

General

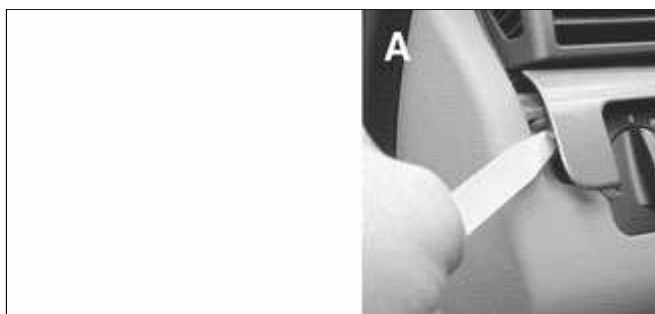
The repair information given under this heading applies to the heating and air conditioning system. Many of the procedures require that the A/C refrigerant charge be evacuated. See ⇒ [A/C system warnings and cautions](#) later in this repair group.

For information on the engine cooling system, see ⇒ [170 Radiator and Cooling System](#).

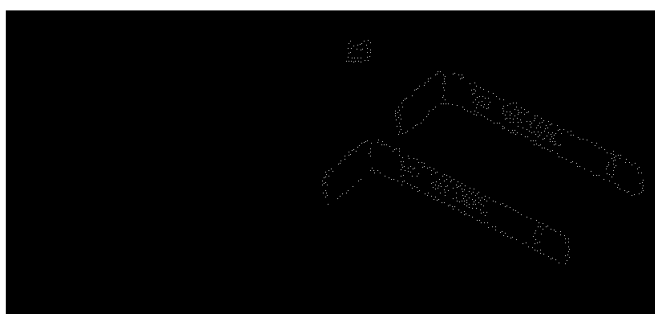
Special tools

Some special tools are necessary for heating and A/C repair procedures.

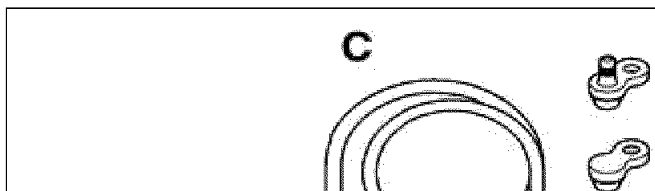
A variety of A/C system evacuation and recharge equipment is available. Follow the equipment manufacturer's recommendations and instructions.



- ◀ Plastic tool for prying off interior trim
BMW 00 9 321



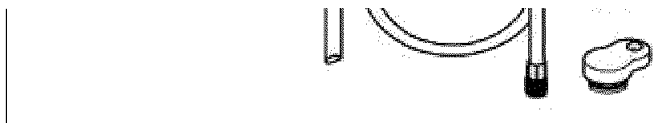
- ◀ IHKA control panel removal tools BMW
64 1 010



- ◀ A/C line plug kit BMW 64 5 100

Note:

A/C system recharging procedures are



beyond the scope of this manual.

Integrated heating and cooling system (IHKA)

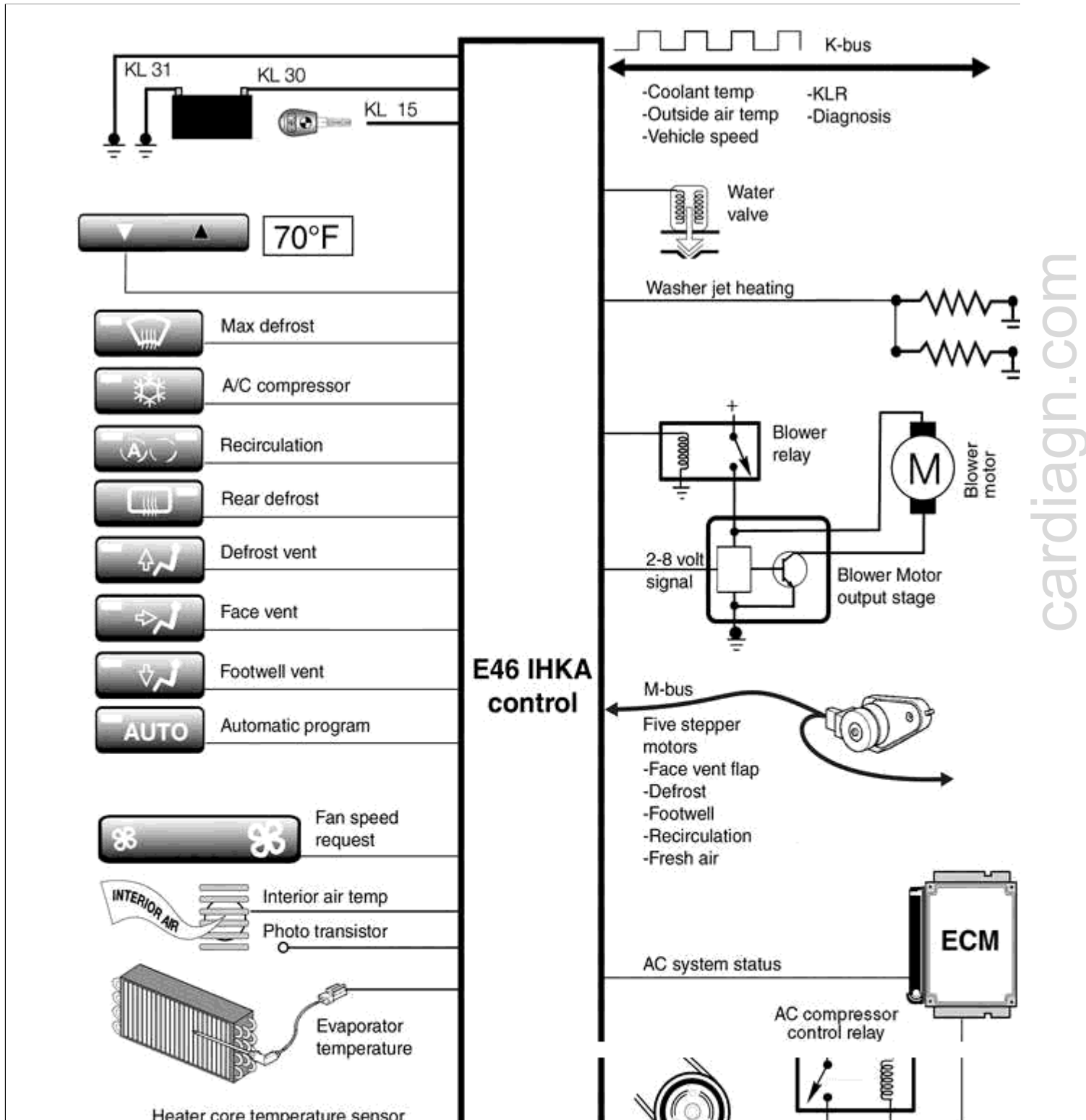
The E46 integrated automatic climate control system (IHKA) offers powerful cooling and heating, effective ventilation, and smooth operation in A/C mode.

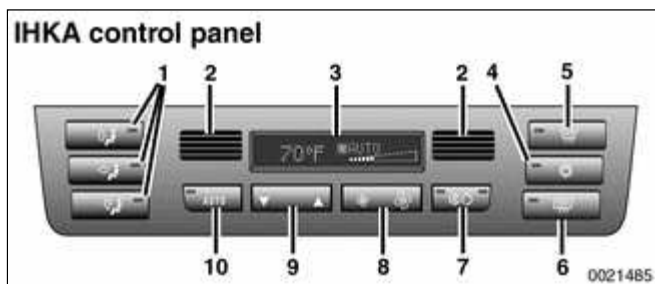
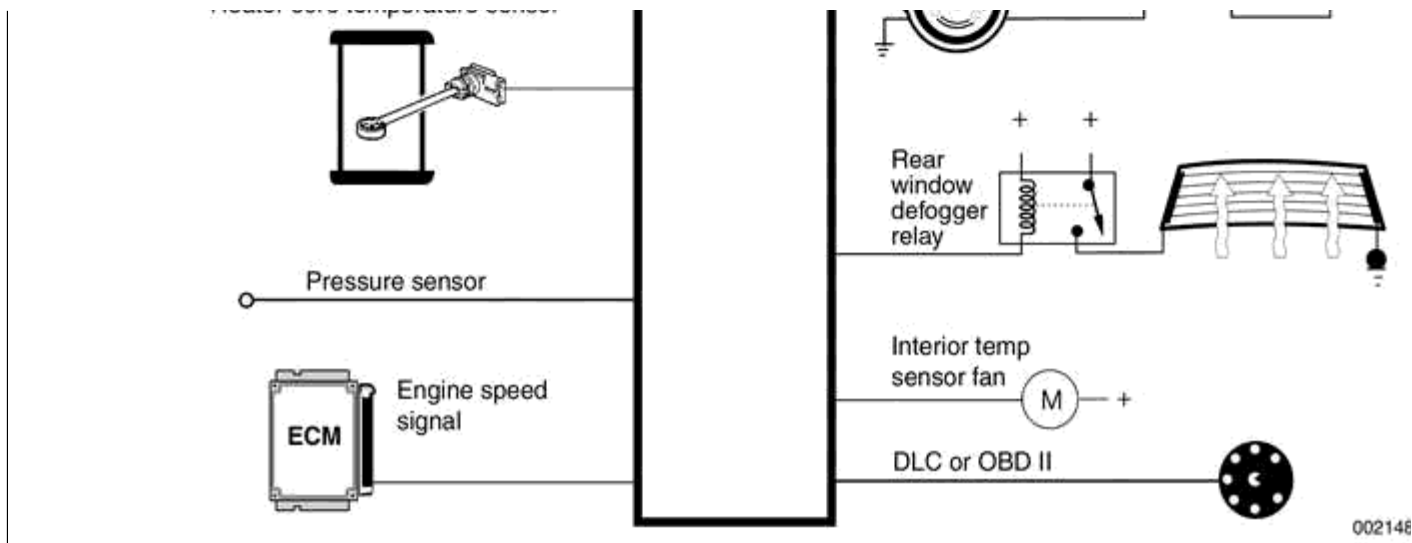
The E46 IHKA design includes the following:

- ◆ Use of R134a refrigerant only
- ◆ Single heater core for temperature regulation
- ◆ Maximum heating and cooling for defroster functions
- ◆ Rear window defogger operation integrated into the heating/cooling system
- ◆ Blower controlled through a final stage variable resistor
- ◆ Road speed dependent air distribution and fresh air volume
- ◆ Self-calibrating air distribution stepper motors controlled via M-bus
- ◆ Fresh air microfilter system
- ◆ Electronically regulated A/C compressor

- ◆ Heater control personalization via Car Memory/Key Memory

E46 IHKA control





Control panel and module

Heating and air conditioning functions are programmed via the center console mounted control panel. The control panel has large, easy to use soft-touch controls, an LED display and a single temperature setting.

