kW sequential twin turbo engine producing a maximum 320 Nm of torque spread across a wide torque band.
- Specially tuned and strengthened suspension for improved handling performance and driveablity.
- Close ratio manual transmission gearbox.
- Higher frequency and bigger capacity ABS computer for faster and more accurate wheel speed control.
- Premium 2DIN McIntosh sound system – comparable to high-class home audio
- Dual stage PIN operated six way immobilisation supplementary security alarm system.

ENGINE

Construction

The phase II engine used in the Liberty B4 is the traditional Subaru horizontally opposed boxer engine with fuel efficient, low emission cylinder heads featuring 'tumble swirl' intake ports.

In the unique configuration of the boxer engine, the pistons move in the horizontal plane from left to right with low levels of noise, vibration and lower power loss. This is due in part to the cancellation of the inertia forces created by the downward force of the pistons that act in opposite directions. With an in-line engine all four pistons are moving in the same direction and therefore a larger and heavier crankshaft is required to counteract this inherent imbalance.

Structurally the horizontal design also yields a more rigid cylinder block because the crankshaft is sandwiched between the left and right hand crankcases and supported by five main bearings. This provides for long life with little wear and tear. An additional improvement on the Phase II engine is the relocation of the crankshaft thrust bearing to the rear of the crankshaft. This provides for a reduction in the transfer of natural engine frequencies to the transmission and driveline thereby improving N.V.H. levels in the passenger compartment.

The natural balance of the horizontally opposed engine along with the lightweight crankshaft provides for excellent rotational balance, rotating smoothly all the way up to high engine speeds without the use of balancer shafts that are necessary with in-line engines. This feature along with the aluminium construction achieves a lightweight compact engine that allows for a great deal of freedom in positioning the engine in the vehicle.

Its low height also makes a low centre of gravity possible with a more balanced left/right and front/rear weight distribution for improved vehicle handling.

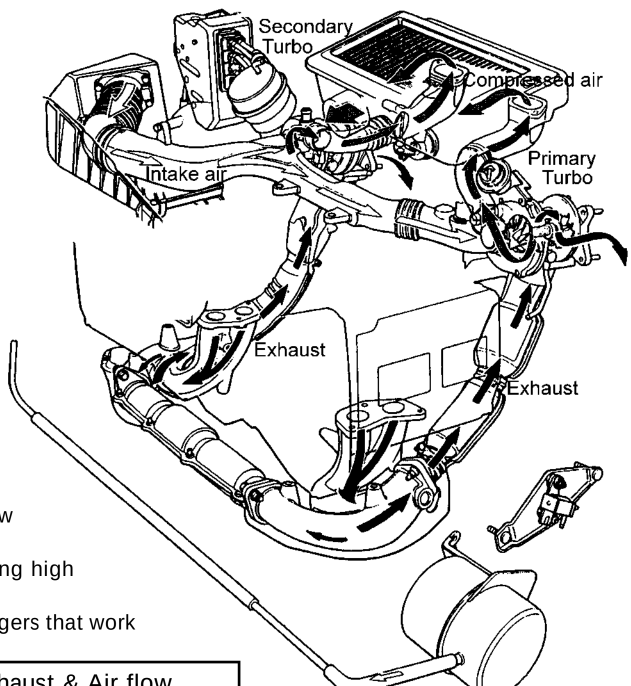
ENGINE

TWIN TURBOCHARGER PERFORMANCE

The purpose of a turbocharger system is to produce a higher engine output while maintaining the same engine capacity. This results in an increased power to weight ratio and therefore improved vehicle performance and handling dynamics due to a better vehicle weight distribution.

The turbocharger harnesses unused exhaust gas energy, to compress the intake air. Compressing the intake air allows a greater mass of air to enter the engine for each firing cycle thereby allowing for a corresponding increase in the amount of fuel injected. The result is a considerably higher power output depending on the 'boost pressure' without increase in engine size or weight.

The problem however with a GT touring car using a single turbocharger is that the torque output is not evenly spread over a wide engine speed range, resulting in a 'peaky' acceleration performance. This is due to the delay in bringing the turbine up to its peak operating speed range when it is most effective in compressing the intake air. This is known as 'turbo lag'. A small modern turbocharger has very little 'turbo lag' because of its low inertia and is most efficient at low to medium engine speeds. Its efficiency however is reduced at high engine speeds due to restriction of the exhaust gas flow and smaller compressor. A large turbocharger works efficiently at high engine speeds producing a high top end power output but at low engine speeds it suffers from excessive turbo lag caused by the delay in achieving high enough compressor speed to compress the intake air. By providing two turbochargers that work sequentially, the advantages of both turbochargers can be realised.



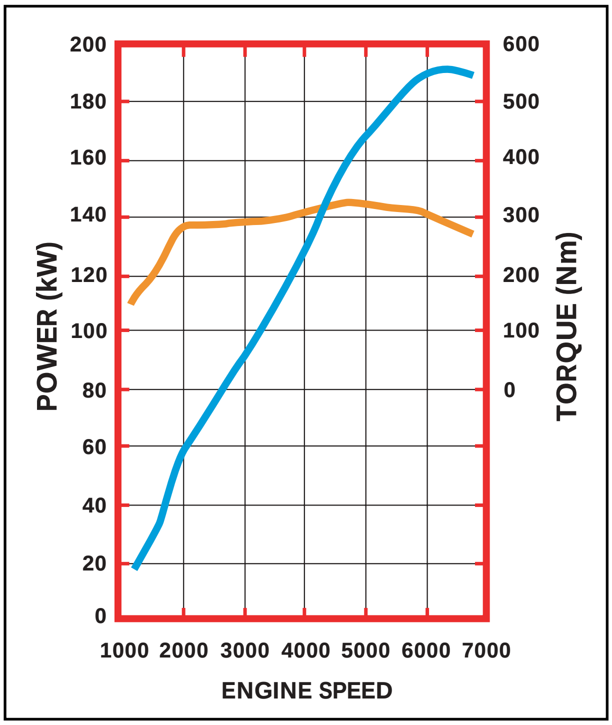
Exhaust & Air flow

ENGINE

TWIN TURBOCHARGER PERFORMANCE

The Liberty B4 provides a smooth and consistent power delivery over a wide operating range with the use of sequentially staged primary and secondary turbochargers.

