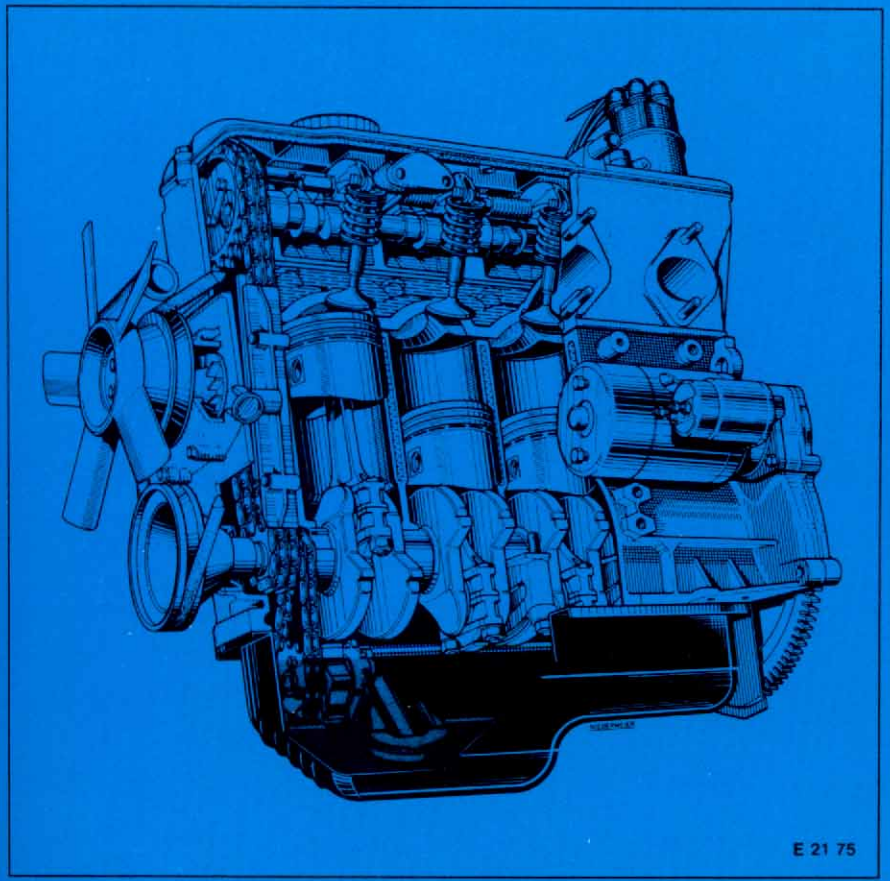
TECHN. DESCRIPTIONS EGR-SYSTEM



E 21 75

Engine
Fuel injection system
EGR-System
Evaporative Control
Clutch and gearbox
Electrical system
Dimensions and weights
Performance data
Tightening torques
Service instruction plan
Air-conditioner
Oil grades for automatic transmission and power steering
Item reference list
At a glance

BMW 320 i - fuel injection system

Your BMW 320 i is equipped with 'K-Jetronic' continuous-acting mechanical fuel injection. This system measures the volume of air drawn into the engine and injects the correct proportion of fuel to form the combustion mixture. The fuel is injected just ahead of the inlet valves under pressure, and is thus finely atomised.

1. Fuel delivery

Fuel is drawn from the tank by an electric fuel pump, and delivered to the fuel distributor by way of a fuel accumulator and a fuel filter in the pressure line. A system pressure regulator in the fuel flow distributor maintains line pressure at approx. 4.7 bar above atmospheric pressure, and returns excess fuel to the tank. In this way, fuel free from vapour bubbles is always available at the injectors.

From the fuel distributor the fuel passes through the injector lines to the injectors. The starting valve is connected to the fuel distributor by a hose.

If the tank runs dry, the system does not need to be bled, but the starter motor must be operated uninterrupted (max. approx. 20 seconds) until the engine starts.

2. Cold starting and warming up

For cold starting, the engine requires a richer mixture than usual. The proportions of fuel and air are controlled by the warm-up regulator and an aux. air device which have the task of increasing the amount of fuel injected.

In addition, an electromagnetic starting valve operated by a temperature/time switch enriches the mixture still further for actual starting, during a period of time dependent on engine temperature.

