Service-information

Tech.Cust.Service VS-2010 bl/LP/fm	BMW 2002 turbo Group: Engine	Munich, March '74 11 02 74(862) e

Ref: Description and Adjustment Operations on the
BMW Exhaust Gas Supercharger/Fuel Injection Unit

Dear Sirs,

In the following text, the design and the functioning of the BMW exhaust gas supercharger/fuel injection unit are described, and the first testing and adjusting routines are given.

The principle of supercharging (Fig. 1)

A determined amount of exhaust emissions (black arrows) is fed through the turbine impeller as a function of the throttle valve position and the engine speed. The turbine impeller (27), which is thus set in motion, drives the supercharger rotor (28) mounted on the same shaft. This draws in fresh air (white arrows) and feeds it into the engine after compression. The amount of fresh air and the supercharger pressure are thus determined by the throttle valve position, the volume and temperature of the exhaust emissions, and by the efficiency of the turbine. The supercharger pressure is limited by a charge pressure limiting valve (26) located before the air collector (23).

The supercharging system just described requires a special fuel flow system. Unlike the injection pump which is used on the BMW 2002 tii model, and where the fuel quantity injected is dependent on the throttle valve position and engine speed, fuel flow in the supercharged engine depends upon the throttle valve position and the charger pressure.

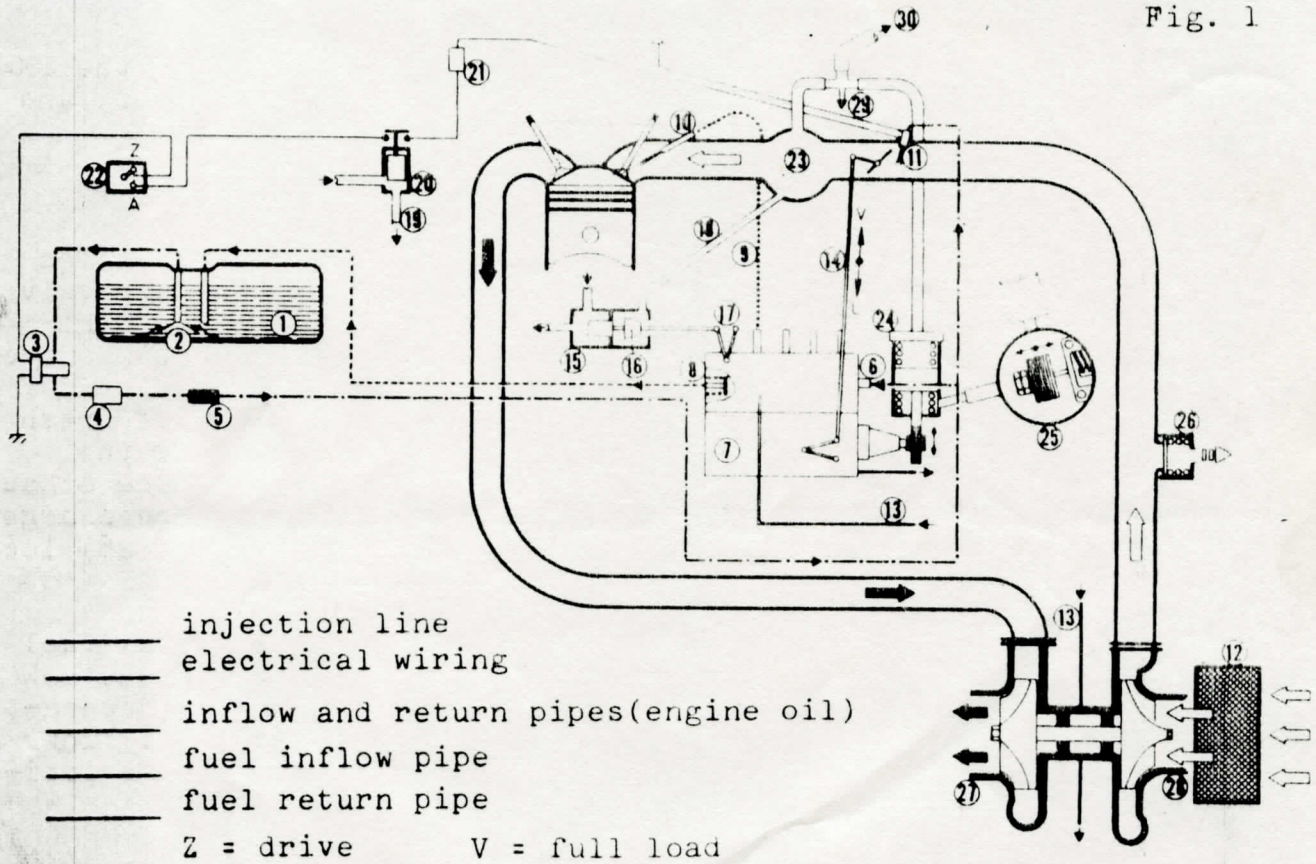
The fuel quantity required for the varying engine loads is determined by the position of the three-dimensional control cam in the injection pump housing, and thus by the throttle valve position and the pressure in the air collector. When the accelerator is pressed and the throttle valve opens, the control cam is moved along its axis at the same time. The control cam is also rotated on its axis as a function of the charger pressure. These two movements determine the amount of fuel injected. The charger pressure acts upon the control piston in the pressure regulator (24) which is linked to a rack. A pinion moves along this rack thus rotating the control cam.