This provides a wider and flatter torque band which begins with a high level of 278 Nm @ 2000 rpm rising to a peak of 320 Nm @ 4800 rpm while still maintaining a very healthy 300 Nm @ 6000rpm.



Engine EJ20B 69H

Max Power = 190kW@ 6400 rpm

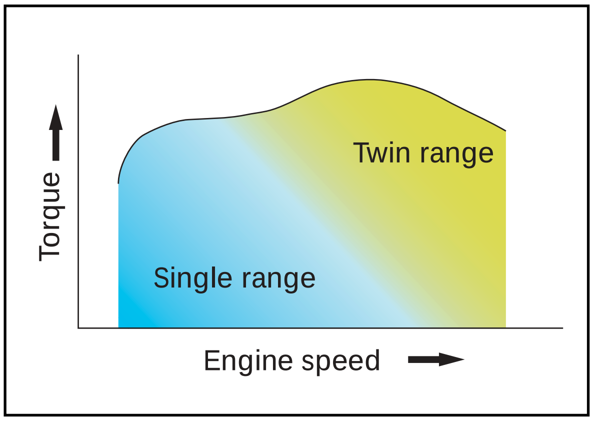
Max Torque = 320 Nm @ 4800rpm

Bore x stroke = 92 x 75 mm

Compression ratio = 9:1

The ‘staging’ between the single and the twin turbo operating range which was quite noticeable to the driver on the previous model B4 has now largely been ‘tuned out’ by the careful selection of turbocharger size and the controlling mechanisms.

As can be seen from the torque curve however under some driving conditions it is still possible to detect a slight reduction in the rate of acceleration in the preparatory or intermediate phase that occurs between 4000 to 4500 rpm.



Torque vs engine speed turbo operation

During this phase exhaust pressure previously only supplied to the primary turbocharger is now supplied to both the turbochargers, leading to a temporary and slight reduction in primary boost pressure.

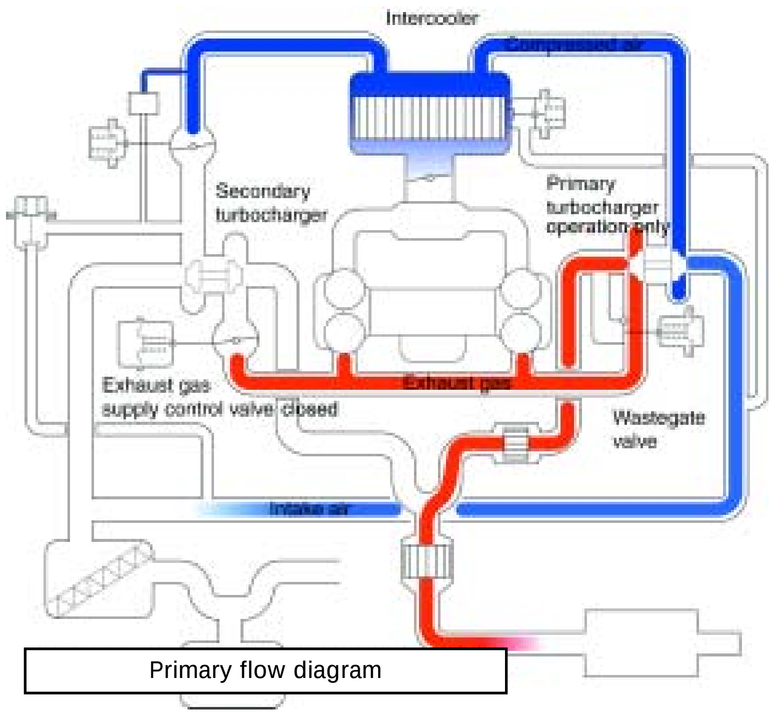
When the twin stage is reached, exhaust pressure to both turbo-chargers increases and a further increase in torque output occurs. The sensation to the driver is one of a slight reduction in engine power. In reality what happens is a flattening of the rate of increase in power output, prior to the full operation of both turbo chargers.

ENGINE

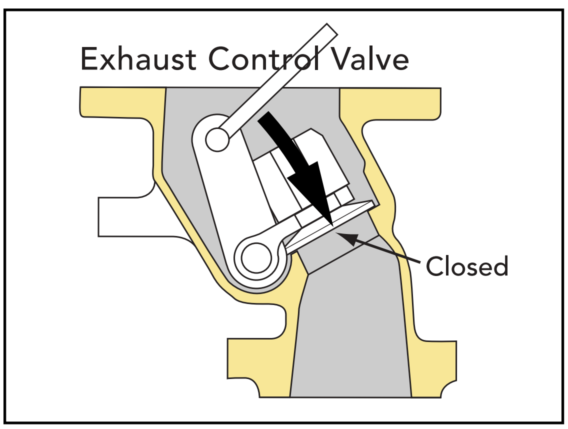
PRIMARY STAGE SINGLE TURBO OPERATION

The Primary Turbocharger, located at the left-hand rear of the engine, primarily provides manifold boost pressure at low to medium engine speeds, however it also continues to generate boost pressure over the entire operating range.

Boost pressure generated by the Primary turbocharger is regulated electronically by the ECM, which regulates the opening of the wastegate via duty solenoid. The secondary turbocharger does not operate at all in the primary stage, as the exhaust control valve is closed at this time.