- 1 - Manual air distribution control buttons
- 2 - Interior temperature sensor intake/outlet
- 3 - LCD matrix
- 4 - A/C control ("snowflake")
- 5 - Windshield defrost control
- 6 - Rear window defogger control
- 7 - Recirculation control
- 8 - Blower control
- 9 - Temperature control
- 10 - Automatic air distribution

The IHKA control module, integral with

the front panel, includes an EEPROM chip for storage of Diagnostic Trouble Codes (DTCs). Inputs to the module include:

- ◆ Heater core temperature sensor
- ◆ A/C evaporator temperature sensor
- ◆ Other programmed functions from Car Memory (such as rear window defrost timing).

The module can go into "sleep mode" to reduce power consumption when the ignition is switched OFF but still retain control panel settings and DTC information. If the control module is replaced it must be recoded using BMW scan tools DIS or MoDiC.

Heat regulation



- ◀ The E46 uses a single water valve and heater core to provide passenger compartment heat. The water valve is electrically pulsed to control the flow of coolant through the heater core.

Temperature regulation is based on the following inputs:

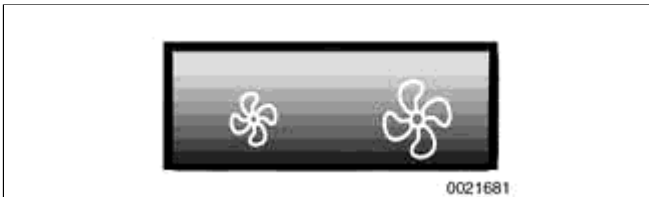
- ◆ Temperature control switch setting
- ◆ Interior temperature sensor signal
- ◆ Ambient temperature signal
- ◆ Heater core temperature sensor signal
- ◆ Evaporator temperature signal

- ◆ Solar sensor input (if applicable)

A rocker switch is used to select the desired cabin temperature, shown in the display matrix of the control panel. The range for temperature display is from 15° to 32°C (60° to 90°F).

A "service station" feature is integrated into the E46 IHKA. This prevents the heater core from being flooded with hot coolant when refueling the vehicle.

Blower control

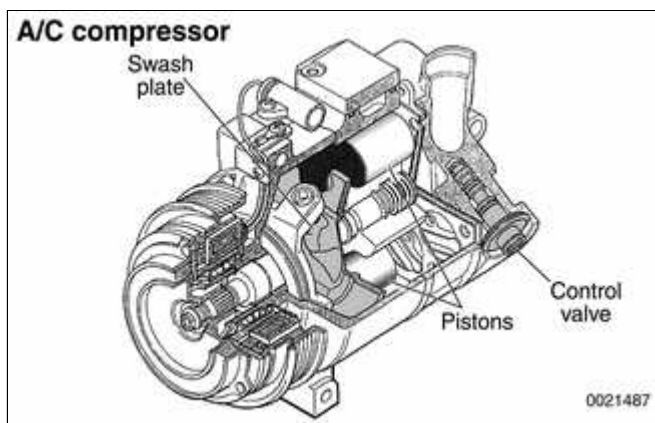


The blower rocker switch on the IHKA control panel is the master switch for the entire system. Rocking the switch to select slower and slower fan speeds eventually results in the following:

- ◆ Blower motor turns off.
- ◆ All air distribution valves are closed.
- ◆ LED and LCD displays are switched off.
- ◆ Rear window defroster is switched off.
- ◆ A/C compressor is switched off.

Even in the lowest setting, the interior temperature sensor blower continues to operate and the IHKA control panel continues to signal the heater water valve for heat.

Regulated A/C compressor



The operation of the A/C compressor is modulated, eliminating noticeable on/off cycling. In order to reduce fuel consumption and improve vehicle performance, the system default is with the compressor OFF.

- ◀ The A/C system uses a variable displacement compressor. The swash plate of the compressor is hinged so that it can vary piston travel based on output requirements of the system.

A/C compressor function is controlled by the Engine Control Module (ECM) based on inputs from the IHKA control panel. Pressing the "snowflake" button is a request for A/C activation. As long as the evaporator temperature is above 2°C (36°F), the IHKA signals the ECM to activate the compressor.

The IHKA control module sends the following signals to the ECM over the K-bus and CAN-bus via the instrument cluster:

- ◆ Request for A/C activation
- ◆ Load torque for switching the compressor
- ◆ Requested cooling fan speed

The IHKA determines the load torque for compressor activation and required engine cooling fan speed from the pressure sensor mounted on the receiver/dryer. The pressure sensor provides a linear voltage input signal (0 - 5 volts) to the IHKA control module. The module processes this signal and determines the load torque of the system (0 to 30 Nm with a variable displacement compressor). The higher the pressure in the system, the higher the voltage input signal to the IHKA module. The output

signal to the ECM enables the ECM to modify the idle speed, timing and fuel injection amount based on the load that is imposed when the compressor is activated.

Regulated engine cooling fan operation

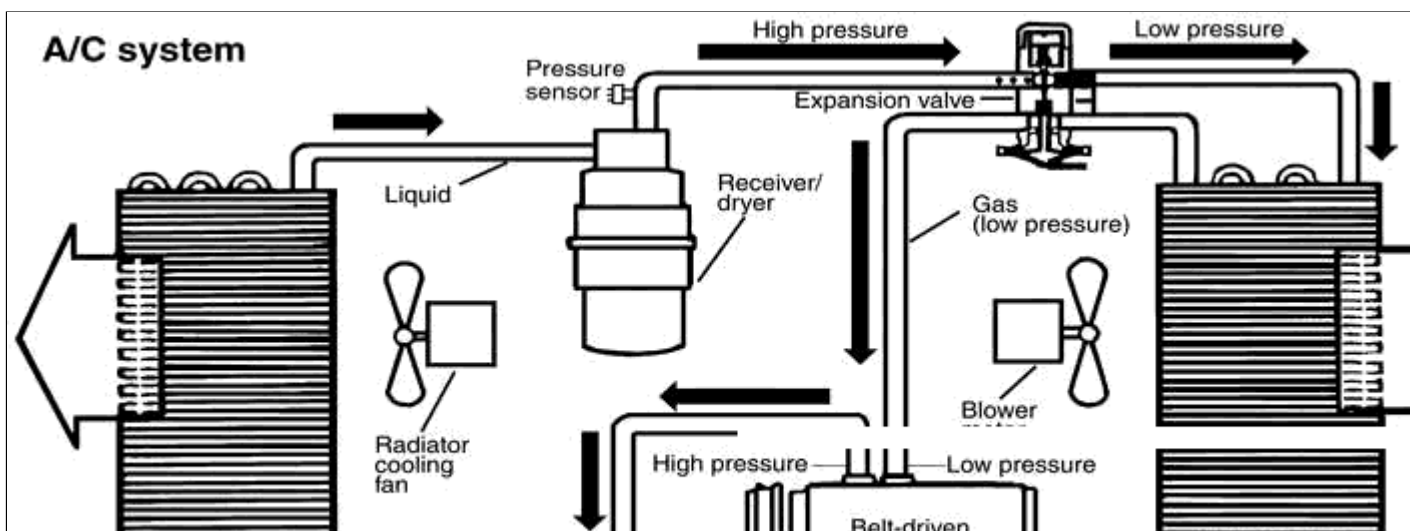


- ✦ The engine cooling fan (**arrow**) operates at variable speeds (15 stages) based on cooling system load. The ECM activates the fan through a pulse modulated final stage control. See ⇒ [170 Radiator and Cooling System](#) for further details.

Note:

- ◆ *Automatic transmission models: The engine cooling fan is located in front of the radiator. A belt-driven fan and fan clutch assembly is installed at the rear of the radiator.*
- ◆ *Standard transmission models: The electric engine cooling fan is installed at the rear of the radiator.*

A/C system





Maximum defrosting

- Pressing the defrost button turns on maximum defrost functions:
- ◆ Fresh air distribution valves are opened.
 - ◆ Recirculation valves are closed.
 - ◆ Windshield defrost vents are opened.
 - ◆ All other air distribution vents are closed.
 - ◆ Blower runs at maximum speed.
 - ◆ Rear window defroster is switched on.