The position of the control piston depends upon the pressure below and above the piston. The pressure above the piston is the same as the pressure in the air collector, the pressure below the same as the atmospheric pressure regulated by the altitude compensator(25).

The other components of the injection unit are the same as for the BMW 2002 tii engine.

Diagram of the BMW exhaust gas supercharger/Fuel injection unit

Fig. 1



injection line
electrical wiring
inflow and return pipes(engine oil)
fuel inflow pipe
fuel return pipe

Z = drive
A = start
L = idling
V = full load

1. Fuel tank with induction unit
2. Fine-mesh filter in induction unit
3. Fuel pump
4. Expansion vessel for pressure balance
5. Main fuel filter
6. Fine-mesh filter in fuel intake
7. Injection pump
8. Fuel return with pressure valve
9. Injection line
10. Injection valve
11. Starter valve
12. Air filter
16. Air regulation cone
17. Lever for eccentric shaft
18. Line for additional air
19. Coolant line
20. Temperature/time switch
21. Time switch (relay)
22. Ignition switch
23. Air collector
24. Pressure regulator
25. Altitude compensator with air filter
26. Charger pressure limiting valve
27. Exhaust turbine
28. Supercharger

13. Inflow and return of engine oil
14. Adjustment of engine idling and full load (by accelerator pedal)
15. Warm-up unit with expansion element
29. Line to charger pressure indicator
30. Line to brake servo

Maintenance of the Fuel Injection Unit

The basic adjustment of linkages and engine idling is the same as for the BMW 2002 tii.

1. Adjustment of injection pump/throttle valve linkage

(a) Remove cover.

(b) Loosen hexagonal-head bolts (C) on the clamp unit (Fig. 2).

(c) Disconnect the linkage bar, check to ensure that L = 85 mm (3.346"), adjust, if necessary, and reconnect (Fig. 2).

(d) Holding the injection pump regulator lever in position: Put the 5-mm diameter set pin through the elongated hole of the regulator lever (A) and insert into the bore in the pump casing (Fig. 2).

(e) Adjusting the corresponding throttle valve position: Insert 4-mm diameter set pin into the bore (B) in the casing. Press the eccentric lever slightly with the finger so that the flat front surface just touches the set pin - there should be no play. The idling stop screw (D) must not touch the lever (Fig. 3).

(f) Tighten the hexagonal-head bolts (C) at the clamp unit. In so doing, the eccentric shaft in the throttle valve stub must be pushed down. The clearance between the clamp unit and the throttle valve stub must not exceed 1.5 mm.

(g) Check procedure:
Pull out the set pin in the pump regulator lever. Press the eccentric lever slightly with the finger against the inserted 4-mm set pin. It must now be possible to insert the 5-mm set pin on the pump regulator lever without any tension or stress. If this is not the case, repeat the adjustment procedure.