3. Injectors

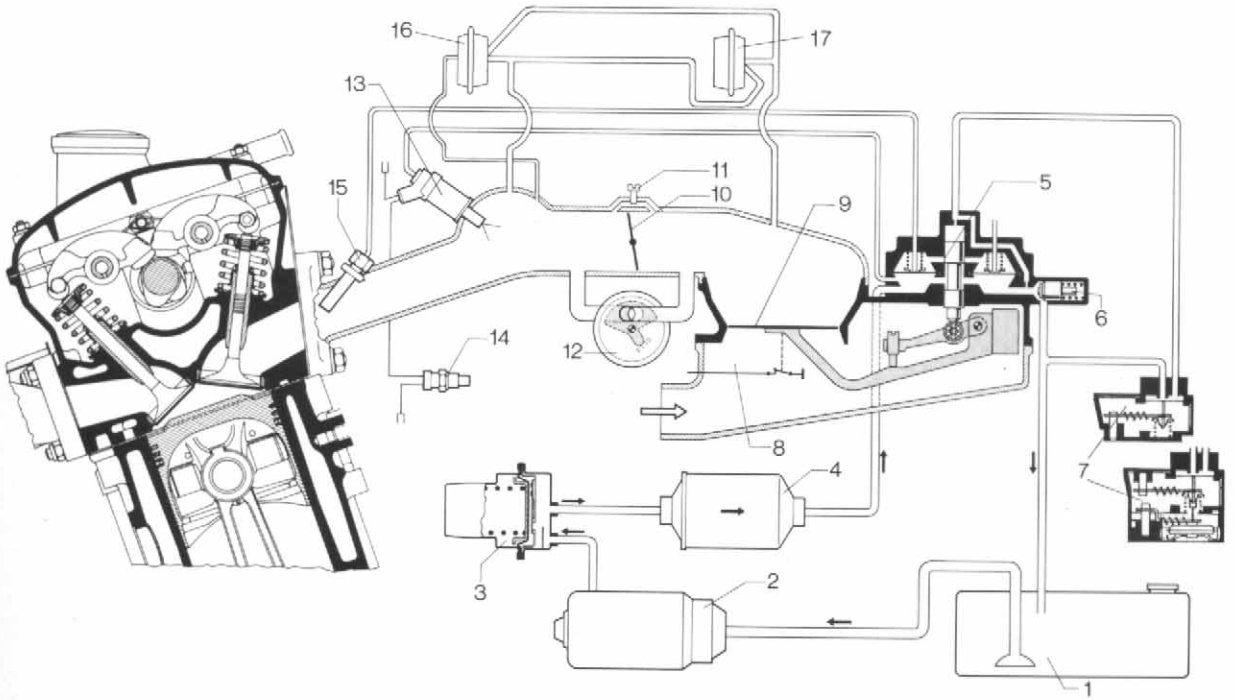
Each injector opens at a pressure of 3.3 bar above atmospheric pressure, and injects fuel into the inlet tract.

4. Intake air supply

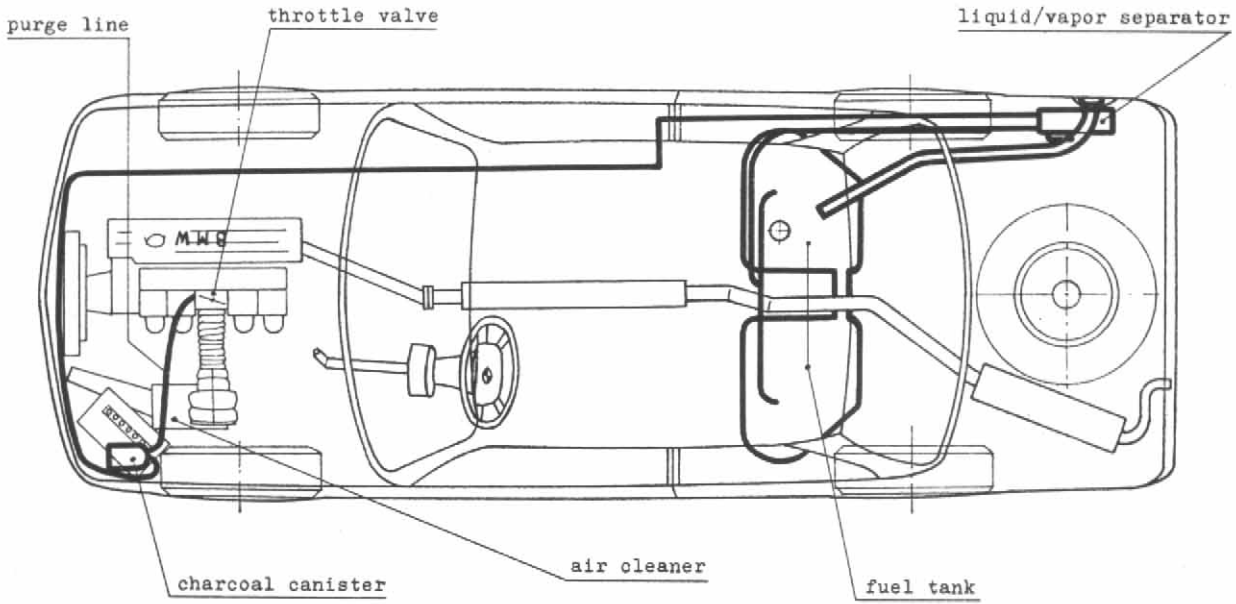
Intake air for combustion is drawn in via an air cleaner and silencer, through the airflow meter, the throttle butterfly, the air collector box and the intake pipes, before admitting into the cylinder of the engine.

1 Fuel tank
2 Fuel delivery pump
3 Fuel accumulator
4 Fuel filter
5 Fuel distributor
6 System pressure regulator
7 Warming-up regulator
(With altitude compensation for high altitude vehicles)
8 Airflow meter
9 Sensor plate
10 Throttle butterfly
11 Idle adjustment screw
12 Aux. air device
13 Electric starting valve
14 Thermo time switch
15 Injectors
16 Vacuum limiter
17 Start air valve

CONTINUOUS INJECTION SYSTEM



EVAPORATIVE CONTROL



E21US

Emission Control System

Your car has been equipped with a further developed Emission Control System consisting of:

1. Crankcase Emission Control System
2. Exhaust Emission Control System
3. Thermal reactor with air injection (California version only)
4. Evaporative Control System

1. Crankcase Emission Control System

This is a "sealed system" which does not permit the entry of fresh air into the crankcase and prevents the emission of blowby to the atmosphere. The Crankcase Emission Control System is maintenance-free.