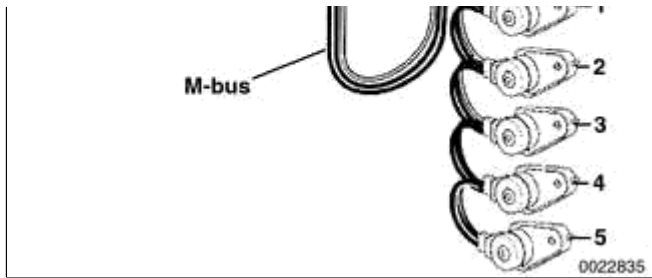
Note:

When windshield defrosting is turned on, the A/C compressor does not run automatically, although it can be turned on manually.

Air distribution control via M-bus



- Five stepper motors control fresh, heated and air conditioned air distribution.
- 1 - Face vent

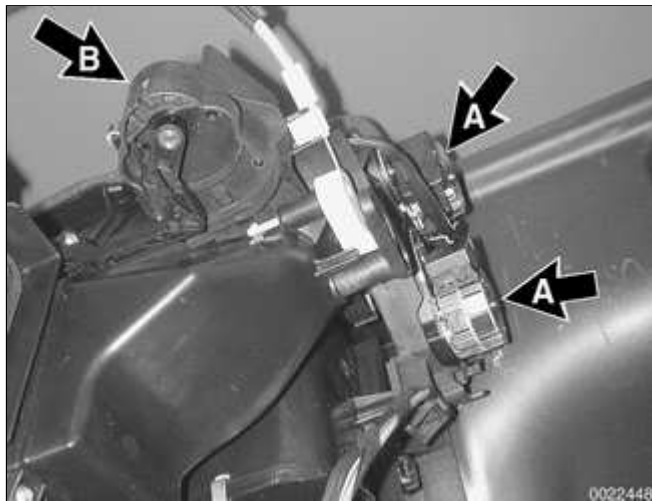


2 - Defrost

3 - Footwell

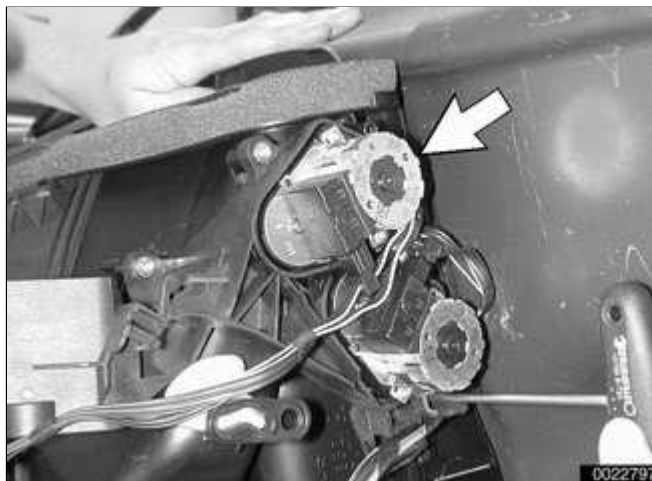
4 - Recirculation

5 - Fresh air

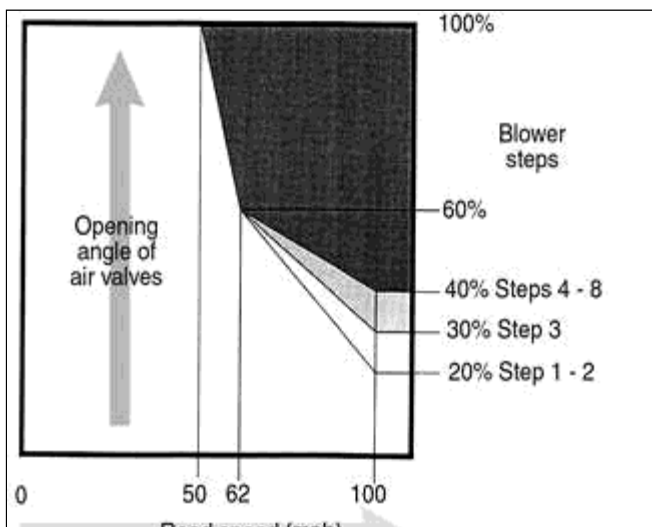


Two different types of air distribution motors are used in the system. Fast acting motors (**A**) are used for the fresh air/recirculation flaps. (Right side shown.)

- Slower acting motors (**B**) are used for the other operations.



The center dashboard air outlet distribution motor (**arrow**) allows ventilation air temperature to be controlled by the driver or passenger.



When fresh air is selected, the fresh air inlet distribution flaps are positioned according to road speed and blower motor speed. The motors close the air inlet flaps incrementally according to road speed but the motion is dampened to avoid closing and opening continually due to slight speed changes.

IHKA personalization

Car Memory/Key Memory allows various functions and features of IHKA control to be tailored to the driver's wishes. The functions of IHKA that can be programmed by the driver include:

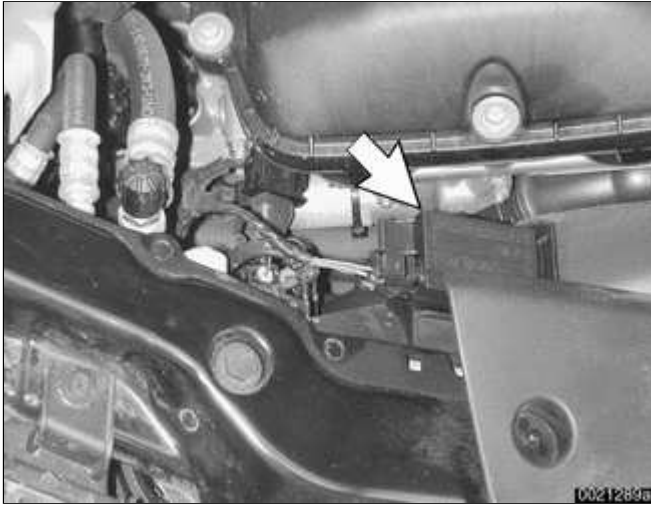
- ◆ Automatic activation of recirculation when the vehicle is started
- ◆ Blower speed adjustment (8-speed blower)
- ◆ Automatic opening of ventilation flaps with warm coolant
- ◆ Automatic closing of footwell flaps with A/C activation
- ◆ Automatic closing of defroster flaps with A/C activation
- ◆ Adjustments to set temperature
- ◆ Automatic activation of compressor control when the ignition is switched on
- ◆ Auto program for blower control when the ignition is switched on

These features are programmed using the coding/programming function of the DIS/MoDiC.

Note:

See ⇒ [515 Central Locking and Anti-theft](#) for an explanation of Car Memory/Key Memory.

Automatic air recirculation



- As of model year 2000, automatic recirculation control is available. This system uses an air quality sensor (AUC) (**arrow**), located at the top right corner of the radiator, to detect high levels of air pollution and automatically switch the IHKA to recirculation of interior air. The recirculation button on the IHKA control panel can be toggled to allow automatic, manual or no recirculation.

Once recirculation is turned on, it runs until it is turned off using the button. Once the ignition is turned off, the recirculation setting is saved for 15 minutes, after which the IHKA system reverts to fresh air mode. This feature can be over-ridden using the Car Memory feature, so that recirculating interior air is automatically selected on engine start-up.

Fresh air micro filter system



- A fresh air micro filter system is used in all E46 models. The filter is housed below the fresh air inlet at the rear of the engine compartment. The filter can be serviced by releasing three-quick release screws and removing a plastic cover.

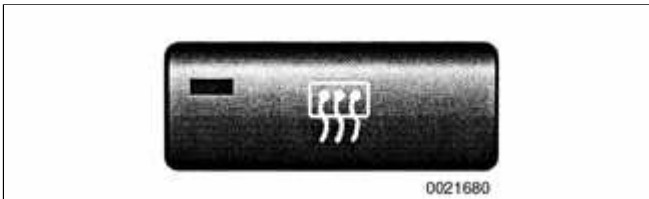
Service

The heating system is part of the engine cooling system and is sealed. The only required service is periodic coolant flushing. See ⇒ [170 Radiator and](#)

Cooling System.

Servicing the A/C system requires the use of specialized equipment. Follow the equipment manufacturer's instructions.

Rear window defogger



- ⚡ The electric rear window defogger switch is integrated in the IHKA control panel. Pressing the rear window defogger button activates the rear window heating element for about 17 minutes, although this can be changed through Car Memory settings. Pressing the button again activates a cycle of 40 seconds on/80 seconds off for 5 minutes.

The defogger element in the rear glass is integrated with the radio antenna.



- ⚡ The rear window defogger relay (**arrow**) is located in the right side of the luggage or cargo (Sport Wagon) compartment behind the trim.

Convertible heated rear window

In the E46 Convertible, both the soft top and the hard top are equipped with rear window defogger. Power is supplied by two relays located on the right side rear quarter panel behind the interior trim cover.

Rear defogger operation is controlled by the IHKA control module.

On hard top:

- ◆ Rear relay is energized.
- ◆ Power to hard top window is supplied through connector strip on hard top lock.

On convertible top:

- ◆ Rear relay is energized. It powers front relay.
- ◆ If convertible top control module (CVM) signals that convertible top is locked to windshield frame, front relay powers rear window heater grid.
- ◆ If convertible top is lowered, a signal from CVM to front relay prevents heated top operation.
- ◆ Front relay also signals sound system to switch stereo sound ON when top is up, stereo sound OFF when top is down.

Solar sensor

The purpose of the solar sensor is to detect and relay information about the amount and intensity of solar heating to the IHKA control module. The settings of the climate control system are changed to compensate for this additional influence.