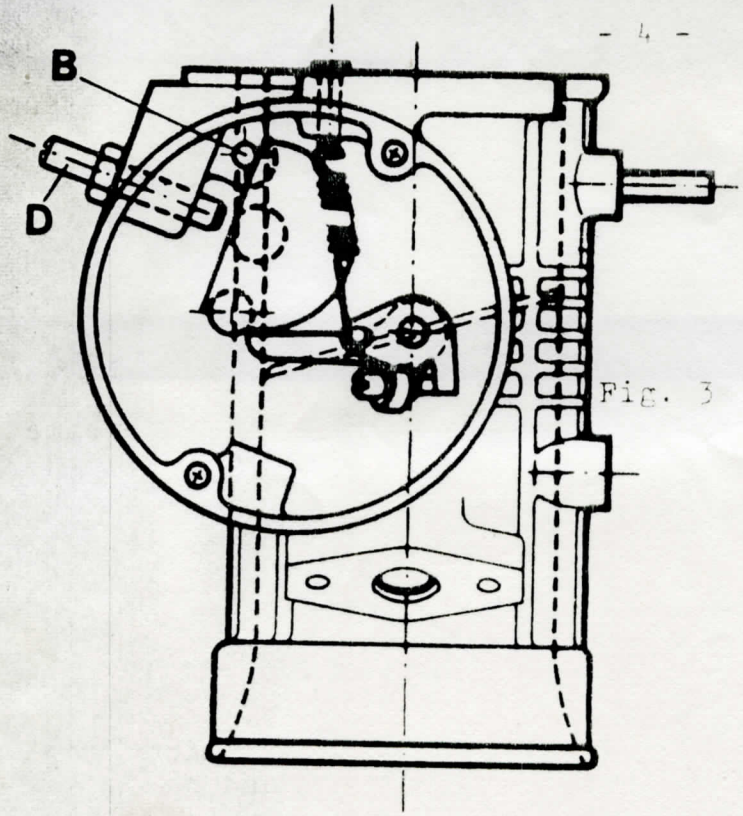


Fig. 3

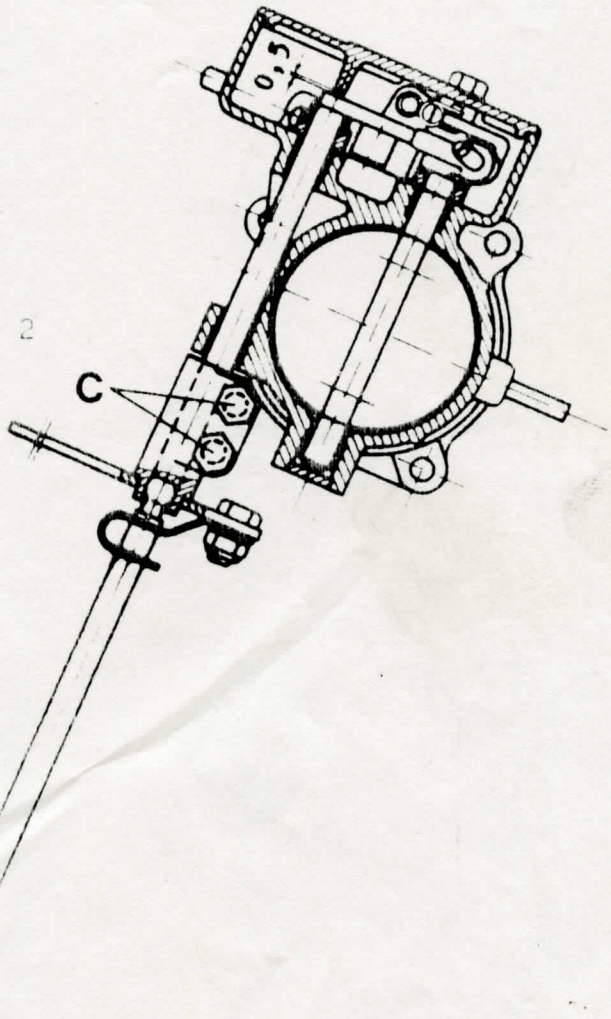
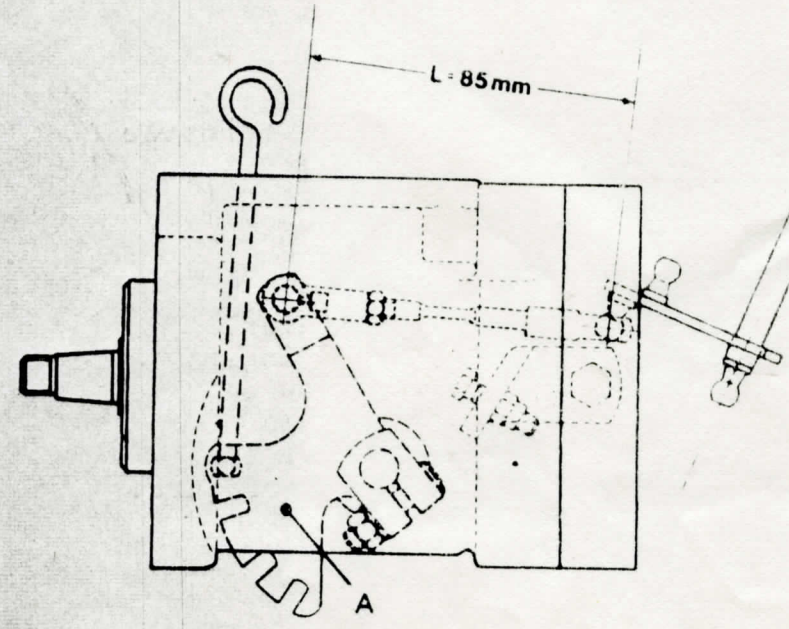