2. Exhaust Emission Control System

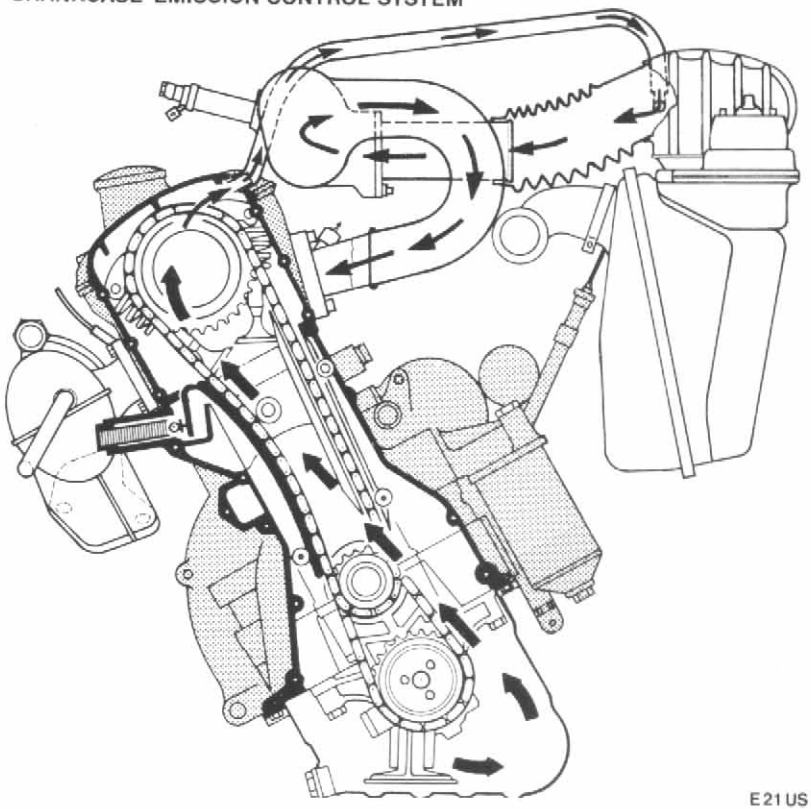
With pressure transmitter control. The reduction of CO- and CH contaminates in exhaust emissions is accomplished by means of the following design features.

EGR-valve
Pressure transmitter
EGR-filter

EGR-valve

The exhaust gas recirculation valve is controlled by a pressure transmitter which combines the different input values into one resulting control vacuum.

CRANKCASE EMISSION CONTROL SYSTEM



E21 US

The input values to the pressure transmitter are:
1. exhaust gas backpressure
2. intake manifold vacuum

The diaphragm portion of the EGR valve consists of two diaphragms, the lower is intended to control the quantity of exhaust gas recirculation (control vacuum from pressure transmitter), the upper diaphragm has the purpose to interrupt the exhaust gas recirculation (shut-off diaphragm).

Under the following conditions the shut-off diaphragm is closed:
1. Idle speed and deceleration (closed throttle)
2. Full load (wide open throttle)
3. Coolant temperature below 45°C (113°F).

At these conditions the spring below the diaphragm closes the EGR valve.

Pressure transmitter

The output values which determine the quantity of exhaust gas recirculation are the control vacuum (transmitter) and manifold vacuum (throttle) which are applied to the working diaphragm of the EGR valve.

As control signal for the pressure transmitter the exhaust gas backpressure is used which acts onto the primary diaphragm. With increasing exhaust gas backpressure the control vacuum decreases and as lower the control vacuum as more the exhaust gas recirculation.

Resulting from the changing control vacuum a continuous balance condition between secondary diaphragm and spring is created. Hereby the EGR valve opens infinitely variable.

During acceleration – the phase of increased NO_x creation – the admitted quantity of exhaust gas is optimally adjusted to the load conditions of the engine by the function of the pressure transmitter.

3. Thermal reactor with air injection
(california version only)

To further reduce the HC/CO values, a thermal reactor (california version) or MANAIROX manifold (49-States version) is used thus allowing the exhaust gases to be burned by injecting fresh air.

An air pump driven by the engine blows air via a diverter – and a check valve through a distributor pipe above the reactor into the exhaust ports behind the exhaust valves.

The reactor is housed in a double casing and has internally vented flame deflector plates. The reactor is not cooled and operates by spontaneous ignition.

After 25.000 miles or 40.000 km a warning lamp lights up indicating that the reactor should be inspected.

After inspecting the reactor, the workshop mechanic re-opens the contact in the interval switch. This extinguishes the warning lamp in the indicator and the mileage recorder is reset to zero.

A second contact trigger marked "EGR" refers to the filter of the exhaust gas recirculation system. This filter must be renewed every 25 000 miles or 40 000 km. The contacts are opened as described after the filter has been renewed.

Air System

The required volume of air is supplied by a maintenance-free engine-driven air pump.

The air injection cut-off via the diverter valve is controlled by vacuum from the intake manifold.

Note: The AIR System is not completely noiseless. Under normal conditions, noise rises slightly in pitch as engine speed increases.