Solar sensor



The solar sensor consists of a photoresistor installed in the right defroster outlet and a short harness.

The solar sensor receives power (5 volts) and ground from the IHKA control



module. The module then calculates voltage drop across the photoresistor and determines the degree of solar heating based on the change in voltage. Voltage drop across the photoresistor increases as solar radiation increases. The IHKA control module processes the photoresistor input every 10 seconds and also checks it for plausibility based on mapped values. Values outside the limit indicate a malfunction and the solar sensor signal is ignored by the module.

The IHKA module regulates interior climate settings using the following:

- ◆ Blower. The blower activation curve is changed.
- ◆ Ventilation. The opening angles of air distribution flaps are changed.

Troubleshooting of the solar sensor is carried out through the IHKA diagnostic program incorporated in DIS or MoDiC. The IHKA control module may set codes indicating a short or an open circuit.

To access the solar sensor, remove the trim in front of the main dashboard panel, ahead of the dashboard vents.

Troubleshooting

Trouble with the heating and A/C system can be broken down into one or more of the following categories.

Mechanical problems

- ◆ Control head malfunction
- ◆ Blower motor malfunction

- ◆ Noisy or seized compressor
- ◆ Noisy compressor clutch
- ◆ Malfunctioning belt

Diagnosis of noisy engine compartment components is covered in ⇒ [100 Engine-General](#). A/C belt replacement is covered in ⇒ [020 Maintenance](#).

Cooling system problems

- ◆ Coolant problems
- ◆ Cooling fan problems

Cooling system pressure testing and other diagnosis is covered in ⇒ [170 Radiator and Cooling System](#).

Refrigerant leak

Use diagnostic equipment to pinpoint refrigerant leaks. Replace leaky components or seals.

Note:

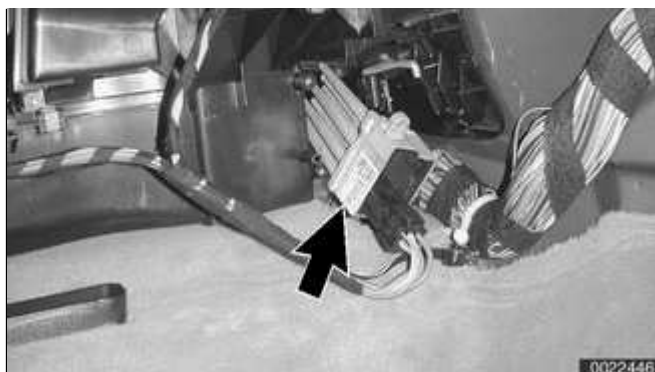
Diagnosis of A/C system components is beyond the scope of this manual. Follow the equipment manufacturer's instructions.

Odors

Mildew in the IHKA housing and in the evaporator fins can cause strong odors.



- ◀ Working under right side of dash, remove blower fan resistor pack (**arrow**) as described later in this repair group.



- Poke a spray wand through IHKA housing opening and spray commercially available cleaning agent on evaporator. Move wand back and forth to cover evaporator fins with liquid.
- Allow 5 minutes for liquid to drip through evaporator drain.
- Start car and run heater and A/C at maximum power for 5 minutes to dry out evaporator.

Functional problems

IHKA self diagnostics monitors the inputs and outputs of the system. If a fault is detected, a Diagnostic Trouble Code (DTC) is initially entered in RAM and then in the EEPROM when the ignition is switched off. A maximum of six DTCs can be stored in the EEPROM when the ignition is switched off. The E46 IHKA module is connected to the Diagnostic Link Connector (DLC) via the K-bus/instrument cluster. Use DIS, MoDiC or other suitable scan tool to access DTCs.

When troubleshooting problems with the E46 IHKA, it is important to note that because the Car Memory/Key Memory feature can change the functionality of the system, a review of memory settings should be performed prior to condemning a component as faulty.

Substitute value operation

If an input potentiometer, sensor or circuit fails or the signal from it is not plausible, the control module ignores the faulty signal and substitutes a

programmed substitute value. See ⇒ [Table a.](#)

Table a. Substitute programmed values for IHKA component inputs		
Input	Working range	Substitute value
Heat exchanger sensor	5° to 124°C (41° to 255°F)	55°C (131°F)
Evaporator sensor	-10° to 30°C (14° to 86°F)	0°C (32°F)
Interior temperature sensor	10° to 40°C (50° to 104°F)	20°C (68°F)
Exterior temperature	K-bus	0°C (32°F)
Coolant temperature	K -bus	100°C (212°F)
Specified temperature	16° to 32°C (61° to 90°F)	22°C (72°F)

Note:

The substitute value for the evaporator temperature sensor is below the A/C compressor cycling temperature (2°C/34°F). If the evaporator temperature sensor signal is not plausible, the substitute value will switch the A/C OFF.

⇒ [Table b](#) lists resistance values and fault limits for IHKA temperature sensors.

Table b. Temperature sensor resistance values at 25°C (77°F)		
Sensor	Resistance	Fault limit
Heater core	9 k Ω $\pm$ 2%	Temp >

Table b. Temperature sensor resistance values at 25°C (77°F)		
Sensor	Resistance	Fault limit
		125°C (257°F)
Evaporator	9 kΩ ± 2%	Temp > 120°C (248°F)
Interior	10 kΩ ± 2%	Temp ≤ -46°C (-51°F)

⇒ [Table c](#) lists A/C evaporator temperature-dependent resistance values.

Table c. A/C evaporator temperature sensor resistance values	
Temperature °C/°F	Resistance range kΩ
-5/23	11.7 - 11.9
0/32	8.8 - 9.2
5/41	6.8 - 7.2
10/50	5.3 - 5.6
15/59	4.2 - 4.5
20/68	3.3 - 3.6
25/77	2.6 - 2.9
30/86	2.1 - 2.3
35/95	1.7 - 1.9

⇒ [Table d](#) lists A/C expansion valve pressure values.

Table d. Expansion valve pressure values

Table d. Expansion valve pressure values

Inlet pressure	14 bar (203 psi)
Outlet pressure	1.8 bar (26 psi)
Leak test with detector pressure	1 - 2 bar (14.5 - 29 psi)

A/C system warnings and cautions

WARNING!

- ♦ *Always wear hand and eye protection (gloves and goggles) when working around the A/C system. If refrigerant does come in contact with your skin or eyes: do not rub skin or eyes; immediately flush skin or eyes with cool water for 15 minutes; rush to a doctor or hospital; do not attempt to treat yourself.*
- ♦ *Work in a well ventilated area. Switch on exhaust/ventilation systems when working on the refrigerant system.*
- ♦ *Do not expose any component of the A/C system to high temperatures (above 80C/176F) or open flames. Excessive heat causes a pressure increase which could burst the system.*
- ♦ *Keep refrigerant away from open flames. Poisonous gas is produced if it burns. Do not smoke near refrigerant gases for the same reason.*

- ♦ *The A/C system is filled with refrigerant gas which is under pressure. Pressurized refrigerant in the presence of oxygen may form a combustible mixture. Never introduce compressed air into any refrigerant container (full or empty).*
- ♦ *Electric welding near refrigerant hoses causes R-134a to decompose. Discharge system before welding.*

CAUTION!

- ♦ *As of January 1, 1992, any person who services a motor vehicle air conditioner must, by law, be properly trained and certified, and use approved refrigerant recycling equipment. Technicians must complete an EPA-approved recycling course to be certified.*
- ♦ *It is recommended that all A/C service be left to an authorized BMW dealer or other qualified A/C service facility.*
- ♦ *State and local governments may have additional requirements regarding air conditioning servicing. Always comply with state and local laws.*
- ♦ *Do not top off a partially charged refrigerant system. Discharge system, evacuate and then recharge system.*
- ♦ *Do not use R-12 refrigerant, refrigerant oils or system*

***components in R-134a system.
Component damage and system
contamination results.***

- ♦ ***The mixture of refrigerant oil (PAG oil) and refrigerant R-134a attacks some metals and alloys (for example, copper) and breaks down certain hose materials. Use only hoses and lines that are identified with a green mark (stripe) or the lettering "R-134a".***
- ♦ ***Immediately plug open connections on A/C components and lines to prevent dirt and moisture contamination.***
- ♦ ***Do not steam clean A/C condensers or evaporators. Use only cold water or compressed air.***

Vents and Ducts

The IHKA air distribution system includes 5 air distribution motors (stepper motors), right and left footwell ducts, dashboard mounted defroster vents, and three sets of face level vents.

Removal of at least one of the stepper motors (right footwell vent) involves removal of the passenger side airbag in the dashboard.

WARNING!

Airbags are inflated by an explosive device. Handled improperly or without adequate safeguards, the system can be very dangerous. Special precautions must be observed prior to any work at or near the airbags. See ⇒ [721 Airbag System \(SRS\)](#).

CAUTION!

When working on interior trim removal, work with plastic prying tools or wrap the tips of screwdrivers and pliers with tape.

Air distribution motors

The five air distribution motors are installed under the dashboard. They are made accessible by removing either the glove compartment and right footwell trim panel or the left footwell (pedal cluster) trim panel as described below.



Each motor can be removed after its electrical wiring harness connector has been removed.





- ◆ Squeeze plastic clip (**arrow**) to release motor.
- ◆ Tilt motor out of housing.
- During installation, be sure to align air distribution flap and motor drive (**A**).