Fig. 2



2. Idling adjustment (Fig. 4)

Adjustment should be made with engine at normal running temperature.

(a) Unscrew the throttle valve adjustment screw (E) until it no longer touches the stop on the return lever. The throttle valve is closed.

(b) Insert the 4-mm set pin into the bore (B) in the throttle valve stub.
Press the eccentric lever slightly with the finger (Arrow F) so that the flat front surface of the lever just touches the set pin - there should be no play. The idling stop screw (D) must not touch the lever.

(c) Screw in the idling stop screw (D) until it just touches the eccentric lever.

(d) Screw in throttle valve adjustment screw (E) until it touches the stop on the follower (M) and the drag lever (S) rests on the eccentric lever without any play.
After this setting has been obtained, the throttle valve adjustment screw (E) should be screwed in until the throttle valve is opened sufficiently for warming up the engine. Engine speed: 800-950 rpm.

Checking the warm-up unit

When the engine is warm, the enrichment lever must lie up against the stop screw.
When the warm-up unit has an effective temperature of +20 ± 2° C, the check gap between the enrichment lever and the stop screw should be 3.6±0.4 mm.
If correction is necessary or if there is any damage to the linkage between the enrichment lever and the warm-up unit, please have this adjustment carried out by the Service Department of Messrs. Schäfer.