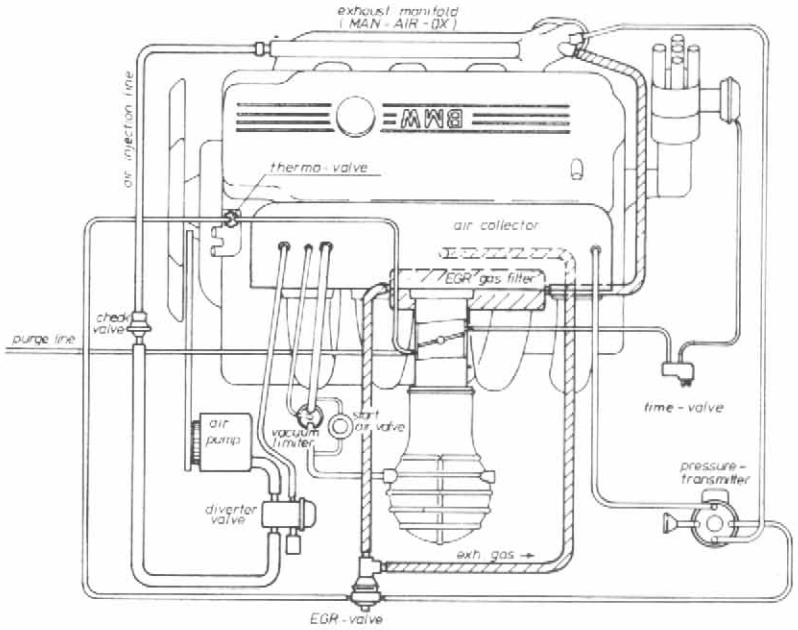
4. Evaporative Control System
(see page 80)

This is a purge system consisting of a liquid-vapor separator, activated charcoal canister and purge lines and prevents gasoline vapors from espacing to the atmosphere.

An increased purging was accomplished by connection of the system to the intake manifold.

When the vehicle is stopped and the engine is off, or while standing at a non level position, the gasoline vapors are collected in the liquid-vapor separator where part of them condenses and flows back to the fuel tank and the rest continues to the charcoal canister where they are absorbed and retained until the engine is started again. Then, suction effect causes a flow into the intake manifold and the gasoline vapor is burnt by the engine. The liquid-vapor separator is also capable of compensating for fuel expansions of a completely filled gasoline tank under conditions of ambient temperatures which may fluctuate about 80°F or 27°C. The system is maintenance-free.

EXHAUST EMISSION CONTROL SYSTEM



E21US

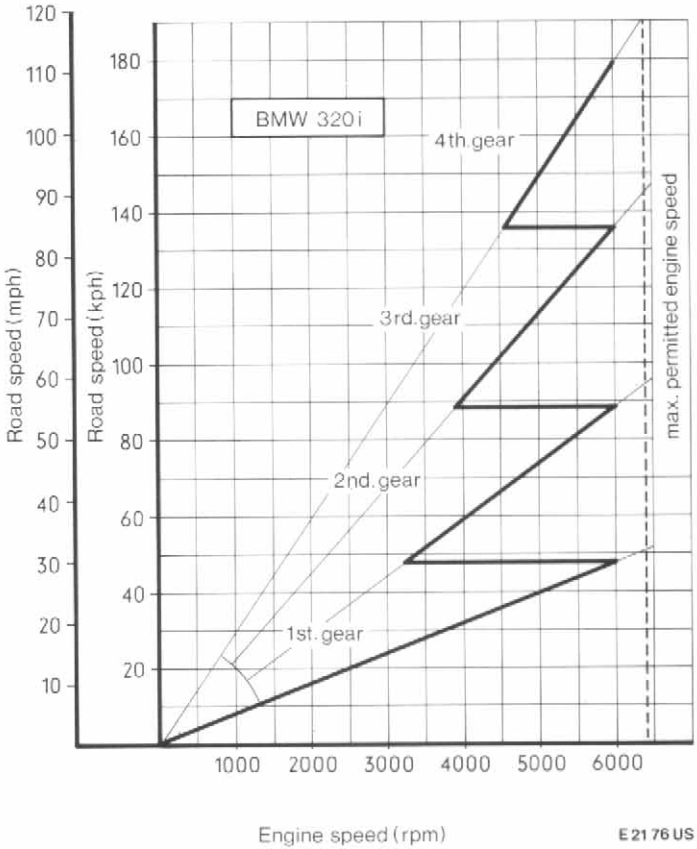
Engine

Capacity	1990 cm^3/ 121.44 cu.in.
Max. output (SAE J 245)	
49-State version	110 HP (81 kW)
California version	105 HP (77 kW)
at engine speed	5,800 rpm
Max. torque	
49-State version	15.5 kpm/112,1 ft.lb
California version	15.0 kpm/108.4 ft.lb
at engine speed	3,750 rpm
Max. permitted engine speed	6,400 rpm
Max. continuous engine speed	6,000 rpm
Compression ratio	8.2 : 1
Bore / stroke ratio	89 / 80 mm
in mm	3.50 × 3.14 in.
in inch	
Mean piston speeds	15.5 m/s (3.051 ft/min)
at engine speed	5.800 rpm
Idle speed	950 ± 100 rpm
Idle CO value (air injection disconnected)	
49-State version	max. 2.0 vol. %
California version	2.5 - 3.0 vol. %

Performance

Acceleration 0–60 mph	11,6 sec
Top speed	106 mph
(automatic transmission)	104 mph