Right side air distribution motors, accessing

Four of the air distribution motors are under the right side of the dashboard:

- ◆ Right side fresh air/recirculation
- ◆ Defroster
- ◆ Ventilation flaps
- ◆ Right footwell vent
- Remove glove compartment and right footwell trim panel for access. See ⇒ [513 Interior Trim](#).

CAUTION!

Disassemble interior trim carefully to avoid damage.

- Disconnect negative (-) battery cable in trunk.

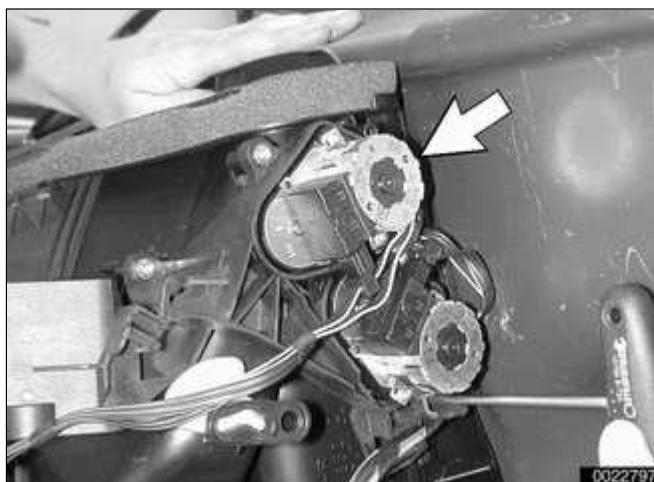
CAUTION!

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

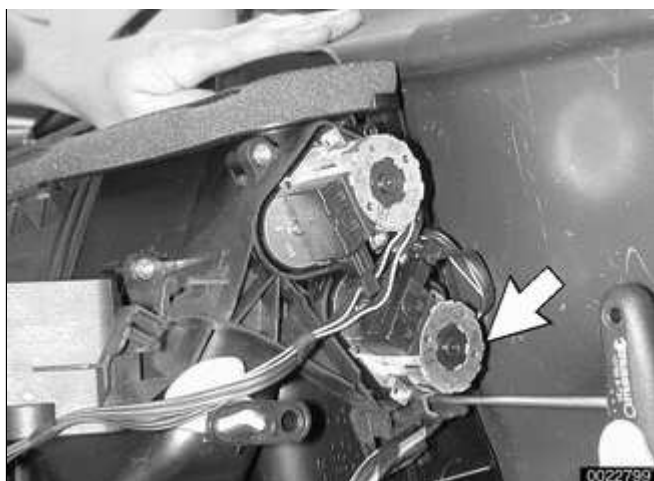


➤ Right side fresh air/recirculation motor (**arrow**):

- ◆ For access, remove right footwell duct as described below.
- ◆ Unhook linkage, then remove motor.

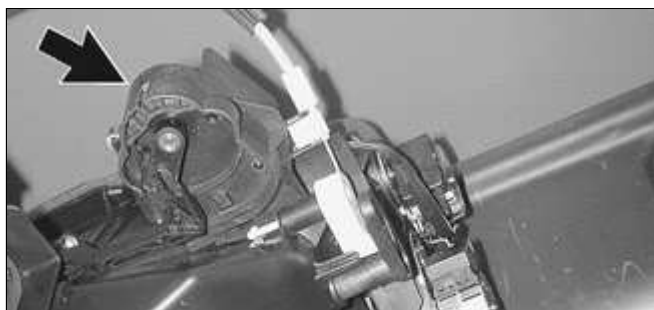


➤ Defroster air distribution motor (**arrow**)



➤ Ventilation distribution motor (**arrow**)

- ◆ For access, remove defroster air distribution motor.



➤ Right footwell vent air distribution motor (**arrow**):

- ◆ For access, remove passenger side airbag as described in ⇒ [721 Airbag System \(SRS\)](#).



- ◆ Unhook linkage, then remove motor.

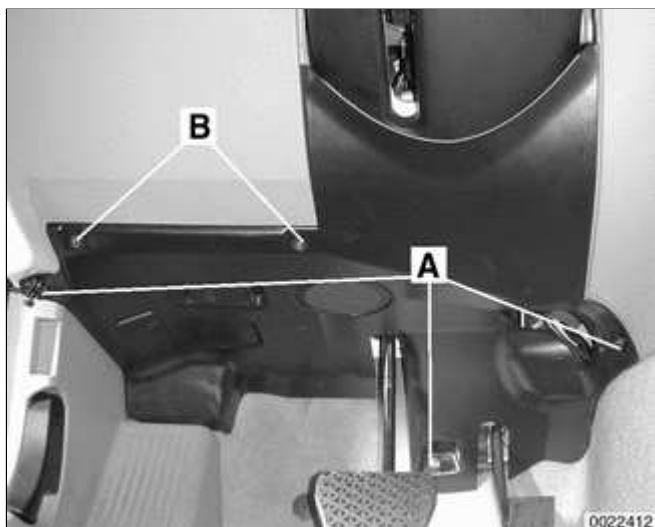
Left side air distribution motor, accessing

The fresh air distribution motor is under the left side of the dashboard. Remove the left footwell (pedal cluster) trim panel for access.

CAUTION!

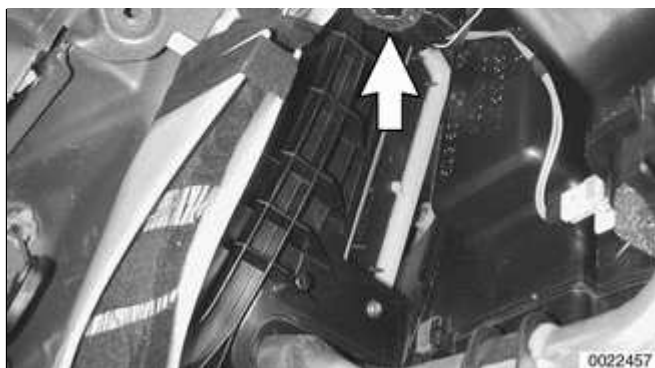
Disassemble interior trim carefully to avoid damage.

- Move steering column to maximum extended position.



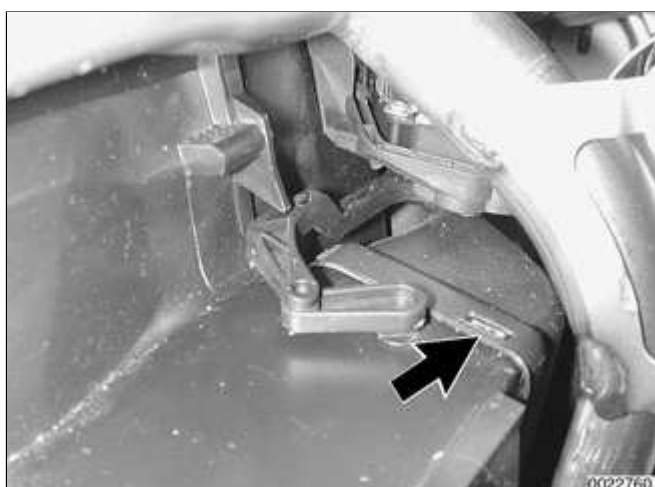
- ✦ Working at trim panel, remove fasteners.
 - ◆ Note locking clips (**A**) which must be rotated 90° to remove.
 - ◆ Remove mounting screws (**B**).
 - ◆ Unhook retaining clip from steering column lower trim.
 - ◆ Detach electrical harness connectors from footwell light and speaker (if equipped).
 - ◆ Release OBD II socket from panel and pull out.
- ✦ Reach up above accelerator pedal to gain access to fresh air distribution motor (**arrow**).





Right footwell duct, removing and installing

- Remove glove compartment as described in ⇒ [513 Interior Trim](#).
- Remove IHKA control panel or GPS On-Board Monitor, as applicable (described below).



- Reach through control panel opening to detach air duct locking clip (**arrow**) from heater/evaporator housing.
- Separate bottom of air duct from rear compartment duct.
- Pull forward and down to remove.
- Installation is reverse of removal.

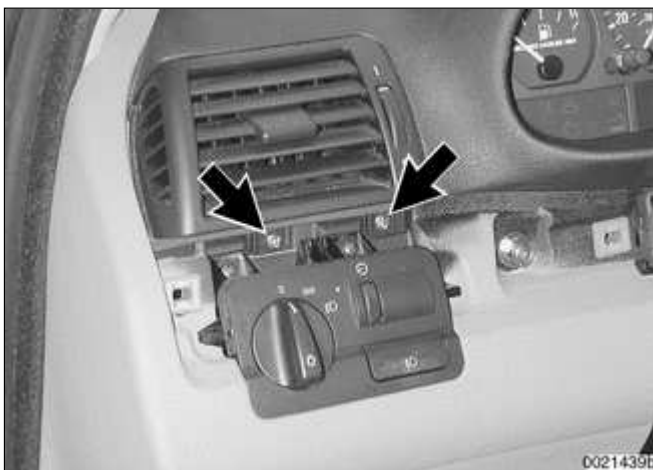
Dashboard vent, removing and installing



- Pry gently at dashboard trim to remove.

CAUTION!

To avoid marring interior trim, work with a plastic prying tool.



✦ Remove air vent mounting screws (**arrows**).

- Lift vent slightly and withdraw from dashboard.
- Installation is reverse of removal.