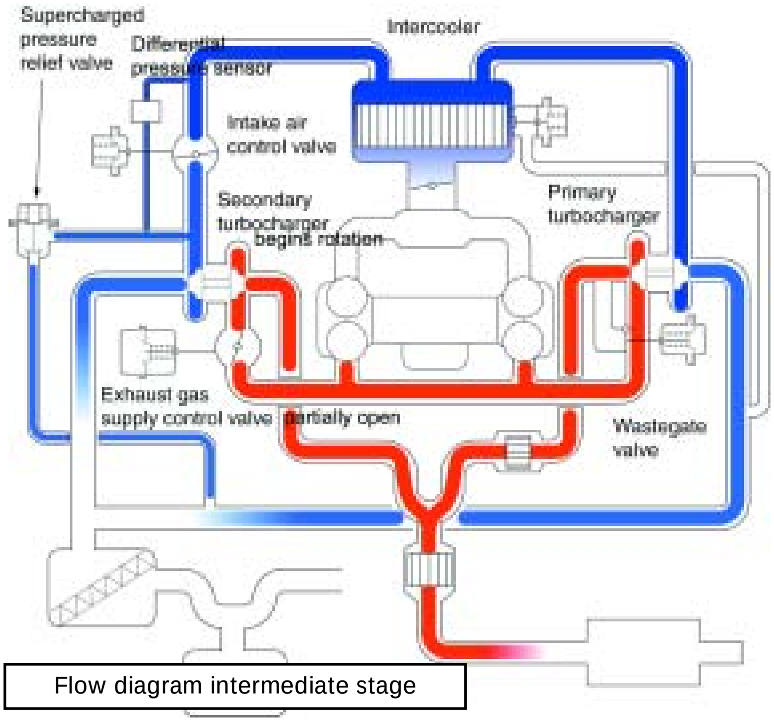


Primary flow diagram



Exhaust Control Valve closed

ENGINE

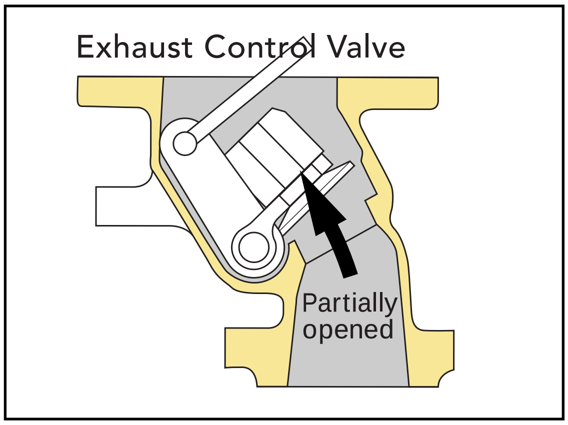


Flow diagram intermediate stage

intermediate (preparatory) stage

At medium engine speeds, the Exhaust Control Valve is partially opened. This causes the Secondary Turbocharger to begin rotating. The amount that this valve is opened is regulated by the ECM via duty solenoid, which controls vacuum applied to the diaphragm of the Control Valve.

Any pressure generated by the Secondary Turbocharger during this preliminary phase is redirected to the inlet side of the air intake. The ECM uses the Differential Pressure Sensor to measure the difference in boost pressure between the intake manifold (generated by the Primary Turbocharger) and the Secondary Turbocharger.



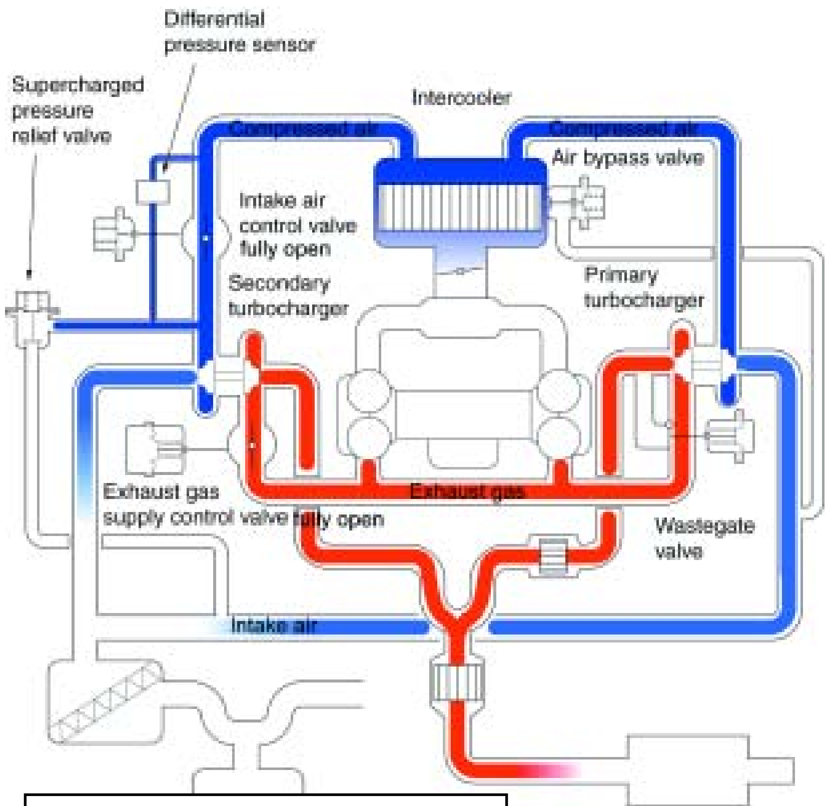
Exhaust Control Valve partially open

ENGINE

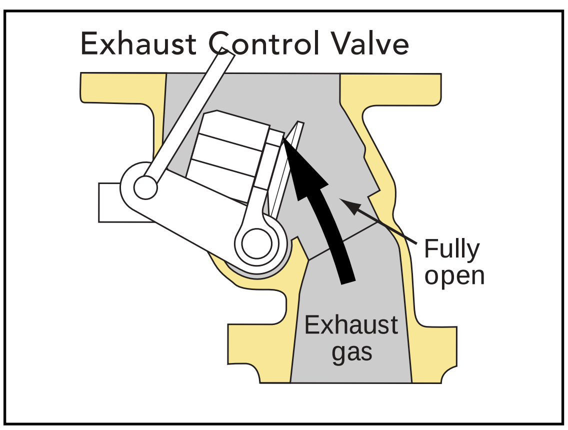
secondary stage

twin turbo operation

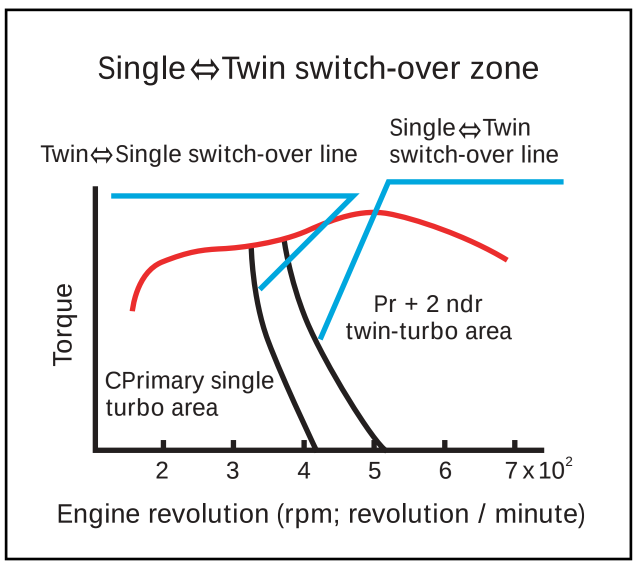
When the ECM determines that the engine operating conditions are suitable, the Relief Valve is closed and the Exhaust Gas Control Valve is fully opened. By measuring the pressures via the Differential Pressure Sensor, the ECM determines the correct opening of the Intake Control Valve. When this valve is opened, pressure from the Secondary Turbocharger is supplied to the Intercooler. Boost pressure control during this phase is regulated via the Primary Turbocharger's wastegate.