Road speed / engine speed - BMW 320i



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Dimensions and weights

Length	177.5 "	4509 mm
Width	63.4 "	1610 mm
Height (unladen)	54.3 "	1379 mm
Wheelbase	100.9 "	2563 mm
Ground clearance (laden)	5.7 "	145 mm
Front overhang	35.43 "	900 mm
Rear overhang	41.22 "	1047 mm
Front track	54.48 "	1384 mm
Rear track	55.07 "	1399 mm
Min. turning circle dia. (wheels)	30.82 ft	9.40 m
Min. turning circle dia. (overall)	33.44 ft	12.20 m
Vehicle weight (unladen)	2590 lb	1176 kg
(in road trim, with full tank)	2612 lb[1)]	1186 kg
Max. permitted gross weight	3530 lb	1603 kg
Permitted front axle load	1730 lb	786 kg
Permitted rear axle load	1840 lb	835 kg
Permitted roof load	165 lb	75 kg

(When fully laden, the permitted axle loads must not be exceeded)

1) Automatic model

Steering

ZF rack and pinion, with flexible rubber mountings.

Overall ratio: 21.1 : 1

Track rods: left and right side track rods.

Steering damper

Hydraulic single tube damper.

Steering column

Safety steering column with divided shaft, 2 universal joints and 1 rubber disc joint.

FINAL DRIVE

Hypoid bevel, running on taper roller bearings.

Ratio:

Pinion/ crown wheel	No. of teeth	Contact pattern
3.64 : 1	40 : 11	Klingelnberg or Gleason

Final drive

Left and right double universal joint halfshafts with no-maintenance homokinetic joints.

GEARBOX

a) Manual gearbox:
Four-speed with BORG-WARNER synchro-mesh on all forward gears, 1 reverse gear.

b) Automatic transmission: ZF 3 HP-22

Gear ratios

Manual	4-speed	Auto-matic
1st gear	3.764	2.478
2nd gear	2.022	1.478
3rd gear	1.320	1.0
4th gear	1.0	–
Reverse gear	4.096	2.09

Torque converterion ratio
1 - 226 : 1

PROPELLER SHAFT

Divided shaft with flexible mounting for centre bearing and joint disc at front, universal joints in the centre and at rear, needle rollers.

ELECTRICAL SYSTEM

Battery 12 V / 55 Ah

Ignition coil: Bosch KW 12 V
Distributor: Bosch
(without centrifugal revolution limiter)

Contact breaker dwell angle: 59°–65°

Contact breaker points gap:
0.016 in (0.40 mm)

Firing order: 1–3–4–2

Ignition timing:
49 - State version 25°BTDC at 2,200 rpm
California version 25°BTDC at 2,400 rpm

Adjust dynamically with engine at normal operating temperature (engine speed 2,200 or 2,400 rpm) illuminate timing mark on flywheel with a stroboscope light pistol.

Centrifugal advance:
Begins: approx. 900 rpm
Ends : approx. 3,700 rpm
Max. adjustment range:
36° at crankshaft

Vacuum retard
Retard
Begins: approx. 50 mm Hg
Ends: approx. 100 mm Hg
Max. adjustment range:
12° at crankshaft

Alternator
Bosch K1 – 14 V 55 A 20 – 770 W

Voltage regulator
Bosch EE/14 V 3

Starter
Bosch GF (R) 12 V 1.0 HP

Spark plugs
Bosch W 145 T 30
Champion N 10 Y
Electrode gap:
0.024 + 0.004 in (0.6 + 0.1 mm)

Headlights: Sealed beam

Fusebox

in the engine compartment, on the lefthand wheel arch.

Horns

2 high-intensity single-tone horns

Wipers

Twin blades, with preselector lever on right of steering column for 2 speeds, intermittent action or automatic wash/wipe.

Automatic screenwasher

Electric gear type pump with delaying relay for wipers, operated by wiper/washer lever.

Heated rear window

with 14 electrodeposited heating elements; power rating 150 Watts.

Cigar lighter and plug socket on facia

Can also be used for plugging in an inspection lamp or razor with standard plug; max. 200 Watt, 12 Volt rating.

Wheels and tires

Steel disc wheels

5½ J x 13 H 2 well-base rims.

Light alloy wheels (special equipment)

5½ J x 13 H 2 well-base rims.

Tires for light alloy wheels: Only in conjunction with metal screw valve 40 G DIN 7771.

Tires (standard equipment)

Radial ply 185/70 HR 13 tubeless, with rubber valve 43 GS/11.5 DIN 7780.

Winter tires

185/70 SR 13 or 165 SR 13

Tubeless, with rubber valve
43 GS/11.5 DIN 7780
or tubed, with metal screw valve 40 G DIN 7771.

Snow chains may be used on the drive wheels only.