Note:

- ◆ *Removal of right or center dashboard vent is similar.*
- ◆ *To fully remove the center dashboard vent, use pliers to detach control cable housing and remove from control lever.*
- ◆ *Remove trim on right side prior to removing center trim.*

Heating and A/C Controls

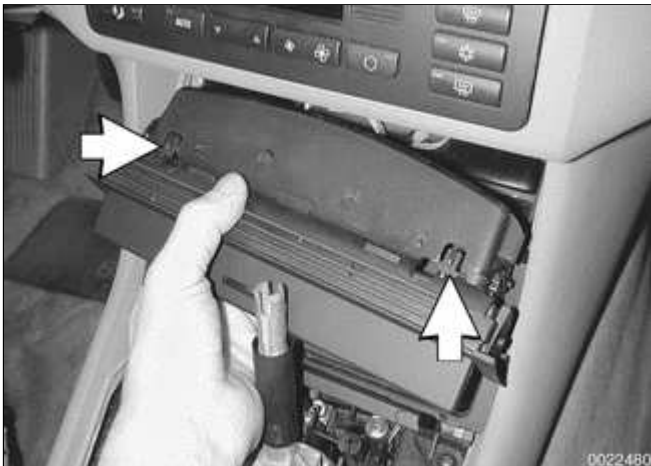
The IHKA control module is integrated with the control panel in the center console below the radio. There is a built-in interior temperature sensor and fan.

Models with GPS navigation are equipped with a center console-mounted On-Board Monitor. This combines sound system control functions, GPS monitoring and heating/A/C control functions.

IHKA control panel, removing

If BMW special tools 64 1 010 are available, slide them between IHKA control panel front bezel and dashboard, then pull panel out. Otherwise, use the following procedure.

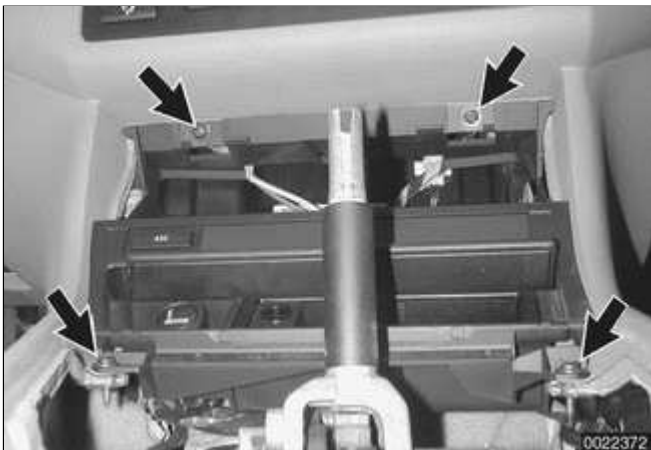
- Remove utility compartment below IHKA control panel:
 - ◆ Open compartment door.
 - ◆ Push upward in center of compartment to release locking tabs (**arrows**).
 - ◆ Pull out compartment.
- Shifter bezel: Lift up by prying gently.
- Shifter boot: Unclip bottom of boot from shifter trim (window switch carrier) by pushing forward. Pull boot up around shifter, but do not



remove.



- ✦ Remove screws (**arrows**) at rear of shifter trim (window switch carrier). Lift trim at back to unhook from front.



- ✦ Remove screws (**arrows**) at front and rear of ashtray carrier. Lift up ashtray carrier.

- Reach up through opening and push IHKA control module and panel out.
- Detach electrical harness connectors.
- Disassemble panel from module using an anti-static mat as a working surface.

CAUTION!

Do not touch circuit boards with bare fingers.

- Installation is reverse of removal.

On-Board Monitor, removing

- Remove dashboard center vent as described earlier.

- Pull off menu button on face of monitor. Reach through apertures with screwdriver to twist catches. This releases monitor from console.
- Pull out monitor and detach electrical harness connectors in back.

Heater core temperature sensor, removing and installing

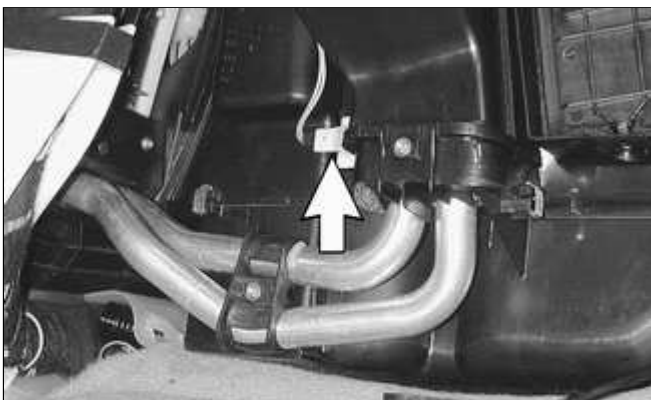
- Remove IHKA control panel or On-Board Monitor as described earlier.



- Reach through dashboard opening and detach heater core temperature sensor electrical harness connector (**arrow**).
- Pull sensor out of IHKA housing.
- Installation is reverse of removal.

Evaporator temperature sensor

- To gain access to evaporator temperature sensor (**arrow**):
 - ◆ Remove left footwell trim panel (above pedals). See ⇒ [513 Interior Trim](#).
 - ◆ Sensor is installed in left side of IHKA housing above coolant

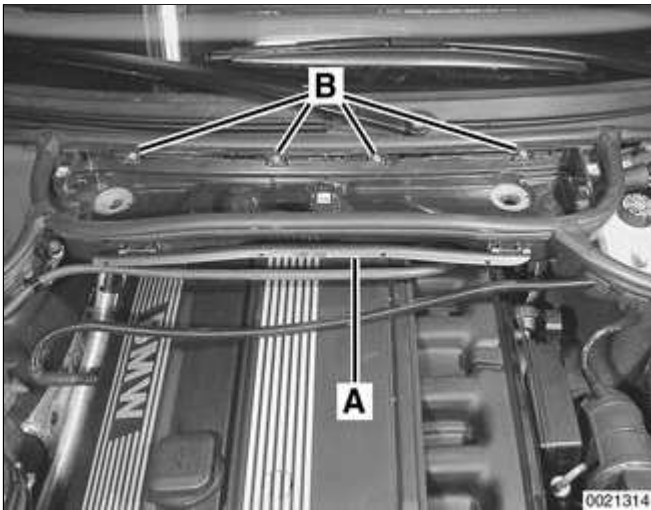




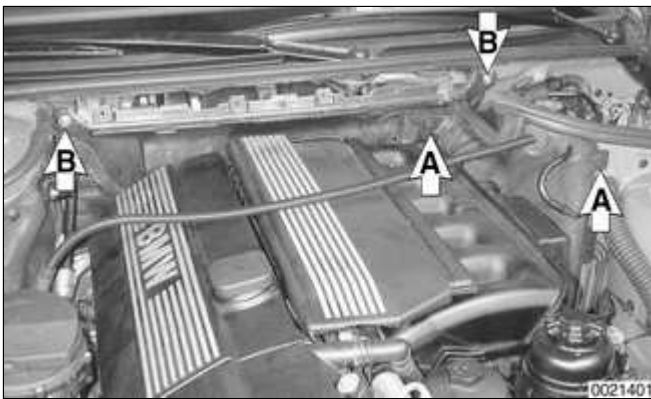
pipes.

Blower Components

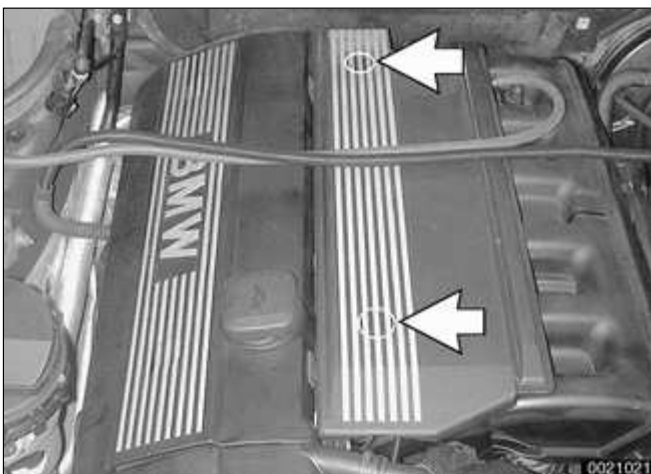
Blower motor, removing and installing



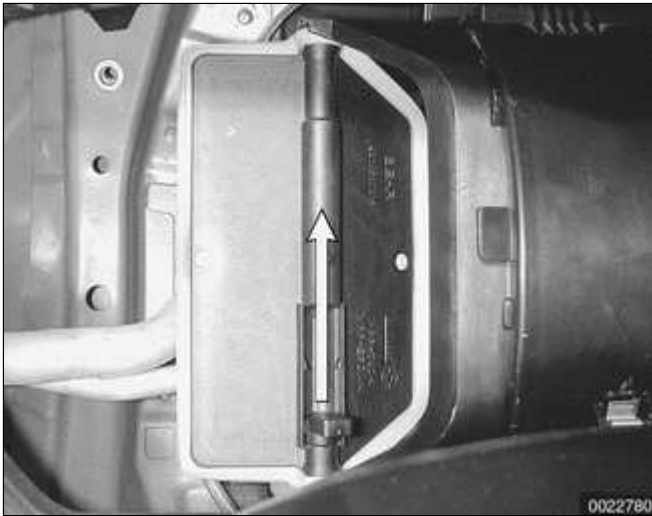
- ✦ Remove housing for interior ventilation microfilter.
 - ◆ Remove upper cover and microfilter.
 - ◆ Open wiring harness loom (A) and remove wires.
 - ◆ Unfasten screws (B) and remove lower housing.