Flow diagram secondary stage



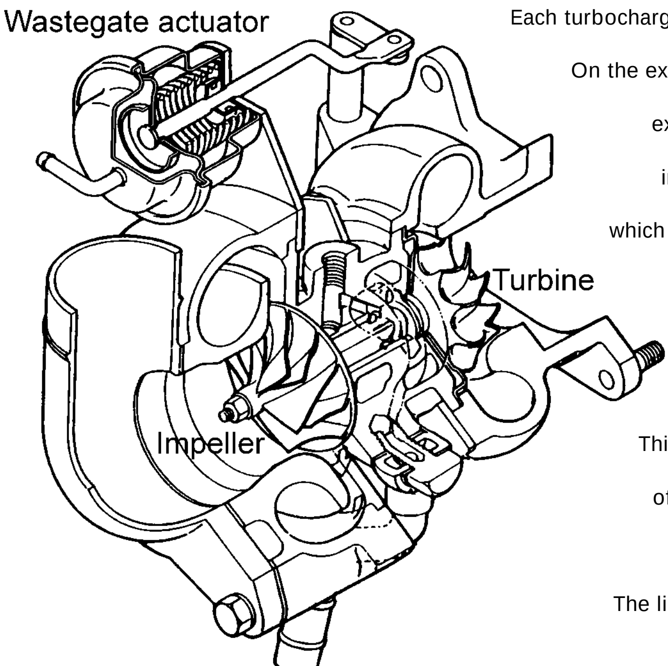
Exhaust Control Valve open



Turbo switch over

E N G I N E

T U R B O C H A R G E R S



Turbo section view

Each turbocharger unit consists of two sections, an exhaust side and an induction side. On the exhaust side is a turbine wheel with vanes that are shaped to harness the exhaust gas energy causing the wheel and centre shaft to rotate. On the induction side there is an impeller wheel attached to the common shaft which also has vanes but shaped in the opposite direction so as to compress the induction air. With increasing engine speed and load the level of kinetic energy in the exhaust gas also increases and as a consequence the turbine rotates faster.

This causes the impeller to also rotate faster causing greater compression of the induction air. Rotational speeds of the turbine are in the region of 20,000 rpm. at idle to approx. 190,000 rpm. at full engine load.

The limiting of boost pressure is achieved by the use of a 'wastegate', which bypasses the exhaust gas around the turbine wheel when the desired level of boost is reached.

The wastegate is a simple flap valve, which is opened by diaphragm to which boost pressure is applied. On the Twin Turbo, a single wastegate only is located on the primary turbocharger. This wastegate is used to regulate boost by effectively controlling overall exhaust gas pressure.


Turbine shaft

ENGINE

TURBOCHARGER CHARACTERISTICS

A turbocharger uses exhaust gas energy to rotate the turbine wheel and as a consequence rotate the impeller which compresses the intake air. Exhaust gas pressure however is low at low engine speeds and as a result the turbine does not respond immediately when the throttle is opened. This phenomenon is referred to as 'Turbo Lag'. In an attempt to overcome this phenomenon, design characteristics of the turbocharger are matched to the prospective use of the vehicle. Two important design criteria are size and the A/R ratio.

Size.

Smaller turbochargers require less rotating energy (exhaust pressure) to rotate due to the smaller mass of the turbine and impeller, and therefore provide improved throttle response at lower engine speeds. The use of a small turbocharger however will result in a lower power output at high engine speeds due to the smaller volume of compressed air that is generated by the smaller impeller.

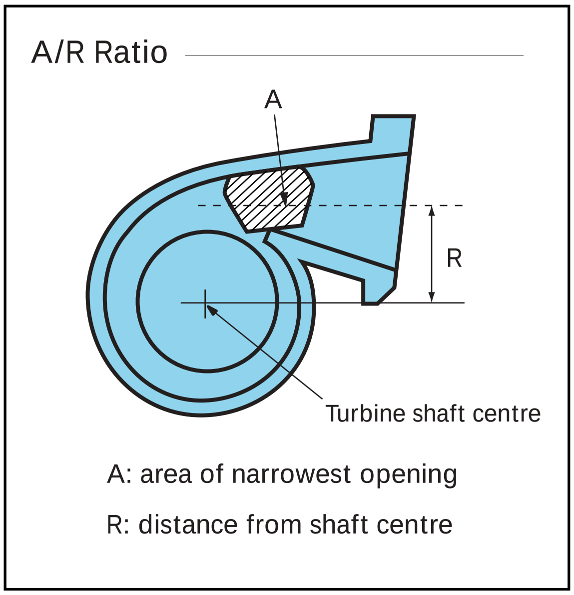
A large turbocharger is capable of supplying a larger volume of compressed air, and is therefore more suitable in providing maximum power output. The increase in turbocharger size however will result in a large amount of turbo lag, as more exhaust energy which is dependent on engine speed is required to rotate the bigger turbine and impeller.

A/R Ratio.

The A/R ratio of the turbocharger determines the characteristics of exhaust gas pressure production. 'A' represents the smallest area of the inlet of the turbine housing, and 'R' represents the distance from the centre of the turbine shaft to the centre of the turbine-housing inlet.

By reducing the area 'A', exhaust velocity is increased. With higher exhaust velocity acting upon the turbine, response time is reduced because the turbine spins faster at lower engine speeds. If the area is too small, flow is restricted at higher engine speeds thereby limiting power output. An increase in dimension 'R' will improve turbine startup response but will diminish maximum turbine speed.