Tread Wear Indicators

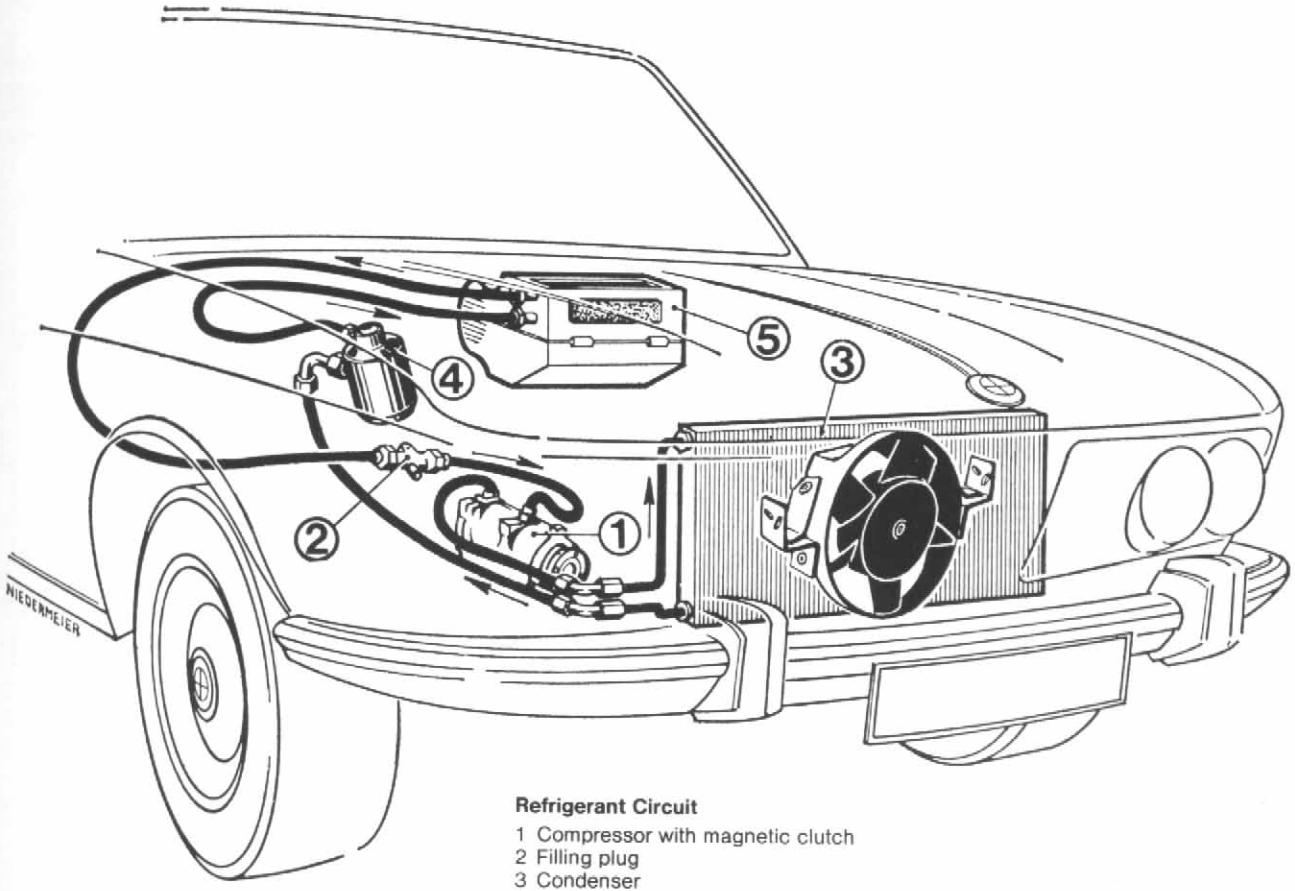
Your BMW is fitted with steel-belt tires, which incorporate built-in tread wear indicators. These are molded into the bottom of the tread grooves and will appear as approx. ½" wide bands when the depth of tire tread becomes 1/16". The indicators help you determine when your tires have been worn down so far that they need replacing. If they appear in two or more adjacent grooves, tire replacement due to tread wear is recommended.

TIGHTENING TORQUE
VALUES FOR NUTS AND BOLTS

	lb. ft	Nm
Engine:		
Cylinder head studs	51 ± 1.4	70 ± 2
Crankshaft V-belt pulley	101	140
Exhaust manifold at cylinder head	22 + 2.2	30 + 3
Nuts for thermal reactor	24 ± 1.5	32 ± 2
Support bracket on engine	34	47
Rubber mounting nuts	18.4	25
Full-flow throwaway filter	17.7 + 1.4	24 + 2
Injector collar nuts	18.4	25
Gearbox		
Flange mounting to engine	18 (M 8)	25 (M 8)
	34 (M 10)	47 (M 10)
Front axle	57 + 5.9	
Spring strut, centre top	16 + 1.4	78 + 8
Spring strut thrust bearing	43 + 7.2	22 + 2
Guide joint at track rod arm		60 + 10
Front axle beam to engine	32 + 3.7	
mounting	60 + 6.6	43 + 5
Wishbone to front axle beam*	52 + 15	81 + 9
Stabilizer at wishbone*	35 + 3.7	70 + 20
Stabilizer at front axle beam		47 + 5
Brakes	58 + 10.8	
Caliper to kingpin	60 + 6.6	80 + 15
Wheel studs		81 + 9