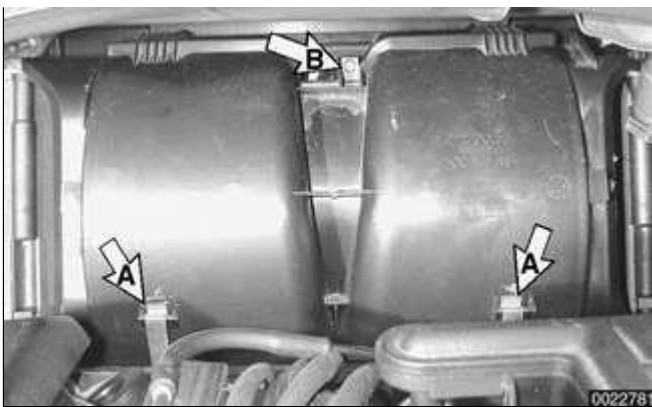
- ✦ Remove heater bulkhead cover:
 - ◆ Remove engine compartment side trim panel. Turn locking clips (A) and slide trim panel up.
 - ◆ Remove heater bulkhead cover mounting screws (B) and lift cover off bulkhead.



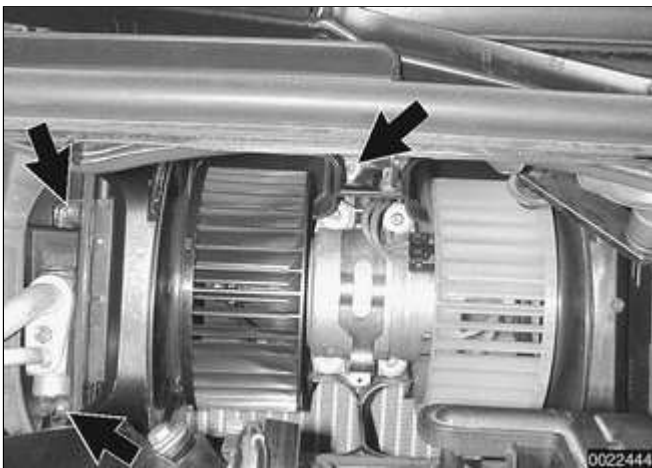
- ✦ Remove intake manifold cover:
 - ◆ Remove plastic trim covers (arrows).
 - ◆ Remove cover hold down bolts and lift off cover.



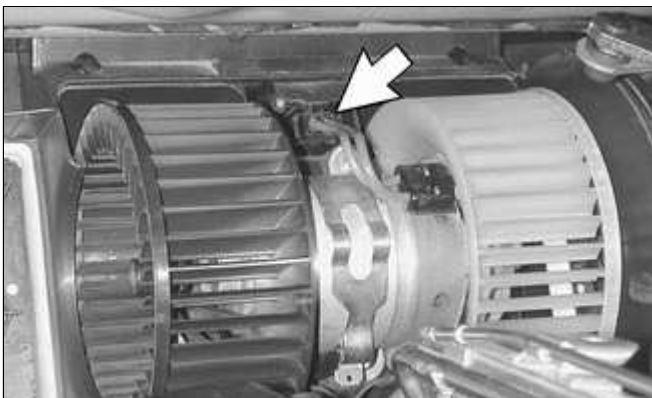
- Working inside right side of cowl, pull up on lever (**arrow**) and detach right air intake flap from blower housing.



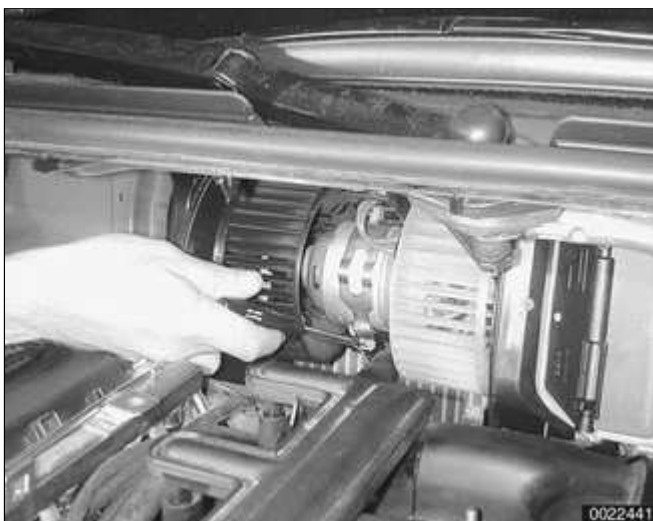
- Pry off blower cover retaining clips (**A**). Remove screw (**B**) and lift off outer blower housing cover.



- Remove blower cover retaining screws (**arrows**). Lift off cover.



- Detach electrical harness connector (**arrow**).



- ✦ Pry off blower motor retaining strap.
 - Pull blower motor forward to remove.
 - Installation is reverse of removal:
 - ◆ Align slot in blower motor with mounting tab in blower motor housing.

Blower motor resistor pack, replacing

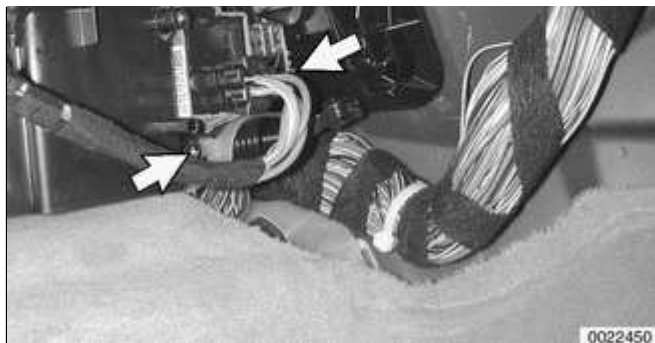
Note:

The blower motor resistor pack is also referred to as the final stage unit.

- Remove right footwell air duct as described earlier.



- ✦ Working under right side of dashboard at side of IHKA housing, unhook linkage, then remove air distribution motor (**arrow**).
- ✦ To remove blower resistor pack from IHKA housing:
 - ◆ Remove mounting screws



(arrows).

- ◆ Detach electrical harness connector.
- ◆ Press retaining clip away from switch to release switch.
- Installation is reverse of removal.
- ◆ Make sure electrical harness is routed as before.
- ◆ Align guides and clips correctly.

Heater Components

The heater valve is located in the left side of the engine compartment, attached to the left strut tower. The solenoid operated valve controls coolant flow through the heater core.

The IHKA housing, located underneath the center of the dashboard, houses the heater core, the A/C evaporator, the heating and A/C blower and associated sensors and air distribution motors.

CAUTION!

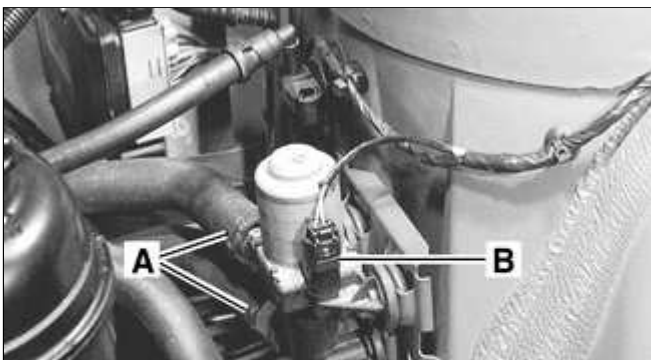
Removal of either the heater core or the IHKA housing involves dashboard removal. Before starting work, disconnect the battery negative (-) cable in the trunk. Be sure to read the battery disconnection cautions on page viii and the airbag warnings in ⇒ [721 Airbag System \(SRS\)](#).

Heater valve, replacing

- Drain engine coolant. See ⇒ [170 Radiator and Cooling System](#).

WARNING!

Allow the cooling system to cool before opening or draining the cooling system.



- ✦ Disconnect hoses (A) and electrical harness connector (B) at heater valve on left inner fender.

- Carefully pull heater valve out of rubber mounting and pull up and out of engine compartment.

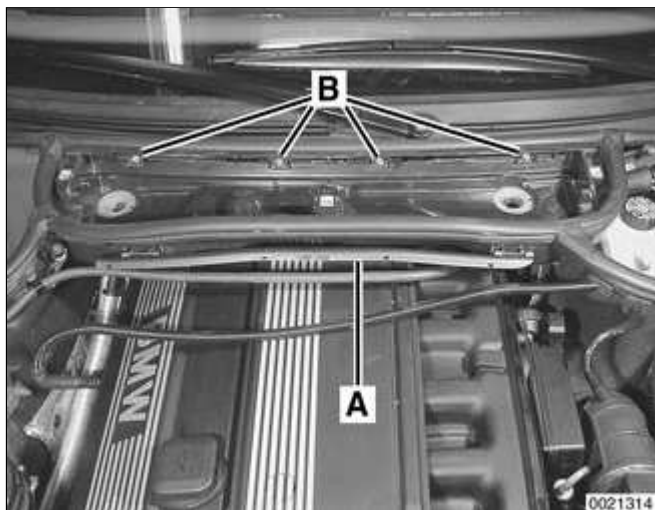


- Installation is reverse of removal.
- ◆ Inspect hoses and rubber mounts. Replace as necessary.
- ◆ Use new hose clamps.