Small A/R ratios are suitable for low speed applications where fast startup response is required at the expense of high speed power. Large A/R ratios are suitable for high speed applications where low speed response is not a priority.



A-R ratio

In the Liberty B4 Twin turbo system a combination of both types small and large turbochargers are used with small and large A/R ratios.

ENGINE

PRIMARY TURBOCHARGER SPECIFICATIONS

Manufacturer	IHI
Turbocharger Type	VF 33
Turbine Blade no.	9
Compressor Blade no.	6 + 6
Turbine Rotor Size	46.5mm / 35.4mm
Compressor Rotor Size	47mm / 35.4mm
Max. Turbine Speed	190000 rpm
Wastegate Port Diaphragm	17mm
Wastegate Open Press.	78 kPa
Intercept Point	1900rpm @ 760mmHg
A/R Ratio	11
Bearing Type	Floating Metal

Primary turbo

SECONDARY TURBOCHARGER SPECIFICATIONS

Manufacturer	IHI
Turbocharger Type	VF32
Turbine Blade no.	9
Compressor Blade no.	10
Turbine Rotor Size	46.5mm / 35.4mm
Compressor Rotor Size	52.5mm / 36.6mm
Max. Turbine Speed	180000RPM
Wastegate Open Press.	N/A
Intercept Point	N/A
A/R Ratio	18
Bearing Type	Floating Metal

Secondary turbo

e n g i n e

i n t e r c o o l e r

The temperature of the intake air is increased as it is compressed by the turbocharger. This rise in temperature causes a corresponding expansion of the air, leading to a reduction in air density. The intercooler is designed to transfer the heat of the compressed intake air to the external air flowing through the intercooler as the vehicle is in motion.

There are two positive by-products of decreased air temperature and increased air density, one; a reduction in combustion chamber temperature allowing for more advanced ignition timing, and two; improved volumetric efficiency due to the increase in air mass for a given air volume. With a denser air charge in the combustion chamber, more fuel can be injected leading to greater power output.

Intercooler

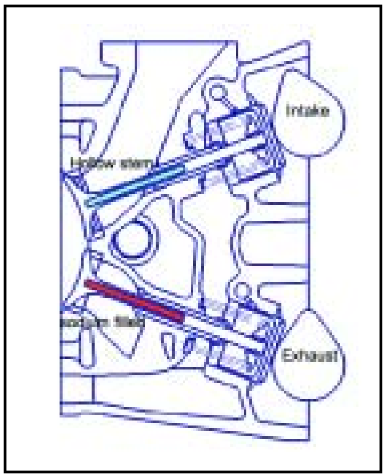
i n t e r c o o l e r   s p e c i f i c a t i o n s

Manufacturer	Sanden
Effective Cooler Depth	73mm
Effective Cooler Width	140mm
Effective Cooler Length	370mm
Number of Tubes	26
Heat Transfer Capacity	13.37kW
Heat Exchange	120° - 130°C → 70° - 80°C.

engine

valve operation

Valve operation is via direct acting twin camshafts per cylinder head using hollow valve stems to reduce the valve mass and increase the engine rev limit. The intake valves (hollow type) have been reduced from 51.6 to 48.4 grams and the exhaust valves, which are sodium filled for more efficient heat transfer have been reduced from 50.5 to 46.7 grams.



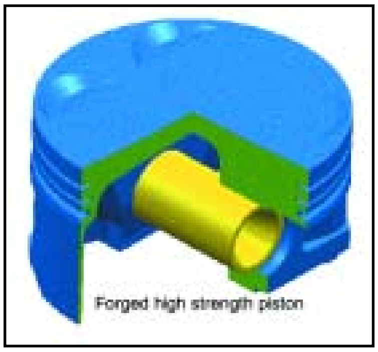
Cylinder head

In order to maximise the 'tumble swirl air' motion a specially shaped intake port combined with increased valve angle and valve lift is used.

A single timing belt with specially designed round profile teeth for quiet operation drives the camshafts. The belt is made from a strong flexible core wire, wear resistant canvas and heat resistant rubber. The recommended replacement interval for the cambelt is 100,000 kms, or four years, whichever should first occur. The belt tension is self-adjusting and valve clearance checking/adjustment is only necessary every 150,000 kms.

Pistons

High strength (up from 152g to 162g) lightweight forged aluminium pistons are used and close attention has also been given to the piston design to reduce friction and improve combustion performance. This has been achieved by reducing piston pin offset, use of solid type skirt design, with molybdenum coating, reduced top land to cylinder clearance and a flat top combustion surface. The compression ratio is 9.0:1 compared to the WRX at 8.0:1.



Piston

e n g i n e

i m m o b i l i s e r   s e c u r i t y   s y s t e m

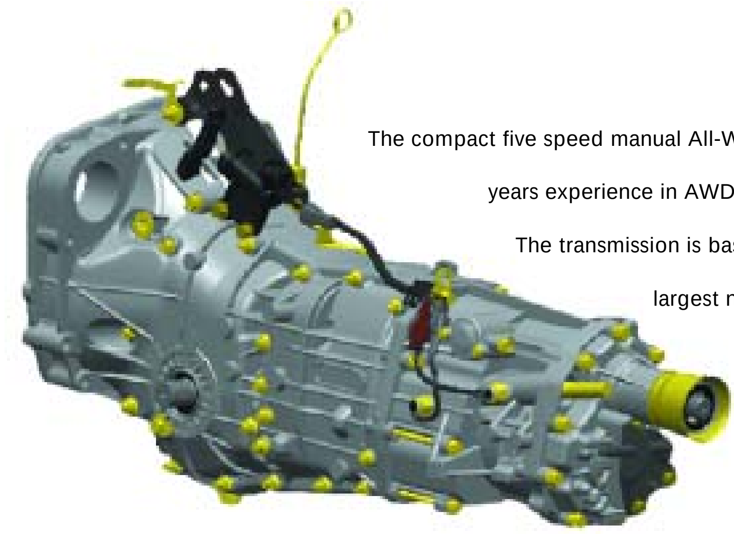
The factory immobiliser system interfaces directly with the engine management computer (ECU). This system is a transponder type that utilises a rolling code for additional security. Once the key is inserted in the ignition lock and the ignition turned on an antenna amplifier positioned around the ignition lock reads the transponder code and transmits it to the engine management and immobiliser computer (ECU). The ECU then compares the transmitted code for the correct sequence and, if correct, allows the engine to start. The remote central locking transmitter is now incorporated as one unit into the key along with the immobiliser transponder.