Rear axle		
Rear axle beam to body floor	133 + 14.7	180 + 20
Rubber mountings on rear axle beam	36 + 3.7	49 + 5
Final drive to rear axle beam	60 + 6.6	81 + 9
Self-aligning support to final drive	60 + 6.6	81 + 9
Self-aligning support to body floor	60 + 6.6	81 + 9
Semi-trailing arm to axle beam	60 + 6.6	81 + 9
Spring/shock absorber strut, lower end	36 + 3.7	49 + 5
Half-shaft to drive flange	33 + 2.2	30 + 3
Half-shaft to final drive shaft	22 + 2.2	30 + 3
Rear axle shaft castellated nuts	33 + 3.7	45 + 5
Propeller shaft to gearbox flange	50 + 5.9	68 + 8
Propeller shaft to final drive	50 + 5.9	68 + 8
Steering		
Steering wheel retaining nut	59 + 7.4	80 + 10
Sleeve tube at bearing mount	12.5 ± 1.5	17 ± 2
Joint disc attachment	14.7 + 2.2	20 + 3
Joint flange attachment top	16 + 1.4	22 + 2
bottom	18 + 2.2	25 + 3
Steering box to front front	18 + 1.5	25 + 2
axle beam rear	36 + 3.7	49 + 5
Track rod castellated nut	26 + 3.7	35.5 + 5
Track rod locknut	63 + 7.4	86 + 10
Steering damper	11.1 + 2.2	15 + 3

* Normal load position: vehicle with full tank and 2 x 150 lbs (2 x 68 kg) on front seats, 150 lbs (1 x 68 kg) on rear seat, 46 lbs (21 kg) in luggage compartment.



Refrigerant Circuit

1 Compressor with magnetic clutch
2 Filling plug
3 Condenser
4 Drying bottle
5 Evaporator with blower

SPECIFICATIONS OF AIR CONDITIONER
(optinal extra)

Evaporator housing

Air distribution: the evaporator is integrated into the fresh ar ventilating system. The air distribution is the same as with standard series production vehicles without air conditioning:
via a center grille and two lateral grilles.
Air circulation:
Four-vane radial blower.

Airflow: Approx.
7 m^3/min

Protection:
Fuse element 25 amps. (blue) in fuse box.

Minimum air discharge temperature on evaporator: 2-3° C.

Maximum
cooling rate:
Approx.
4500 Kcal/hr.

Compressor

Bosch DTA
(Wobble plate design)

Number of cylinders: 6
Speed: 500 rpm up to 6000 rpm
Capacity: 152 cc
Oil capacity: max. 0.35 kg
Power draw: approx. 4.4 kW
(6 HP) at max. speed

Electromagnetic clutch

Bosch DTA
Diameter: 6 inches

Condensor

Surface: 11.5 dm^2

V-belt

Narrow V-belt
12.5×825

Drying bottle

Steel housing with sight glass
Capacity: 0.54 dm^3

Refrigerant

Type: Frigen 12 (CF_2Cl_2, difluordichloromethane)
Capacity, max.:
900 g

Auxiliary electric fan:

Located in front of the condensor, being cut in and out of operation by means of the magnetic clutch as well as thermostatically in function of the coolant temperature.

Make:
Type:

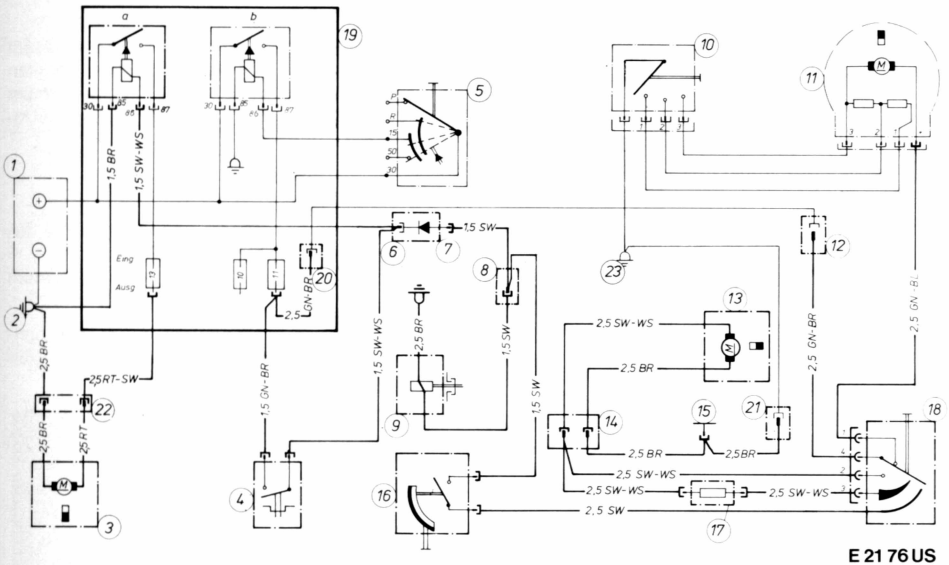
Bosch IPK 12 V
11-vane axial fan
ring diameter
with 282 mm fan

2-stage control via thermostat in radiator

Power draw:
100 W at 13 V (stage I)
300 W at 13 V (stage II)

Protection: Supplementary fuse,
fuse element 25 amps (blue).

Electrical wiring diagram for air conditioning unit



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Key to wiring diagram

1 Battery
2 Ground (earth)
3 Auxiliary fan motor
4 Temperature switch
5 Ignition starter switch
6 Connection for air conditioning
7 Diode
8 Connection for magnetic clutch
9 Magnetic clutch for compressor
10 Blower switch
11 Heater blower motor
12 1-pin plug connection
13 Air blower motor
14 2-pin plug connection
15 Lighter ground connection
16 Temperature selector switch
17 Resistance
18 Blower switch for air conditioner
19 Current distributor
a) Auxiliary fan relay
b) Load-shedding relay
20 1-pin plug connection
21 1-pin plug connection
22 2-pin plug connection
23 Ground (earth)

Function

The combination of the standard heater with the Air Conditioner offers you an ideal all-weather comfort control in your BMW.