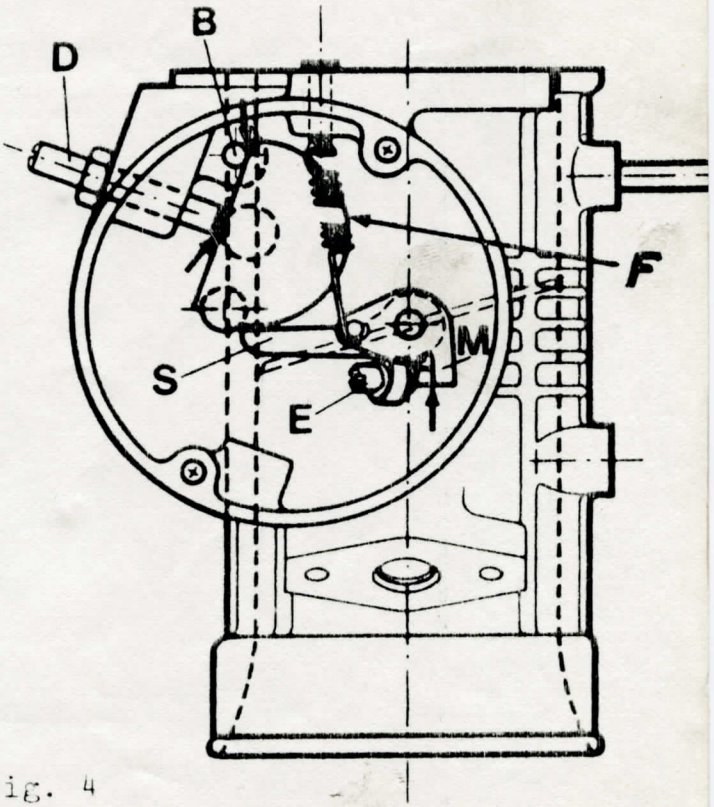


Fig. 4

3. CO Adjustment (Fig. 5)

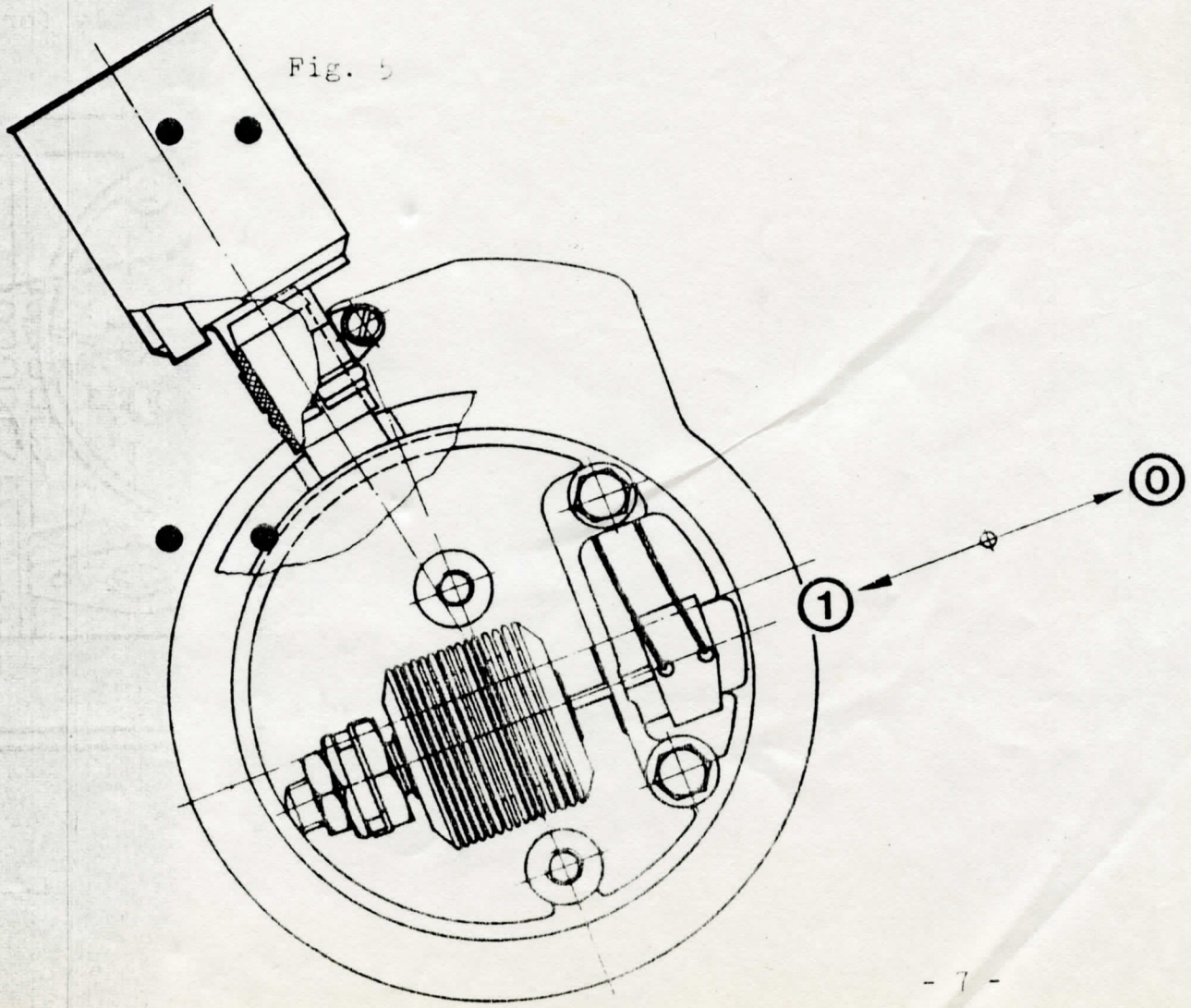
The adjustment of the CO content must only be made at the altitude compensator (Fig. 5) with the engine running at its normal temperature.
Remove the cover of the altitude compensator and loosen the locknut of the barometer bellows. The CO content - max. 3% - can now be set to give a smooth idle by turning the barometer bellows (Fig. 5).
Moving the barometer bellows towards "0" (right) gives a lower CO content, turning towards "1" (left) increases the CO content.