If a duplicate key is required, the transponder code needs to be registered with the ECU. This teaching operation can only be performed with special equipment and the software is only available to authorised personnel.

In addition to the factory immobiliser system all Liberty B4 are fitted as standard with a Subaru Australia designed ‘Dual Stage Security System’. This system provides two separate security systems. The remote locking transmitter operates one system and the other by a PIN operated keypad.

This provides for additional six points of immobilisation, anti hijack mode, automatic re-arm, Intrusion Alert, False Alarm Prevention, Internal Screamer, Infrasonic sensor, valet mode and also features anti cross pollination software for additional theft protection.

transmission



Manual Transmission

MANUAL TRANSMISSION

The compact five speed manual All-Wheel Drive (AWD) transmission is the culmination of more than twenty years experience in AWD technology during which time continuous development has occurred. The transmission is basically the same unit first introduced in Model year 1999 which saw the largest number of changes since Liberty introduction in 1990, too numerous to mention individually but in summary are as follows;

- Increased rigidity of the transmission case design and double the number of mounting bolts from 4 to 8 attaching the transmission to the engine. This provides for a more rigid power plant unit and as a result reduces transmission noise vibration and harshness (NVH).
- All synchromesh baulk ring and gear docking teeth angles along with the double cone synchro on 2nd gear and 3rd gear have been tuned to provide a precise but smooth gear shift action.
- Adoption of cold forging and a shot peen hardening process of gears for improved durability.
- Adoption of a flexible flywheel design to minimise the transfer of natural engine frequency vibration to the transmission and the drive-line.

The clutch is an increased capacity, 230mm-diameter single plate diaphragm with hydraulic pull type operation. The pressure plate clamping load has been increased to 830 kg (non turbo is 550 kg) to cope with the higher power output.

A viscous coupling limited slip centre differential is used to constantly transmit the engine power to all four wheels. The rear differential is also fitted with a limited slip viscous coupling to improve vehicle stability at high speed and to improve traction during low speed cornering under full acceleration.

During straight line driving the torque split by the differential is 50/50 to front and rear wheels. Torque distribution at the road however is also dependent on load distribution and tyre grip and as a result the static ratio is 60/40. During actual driving conditions load movement when cornering, accelerating or braking etc. causes the torque distribution to also move in the same proportions.

When wheel slip occurs a rotational speed difference between the front and rear axles is created and the viscous coupling automatically matches the torque to grip in order to restore maximum traction.

TRANSMISSION

MANUAL TRANSMISSION

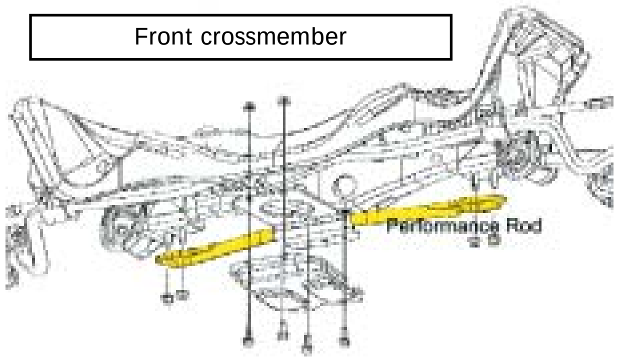
The B4 is also equipped with a close ratio ‘S type’ gear set.

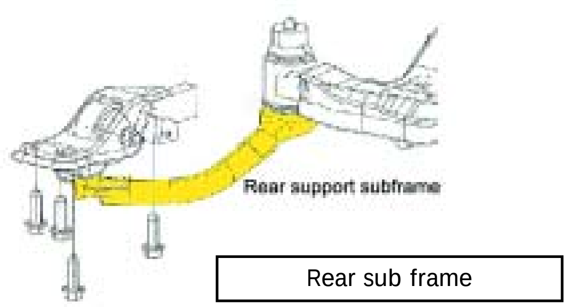
Gear	**Liberty B4** (S type)	**Gear spacing**	**Liberty 2.5 RX** (R type)	**Gear Spacing**
1st	3.166		3.545	
2nd	1.882	1.284	2.062	1.483
3rd	1.296	0.586	1.448	0.614
4th	0.972	0.324	1.088	0.360
5th	0.738	0.234	0.780	0.308
Rev	3.333		3.333	
Final drive	4.111		4.111	

SUSPENSION

SUSPENSION

The front suspension is a lightweight Bilstein inverted MacPherson strut independent system that has proven its durability during the World Rally Championship (WRC). The base development for the suspension in the areas of damping, spring and stabiliser rates and settings was undertaken in Japan and finally tuned at the Nurbergring motor racing circuit in Germany. The target was to at least equal the performance of BMW M3.





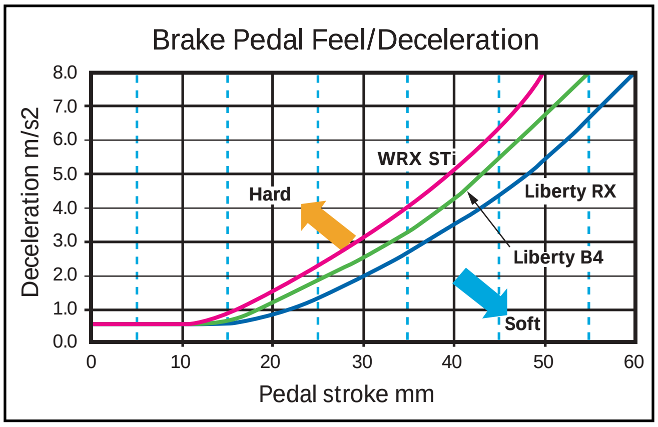
Inverted struts provide for a higher bending rigidity due to a larger damping tube diameter, and provide superior damping characteristics with less damping fade as a result of increased piston size. The front suspension also features cast aluminium ‘L’ shaped transverse link for increased lateral strength and lower unsprung mass. The coil springs are also offset, so that the centre line of the spring coincides with the pivot axis, thereby minimising the friction generated by the up and down movement of the strut. The effect is to lessen vibration and reduce the feeling of thrust transmitted from the road thereby providing good ride comfort with good road tracking.