The air conditioner functions on the principle of a domestic refrigerator. The refrigerant (Frigen 12) is drawn into the compressor which compresses and discharges it in a gaseous state to the condenser located in front of the radiator. The refrigerant being cooled down by the air drawn in through the blower and the air resistance encountered when driving, returns to liquid. On the way to the evaporator the refrigerant passes the dehydrator which serves the purpose of removing any traces of moisture that may have accumulated in the system. The refrigerant dilates in the evaporator through the expansion valve and evaporates. The heat required for the evaporation is withdrawn from the passing air stream supplied by the blower assembly. The evaporated refrigerant is drawn in by the compressor and compressed again. The cycle thus is completed.

The compressor is equipped with an electromagnetic clutch by which the compressor is cut in and out of operation. The magnetic clutch is controlled by a thermostatic switch which has its temperature sensing tube inserted in the fins of the evaporator core.

The electric additional fan is automatically switched on when the compressor starts running or when a too high coolant temperature is reached.

The evaporator is integrated into the fresh air ventilating system. The passenger compartment air to be cooled is drawn in by the auxiliary fan and blown through the evaporator fins and cooled this way. The supply of cooled air into the passenger compartment and the air distribution is effected as follows:
via an adjustable center grille and two lateral grilles.

1. Adjustment on the heater controls

In order to avoid errors the heater blower is automatically switched off when you turn on the air-condition.

Blower control for air distribution in position 0. Temperature slide in position "cold".

For quick cooling we recommend to close for a moment the fresh air by closing the cold air supply slides left and right. When driving you may then mix the desired quantity of fresh air with cooled air by opening these slides.

2. Blower switch (1)

For cooling operate the blower switch.
The various switch positions are:

O = lever to the left = blower and air conditioner cut out.
1 = moving the lever to the right to the 1st notch = cuts in fan and air conditioning.

Moving the lever further to the right provides infinitely variable increase of fan speed.

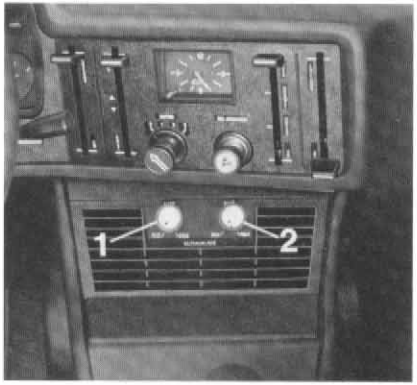
2 = second notch: medium fan speed
3 = third notch (stop):
max. blower speed.

When your vehicle was exposed to direct sunlight for a fairly long time, first shift the fan control to high speed position for maximum cooling. Then switch down to a convenient lower blower speed.

3. Temperature selector (2)

Lever to the left = minimum cooling
Moving to the right = infinitely variable decrease of the air temperature.
Lever to right-hand stop position = maximum cooling.

The preselected temperature is kept constant by means of a thermostatically controlled expansion valve.



Important hints

1. The air conditioning operates only with the engine running.
2. If despite cut-in air conditioning the air enters uncooled from the fresh air outlets, the unit must be switched off as otherwise the compressor would be damaged (have the unit checked).
3. Operate the unit for a short time at least once a month (particularly important during the cold season) as otherwise there is the risk that the seal of the compressor shaft dries out and leaks.
4. When part of the cooling plant, e.g. by an accident, gets untight or damaged – lack of cooling effect – the plant has to be switched off. Otherwise you risk that the compressor gets damaged by lack of cooling effect.

Maintenance

The tension of the compressor belt should be checked every 6,000 miles or 10 000 km. Adjust the belt tension until a ½ inch or 12 mm deflection is obtained midway between the compressor and crankshaft pulley.

Retensioning pulley:

To adjust the belt tension, loosen 3 securing nuts (spanner size 17 mm) on the compressor support plate and move the compressor away from the support plate.

Retighten the compressor retaining screwes every 6,000 miles (10 000 km).

Oil level control.

Check the oil level each time work is done at the drained conditioner, as otherwise the compressor always maintains overpressure. Please only use appropriate refrigerator oils, for example:

Suniso 5
BP Energol LPT 100
Shell Clavus 33
Texaco Capella E

We especially draw your attention to the fact that all maintenance and repair operations should exclusively be performed in specialized workshops.

See also dealer list.

Safety precautions

The air conditioning system must be charged with a safety refrigerant (Frigen 12). Though this refrigerant at normal temperatures is non-toxic, non-inflammable and non-explosive in whatever mixtures with the air, the respective safety instructions have to be observed. Particularly keep in mind the following points:

As the refrigerant in its liquid state tends to freeze anything that it contacts, extreme care must be used to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes. Always wear safety goggles when servicing any part of the refrigerating system. In case of accidents seek a doctor's aid immediately.

Frigen is heavier than air, therefore don't discharge the refrigerant in enclosed areas. The danger of suffocation exists above all in pits.

Never weld on or in the immediate area of the air cooling system. Due to an eventually arising overpressure (as in any other receiver) exists the danger of explosion. Besides the Frigen decomposes at high temperatures and under the influence of flames. The decomposition products are injurious to health.