Note: Turn the barometer bellows by means of the lateral shaft (AF 8 mm) - do not take hold of the bellows.
Tighten locknut.

Lightly tap the altitude compensator housing after this adjustment to eliminate any tension in the device.

Replace cover - do not forget O-ring - and tighten hexagonal nut.

Fig. 5



Ignition advance	
centrifugal	begins at approx. 1000 rpm ends at approx. 1500 rpm max. adjustment range: $25^{\circ} \pm 2^{\circ}$ on crankshaft
vacuum	begins at approx. 200 mm Hg ends at approx. 310 mm Hg max. adjustment range: $10^{\circ} \pm 2^{\circ}$ on crankshaft
Ignition timing	25° BTDC at 2500 rpm

The distributor advance curve should be checked with the engine idling at 800 - 950 rpm. Advance angle is -2° to -8° on crankshaft.
Note: Carry out test with vacuum advance operative.

Dwell angle	$62 \pm 3^{\circ}$
Contact braker gap	0.016" (0.4 mm)
Alternator	Bosch K 1/14 V 45 A 22 (630 W)
Voltage regulator	Bosch AD 1/14 V
Starter	Bosch GF 12 V 1 HP Bosch W 200 T 30, WG 200 T 30
Spark plugs	Beru 200/14/3 A Champion N 8 Y
Spark plug gap	0.24 + 0.004" / 0.6 + 0.1 mm
Horn	1 single-tone horn
Headlights	Quartz-Halogen H 4 (55/60 W)

CAPACITIES

Cooling system incl. heater	1.28 Imp. gal (7 litres) coolant with the addition of the factory-approved long-term anti-freeze and corrosion inhibitor
Engine oil	SAE 20 W 50 branded HD engine oil, 7 Imp. pints(4 litres) plus 0.44 Imp. pints(0.25 litres) if oil filter is changed (+ 1.3 Imp. pints /0.75 litres in oil cooler and hoses, only refill in case of repair)
Manual gearbox (4-speed)	1.8 Imp. pints(1 litre) SAE 80) Gearbox
(5-speed)	2.5 Imp.pints(1.4 lit) oil,if not available,HD engine oil

Maximum gradients

1st gear	59%
2nd gear	43%
3rd gear	23%
4th gear	14%

Acceleration

khp	secs.
0 - 50	2.4
0 - 80	5.1
0 - 100	6.9
0 - 120	10.1
0 - 140	13.4
0 - 160	18.4

Standing start kilometer	28.0
Average speed over this distance	80 mph / 129 kph
Terminal speed	116 mph / 186 kph

Running-in rules

Maximum permitted speed during the first 600 miles

1st gear	22 mph	(35 kph)
2nd gear	40 mph	(65 kph)
2rd gear	60 mph	(95 kph)
4th gear	75 mph	(125 kph)

Maximum permitted speed from 600 - 1200 miles

1st gear	22 mph	(35 kph)
2nd gear	44 mph	(70 kph)
3rd gear	70 mph	(110 kph)
4th gear	90 mph	(145 kph)

Maximum permitted speed after running-in

1st gear	32 mph	(50 kph)
2nd gear	62 mph	(100 kph)
3rd gear	98 mph	(155 kph)
4th gear	131 mph	(211 kph)

ELECTRICAL SYSTEM

Battery	12 V 44 A
Coil	Bosch KB 12 V
Distributor	Bosch J F U D 4 No. 0 231 180 014

Tightening torques differing from BMW 2002 tii:

Exhaust manifold to cylinder head	39.7 ft/lb (5.5 mkp)
Supercharger flange to exhaust manifold	39.7 ft/lb (5.5 mkp)
4-bore flange of exhaust pipe to exhaust turbine	26 + 2.8 ft/lb (3.6+0.4 mkp)
V-belt pulley to crankshaft	14.5 ± 7.2 ft/lb (20 ± 1 mkp)
Altitude compensator cover	3.6 ± 0.7 ft/lb (0.5 ± 0.1 mkp)
Locknut on barometer bellows)	7.2 + 2.1 ft/lb (1 + 0.3 mkp)

Yours faithfully,
BAYERISCHE MOTOREN WERKE
Aktiengesellschaft
Service Division

i.V. i.V.