The front suspension cross-member on the B4 also now incorporates a new ‘performance rod’ which has improved lateral stiffness by a massive 500% and longitudinal stiffness by 50%. The benefit of this increase in the front cross-member stiffness is that there is less change to the dynamic suspension geometry. This means that the ideal tyre to road surface contact pattern is maintained particularly under hard cornering conditions. This provides greatly increased cornering power due to increased tyre traction. Similarly the rear suspension has an additional support sub-frame to improve the rear suspension longitudinal (+200%) and lateral (+20%) stiffness.

Suspension Performance			Liberty B4	BMW.M3
Lateral Acceleration	Circle diameter	60m	8.8 m/s	8.8 m/s
		190m	8.4 m/s	8.6 m/s
Roll Angle		90m	4.5 deg	4.45 deg
		190m	4.25 deg	4.0 deg
Slalom passing time	Pylon x distance	8x13m	8.0 sec	7.9 sec
		6x30m	6.4 sec	6.2 sec
		10x18m	10.2 sec	10.1 sec

BRAKES

BRAKES



Brake pedal feel

The braking system features high capacity four wheel discs and the traditional diagonally linked interior piping system with pressure control valve for greater braking power, safety and reliability.

The diagonally linked split system means that if one circuit of the brake hydraulic system should fail then braking is retained in the remaining circuit on opposite corners of the vehicle. This results in the vehicle pulling up under control without any violent lurching to one side, which can occur on vehicles that are split on a front and rear basis. The interior routing of the brake pipes also means that there is less likelihood of damage or fracture of a pipe when driving in rough terrain whilst corrosion of the brake pipes is virtually impossible.

A front and rear pressure control valve is also used to balance the braking force to the weight distribution of the vehicle.

The front brakes have 294mm diameter, ventilated discs with heavy-duty twin piston floating callipers. While on the rear 290mm ventilated discs with single piston floating callipers are used.

A vacuum suspended tandem booster provides power assistance with an effective diameter that has been increased from 180 + 205mm to 205 + 230mm for reduced pedal effort but retaining a firm braking feel. Maximum braking force from 100km/hr is 0.99 G with a stopping distance of 39.4 m. Braking feel is designed to be more progressive, between the hard feel of the WRX STi and the softer feel of the Liberty RX.

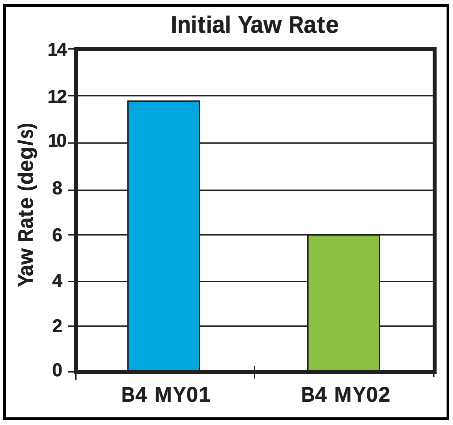
BRAKES

A.B.S.

ABS braking is standard and features the very latest state of the art Bosch 5.3i system made under licence by Nippon ABS.

It is a full four channel three-phase four-sensor system with the front wheels being controlled individually and the rear wheels controlled jointly through the select low method.

This new system features a much higher level of wheel speed control operating the three-phase control cycle with an increased clock frequency up from 12 MHz to 18MHz and a ROM capacity of 32KB up from 12KB. The result is a higher level of stability when braking on road surfaces of different levels of grip either side of the car. This has resulted in the level of 'Yaw moment' (rotation about the centre) being reduced by approximately 50% under test conditions when one side of the car is on ice and the other on an asphalt surface. The necessary steering angle correction therefore has also been reduced under the same conditions by one third.



ABS yaw rate

The select low method uses the rear wheel with the lower coefficient of adhesion to determine the brake pressure applied to both rear wheels. This select low control, along with electronic delayed build up of braking force at the front wheel with a high adhesion coefficient and negative steering roll radius, minimises the tendency for the vehicle to turn about its vertical axis (spin) when braking on uneven road surfaces.

Disc Brakes

I N T E R I O R

I N S T R U M E N T P A N E L

The instrument cluster features a ‘Luminescent Meter’ that employs back lit illumination to display information even during daylight. When the ignition is turned on it sequentially illuminates the clock rings followed by the pointers and then the calibration data.

Instruments

I N - C A R E N T E R T A I N M E N T

The premium McIntosh entertainment system consists of a head unit, a speaker amplifier, two tweeters, four mid-range speakers, and a subwoofer.

The speaker amplifier is located below the front passenger’s seat and the subwoofer at the rear shelf trim. The output power handled by each of the four channels is 24W and the subwoofer is 60W. The total harmonic distortion of the system is as low as 0.05% - comparable to that of high-class home-use audio systems.

S P E A K E R S

Type	Diameter	Number
Front tweeter	20mm	2
Front mid-range	160mm	2
Rear mid-range	160mm	2
Woofer (oval-shaped)	152mm x 229mm	1

Established in the U.S.A. in 1946, McIntosh is regarded as one of the world’s premium car audio systems. McIntosh engineers spent 12 months in Japan to customise their legendary sound systems for Liberty B4 and helped assist FHI technicians with the interior design of the car. The head unit has a 2DIN AM/FM tuner, single CD and cassette controls. The Liberty B4 system features a high performance digital to analogue (D/A) converter with premium 20-bit Burr-Brown chips.

The cassette function has ultra-stable transport with Dolby B noise reduction. The high sensitivity AM/FM radio has two antennas with six AM and 12 FM pre-set channels. The system includes McIntosh’s proprietary Power Guard technology, for low distortion at high sound levels. It has a six-band, four-channel parametric equalizer, tuned specifically for Liberty B4.

The system includes a 20mm high frequency super tweeter. It has soft-dome construction, for low distortion and high-power handling. The front and rear speakers feature a two-way design, with the tweeter integrated into the woofer frame. They include a 165mm polypropylene cone woofer and the 20mm high frequency super tweeter.

The subwoofer is 152 x 228mm and features low distortion/high power (LD/HP). LD/HP technology increases output by reducing induction loss and lowers distortion by stabilizing the magnetic field. The entire system only weighs about 10 kilograms.

EXTERIOR

Weight saving measures on Liberty B4 include a 1.0mm-thick aluminium bonnet, weighing just 9.5kg - 8.0 kg lighter than Liberty's previous steel bonnet, but with no reduction in crash performance. Weight reduction at the front and the rear of the car contributes to improvement in the vehicles dynamic handling as a result of a reduction in the yawing moment of inertia. Yaw is the rotation of the vehicle about its centre of gravity and therefore any reduction of vehicle mass at the furthest point from the centre of gravity will reduce the tendency of the vehicle to spin.

Body strength has also been improved over the first new generation, model year 1999 Liberty with increases in torsional and flexural rigidity. This not only provides for improved occupant protection but also provides a stronger frame structure as a base for the suspension and ensuring that body flex does not impact upon the suspension geometry particularly during hard cornering.

Liberty B4 has halogen headlights shared by the entire Liberty range, now defined by black outlining, with integrated metallic-finish indicators adding to the sporting image and producing 15 per cent better spread on low beam. High beam also offers better light distribution, increased depth and brightness.

Fog lights are integrated in the lower front bumper, which includes an enlarged open area underneath, improving appearance and aerodynamics.

	Model year 1999	**Model Year 2002**
Torsional rigidity	2.52 x10^6 Nm^2/rad	3.5 x 10^6 Nm^2/rad
Flexural rigidity	4.89 x 10^6 Nm	5.47 x 10^6 Nm

LIBERTY B4 SPECIFICATIONS

LIBERTY B4	UNITS	SEDAN
BODY		
Overall Length	mm	4605
Overall Width	mm	1695
Overall Height @ UM	mm	1415
Wheelbase	mm	2650
Front Track (= Front Tread)	mm	1460
Rear Track (= Rear Tread)	mm	1460
Min Road clearance @ UM	mm	155
Approach Angle	degree	17.6
Departure Angle	degree	18
Breakover angle .	degree	15
Unladen mass (UM)	Kgs	1495
Gross Vehicle mass	Kgs	1985
Coefficient of Drag (CD-value)	-	0.34
CdA	m2	0.703
Payload (inc passengers @ UM)	Kgs	490
Internal Noise level (100km/h : 140km/h)	Dba	65 : 70
Torsional rigidity	$10^6 Nm^2$/rad	3.15
Flexural rigidity	$10^6 Nm^2$	5.47
Percentage of Galvanized Body Sheet Metal	%	76
ENGINE		
Type		DOHC turbo
Bore x Stroke	mm	92 x 75
Comp. Ratio		9:1
Max output		190kW@6400rpm
		258ps@6400rpm
Max Torque		320Nm@4800rpm
		32.6kgfm@4800rpm
Alternator	amps	90
Battery manual		12v-27hr
Max turbo boost pressure	kpa(mm Hg)@rpm	93.3(700)@4800rpm
Turbo A/R ratio		11/18
Capacity	cc	1994
Max Turbo turbine speed	rpm	190000/180000
Power to weight ratio @ UM	kg/kW	7.9
Power/litre kW/litre	kW/litre	95
Fuel system		Sequential MPFI
Minimum fuel Octane Rating RON	RON	98
TRANSMISSION		
Gear ratio 1st		3.166
Gear ratio 2nd		1.882
Gear ratio 3rd		1.296
Gear ratio 4th		0.972
Gear ratio 5th		0.738
Gear ratio Rev		3.333
Axle ratio (Final reduction ratio)		4.111
STEERING, TYRE & WHEELS		
Turning circle curb to curb	m	11.20
Tyre size		215/45 ZR17
Manufacturer		Bridgestone
Model		POTENZA RE010
Rim size/manufactuer	inches	17x7JJ / BBS

LIBERTY B4	UNITS	SEDAN
STEERING, TYRE & WHEELS		
Rim offset mm	mm	55
Space saver spare		T135/70 D16
Steering Ratio		16.5
Turns lock to lock	(turns)	3
SUSPENSION		
Front type		Bilstein inverted
Damping rate, Bump/rebound	N'@0.3m/s	932/2159
Suspension Travel. Bump/rebound	mm	105/95
Spring rate	N/mm	25.1
Stabiliser bar diameter	mm	20
Rear type		Muliti link
Damping rate, Bump/rebound	N'@0.3m/s	600/2350
Suspension Travel. Bump/rebound	mm	125/85
Spring rate	N/mm	47.5
Stabiliser bar diameter	mm	17
BRAKES		
System (FRONT/REAR)		Ventilated disc
Front ventilated disc outer diameter mm	mm	294
Rear ventilated disc outer diameter mm	mm	290
Front brake caliper (pot size)	mm	42.8 x 2
Rear brake caliper (pot size)	mm	38.1
Brake Booster Type (size mm)	mm	205+230
CAPACITIES		
Fuel tank	Litre	64
Engine Oil	Litre	4.0
Engine Coolant	Litre	7.7
Fuel range Km combined cycle	Km	650
TOWING WEIGHTS		
Maximum tow capacity unbraked trailer	Kg	500
Maximum tow capacity braked trailer	Kg	1200
Max Tow ball down load/with load dist. hitch	Kg	90/120
Maximum roof load Kgs	Kg	80
FUEL CONSUMPTION		
City	AS2877 Litres/100Km	11.0
Highway		8.6
Combined		9.8
PERFORMANCE		
Max. Speed	Km/hr	220
0-100Km/hr (or. 0-60 mph) (Manual)	secs.	6.5
0-400 m	secs.	14.6
MAX tan _ climb angle	%	68
INTERIOR SIZE (measured by VDA/SAE)		
Boot volume SAE	litre	389
Boot volume VDA	litre	464
Effective head room (rear) SAE H63	mm	930
Min cargo (boot) width (between wheel housing)	mm	1106
Max cargo (boot) width at the floor	mm	1378
Boot height	mm	444
Boot length	mm	1035
Effective leg room (front) SAE L34	mm	1101
Effective leg room (rear) or Leg space (rear)	mm	868

*Ground clearance at unladen mass. Subaru Australia reserves the right to change mechanical specification and equipment levels without prior notice.