Flohr Scholz

Final drive	1.7 Imp. pints(0.95 l)	SAE 90 branded
Steering box	0.55 Imp. pints(0.3 l) (see approved oils)	Hypoid Oil
Control piston housing (rack) of injection pump	0.018 Imp.pints/0.01 l	branded HD engine oil
Drive mechanism of injection pump	0.18 Imp.pints/0.1 l	branded HD engine oil

2. BMW INSPECTION AND SERVICE ROUTINES

Note: Modified service intervals are applicable for the BMW 2002 turbo.

Engine oil: Branded HD oil for Otto engines, 20 W 50
Oil change with filter every 2000 miles (3000 km).

1. Oil change at speedometer reading 600 miles (1000 km).
2. Oil change at 2000 miles (3000 km) and then every 2000 miles (3000 km).

Oil in final drive: Zopf gear oil HT 90 EP Universal
Motul Gear Oil HD 90

1. Oil change at speedometer reading 600 miles (1000 km).
2. Oil change at 4000 miles (6000 km).
3. Oil change at 8000 miles (12 000 km) and then every 8000 miles (12 000 km).

1st BMW Inspection at 600 miles speedometer reading (1000 km)

1. Change engine oil while at normal operating temperature. Renew oil filter.
2. Change gearbox oil while at normal operating temperature.
3. Change final drive oil while at normal operating temperature.
4. Rear axle halfshafts: Check rubber bellows for leaks.
5. Check steering box for leaks, check oil level and top up, if required.
6. Check coolant level and top up, if required.
7. Check brake system lines and unions for leaks, damage, and secure fitting. Check brake fluid level in reservoir and top up, if required.
8. Check oil supply lines and unions - oil filter, oil pressure switch flange - for leaks, damage,and secure fitting.
9. Tighten cap nuts of injection lines and fastening nuts of

fly linkage.

10. Check V-belt tension and re-tension, if required.

11. Tighten nuts and bolts on engine (note tightening torques) left and right rubber engine mounting, intake and exhaust manifolds, exhaust manifold flange, supercharger flange, 4-bore flange joining supercharger-exhaust pipe. Exhaust mounting on gearbox, oil sump, cylinder head bolts.

12. Check valve clearances and adjust as required.

13. Tightening nuts and bolts (note tightening torques): front axle, steering, gearbox, propeller shaft and half-shafts, rear axle, brakes and wheel nuts.

14. Tighten nuts and bolts on front and rear lids, hinges and locks, door locks, striker plates and exhaust system.

15. Check steering for absence of play in straight-ahead position, adjust, if required.

16. Check footbrake, adjust (only rear brake) and bleed, if required. Check handbrake and adjust, if required.

17. Check front wheel bearing play and adjust, if required.

18. Check front wheel toe-in and adjust, if required.

19. Check tyre pressures and correct, if required.

20. Check lighting system, instrument readings, horn, controls, and rear-view mirror.

21. Check headlight beam alignment and adjust, if required.

22. Carry out prescribed engine test with BMW Programm Tester. Adjust engine idling and CO emissions.

23. Final inspection of items affecting road safety (brakes, steering, clutch).

Note: Road wheels can be balanced on request and will be invoiced separately.

BMW OIL SERVICE

every 4000 miles (6000 km), beginning at 2000 miles (3000 km) speedometer reading.

Change engine oil while at normal operating temperature.
Renew oil filter.

BMW OIL SERVICE

with vehicle safety test, if required

every 8000 miles (12 000 km), beginning at 4000 miles (6000 km) speedometer reading.

Change engine oil while at normal operating temperature.
Renew oil filter.

Note: When carrying out the BMW Oil Service at 4000 miles (6000 km), tighten the cylinder head bolts (note tightening torques) and change oil in final drive while at normal operating temperature.

BMW Vehicle Safety Test

1. Check steering:

   Steering box, steering linkage, joint disc, screwed joints, leaks, oil level, V-belt tension.

2. Check brakes:

   Brake pads (remove and refit wheels), brake discs, lines and hoses, unions, brake fluid level, handbrake cable, handbrake adjustment.

   Note: Renew brake fluid every six months at the latest.

3. Check tyres and disc wheels:

   Condition, tyre pressure, permissible size.

4. Check lighting:

   Headlamps, additional headlamps (beam alignment also), parking lights, tail lights, number plate lights, turn indicators, instruments and telltales.

5. Check warning instruments:

   Horn, hazard warning flashers, headlight flasher, rear fog warning lamp.

6. Check screenwasher unit:

   Wiper blades, washer unit (for windscreen, headlight washer, where fitted), reservoir (level, anti-freeze), spray jet adjustment (windscreen, headlight washer, where fitted).

7. Test drive with CO emission test.

BMW INSPECTION

every 8000 miles (12 000 km), beginning at 8000 miles (12 000 km) speedometer reading.

1. Renew spark plugs.

2. Renewing contact breaker points. Apply a touch of Bosch Grease Ft 1 v 4 to the heel of the contact breaker arm.

3. Change engine oil while at normal operating temperature.
   Renew oil filter.
   Add two drops of engine oil to the felt pad in the distributor shaft.
   Check oil level in control piston housing of the injection pump, top up, if required.

4. Check gearbox oil level, top up, if required.
   Change gearbox oil at 16 000 miles (24 000 km) and then every 16 000 miles (24 000 km).

5. Change final drive oil while at normal operating temperature.

6. Halfshafts: check rubber bellows for leaks.

7. Check oil level in steering box, top up, if required.

8. Check coolant level and top up, if required.

9. Check battery acid level and top up with distilled water, if required.

10. Check brake fluid level in reservoir and top up, if required.

11. Check V-belt tension and re-tension, if required.

12. Oil joints and bearings of the injection pump and throttle valve actuation mechanism.

13. Tighten nuts on exhaust manifold (note tightening torques).

    Visual check: left and right rubber engine mountings.

14. Check valve clearances and adjust, if required.

15. Intake air silencer: renew air filter element.
    Shorten this interval in particularly dusty conditions.

16. Check steering for absence of play in straight-ahead position. Examine condition of track rod joints.

17. Propeller and halfshafts: check condition of joints and rubber coupling.

18. Disc brakes: check total thickness of brake pads and surface condition of the discs. Renew pads, if required.

19. Tighten nuts and bolts (note tightening torques): steering box and brake caliper mounting.

20. Front wheel bearings: check play and adjust, if required.

21. Check tyre pressures and correct, if required. Check condition of tyres. If wear is uneven, optional optical alignment and correction of wheel positioning (to be invoiced separately).

22. Check brake lines and unions for leaks, damage, and secure fitting.
Clean brake drums and linings, and check for wear.
Check handbrake cables for freedom of movement. Adjust brakes.

23. Check oil supply lines and unions - oil filter, oil pressure switch flange, injection pump, oil cooler - for leaks, damage, and secure fitting.

24. Tighten nuts and bolts on door locks and striker plates.

25. Oil hinges for doors and front lid, grease front and rear lid locks, door lock catches and strikers.
Check operation of above.

26. Carry out prescribed engine test with BMW Programm Tester.
Adjust engine idling and CO emissions.

27. Final inspection of item affecting road safety (brakes, steering, clutch, headlight alignment, lighting system, instrument readings, horn, controls, and rear-view mirror).

Note: Road wheels can be balanced on request and will be invoiced separately.

Every 40 000 miles (60 000 km) - to be invoiced separately

Clean pre-filter in the fuel induction unit.

Renew main fuel filter.

Renew air filter at altitude compensator.

Tighten nuts and bolts (note tightening torques).

Check left and right engine rubber mountings, intake fuel pump and exhaust mountings for wear. Check clutch driven plate for wear.

Yours faithfully,
BAYERISCHE MOTOREN WERKE
Aktiengesellschaft

i.V. Flohr

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