Tightening torque

Coolant hose clamp 32 - 48 mm (2 1/4 - 4 in.)	2.5 Nm (22 in-lb)
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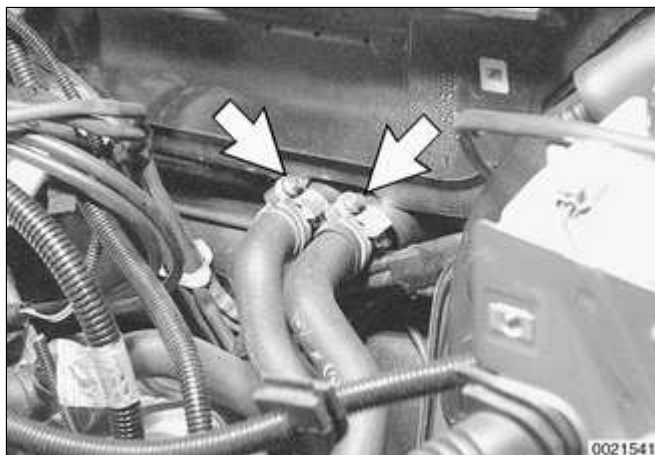
Heater core, replacing



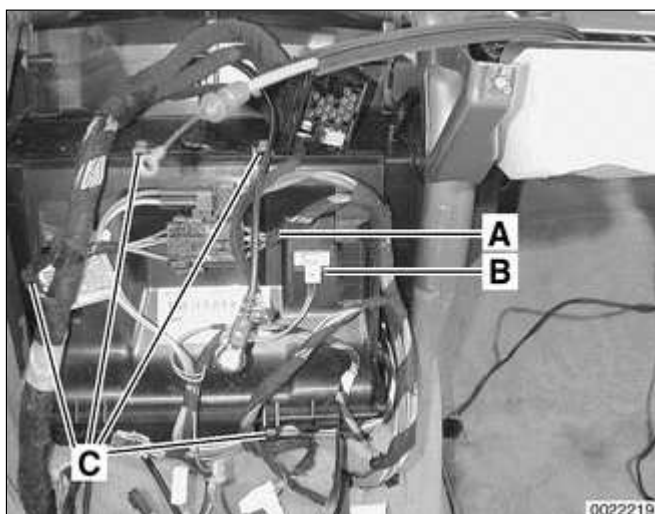
- Remove housing for interior ventilation microfilter.
 - ◆ Remove upper cover and microfilter.
 - ◆ Open wiring harness loom (A) and remove wires.
 - ◆ Unfasten screws (B) and remove lower housing.
- Remove center console and dashboard. See ⇒ [513 Interior Trim](#).
- Drain engine coolant. See ⇒ [170 Radiator and Cooling System](#).

WARNING!

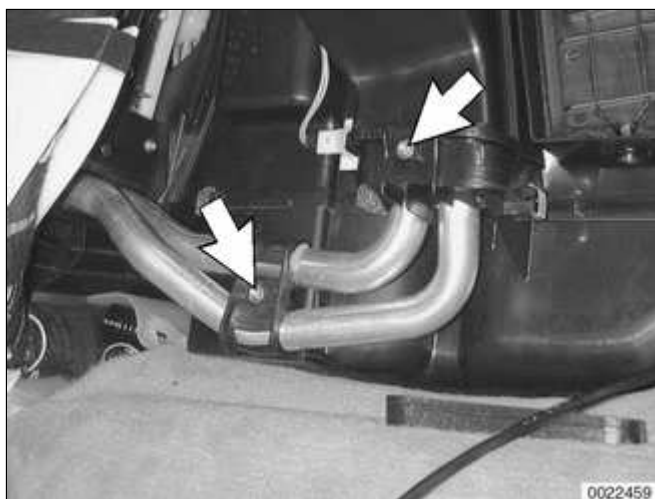
Allow the cooling system to cool before opening or draining the cooling system.



- ✦ Working at rear engine compartment bulkhead, loosen hose clamps (**arrows**) and detach heater hoses.
 - Blow out excess coolant from heater core using compressed air at coolant lines.
 - Release right air duct from IHKA housing.



- ✦ Working inside passenger compartment at IHKA housing:
 - ◆ Detach wiring harness (**A**) from housing.
 - ◆ Remove heater core temperature sensor (**B**) by pulling straight out.
 - ◆ Remove retaining clips (**C**) from housing cover.
 - ◆ Lift off front of cover, then unhook tabs from housing at rear.



- ✦ Remove coolant pipe retaining clamps mounting screws (**arrows**).



- ✦ To remove heater core from IHKA housing:
 - ◆ Remove coolant pipe retainers



(**arrows**) to detach pipes.

- ◆ Tilt heater core to remove from housing.
- Installation is reverse of removal.
- ◆ Fit lugs in back of housing cover in heater housing slots.
- ◆ Use new sealing O-rings and coat with anti-seize agent.
- ◆ Fill and bleed cooling system.
See ⇒ [170 Radiator and Cooling System](#).

CAUTION!

Replace coolant flange O-rings and tighten fasteners to specified torques.

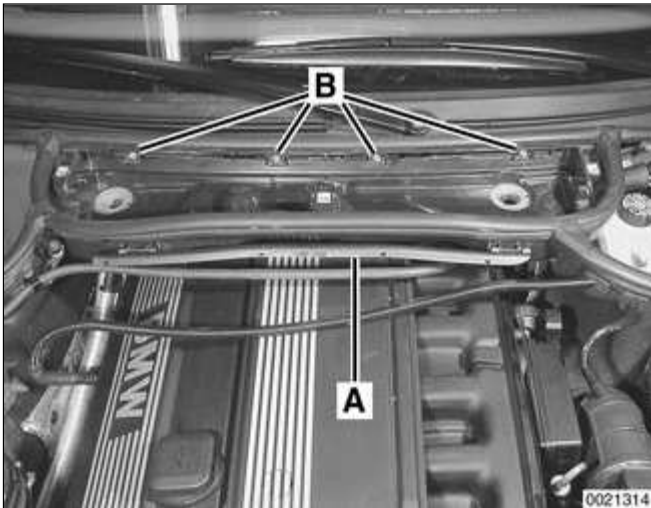
Tightening torque	
Coolant hose clamp 32 - 48 mm (2 1/4- 4 in.)	2.5 Nm (22 in-lb)

IHKA housing, removing and installing

CAUTION!

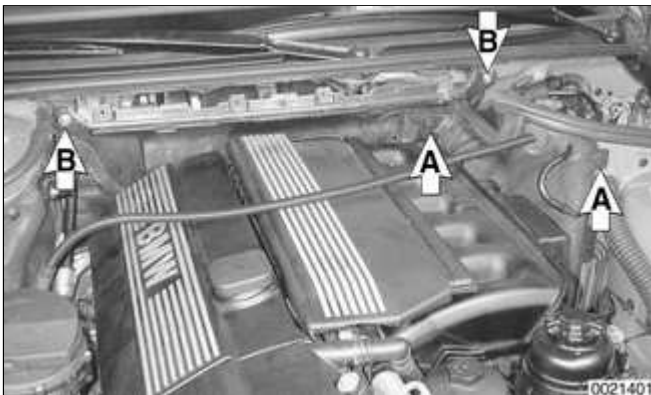
- ◆ ***Removing the IHKA housing requires evacuating the A/C system. DO NOT attempt this procedure without proper tools and training.***
- ◆ ***Any person who services a***

motor vehicle air conditioner must, by law, be properly trained and certified, and use approved refrigerant recycling equipment. Technicians must complete an EPA-approved recycling course to be certified



➤ Remove housing for interior ventilation microfilter.

- ◆ Remove upper cover and microfilter.
- ◆ Open wiring harness loom (A) and remove wires.
- ◆ Unfasten screws (B) and remove lower housing.



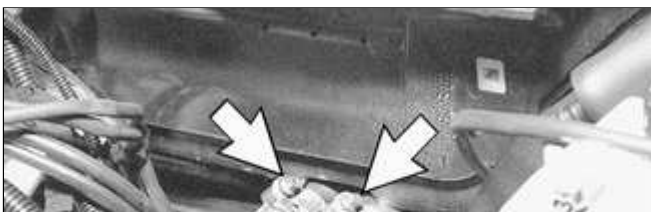
➤ Remove heater bulkhead cover:

- ◆ Remove engine compartment side trim panel. Turn locking clips (A) and slide trim panel up.
- ◆ Remove heater bulkhead cover mounting screws (B) and lift cover off bulkhead.

- Drain engine coolant. See ⇒ [170 Radiator and Cooling System](#).

WARNING!

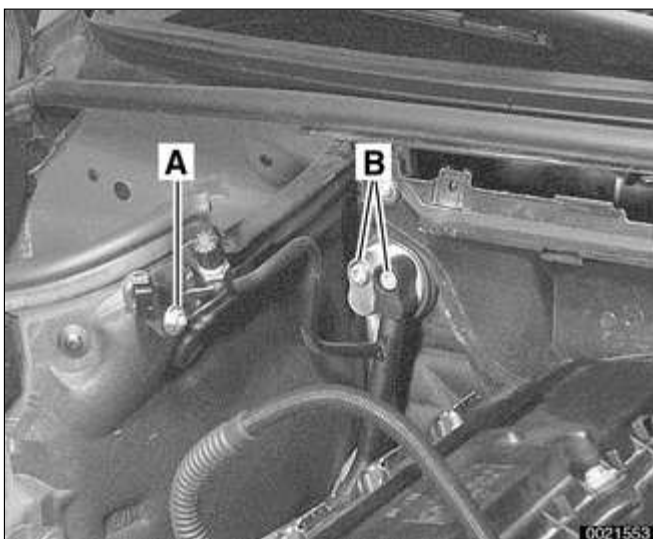
Allow the cooling system to cool before opening or draining the cooling system.



➤ Working at rear engine compartment bulkhead, loosen hose clamps (arrows) and detach heater hoses.

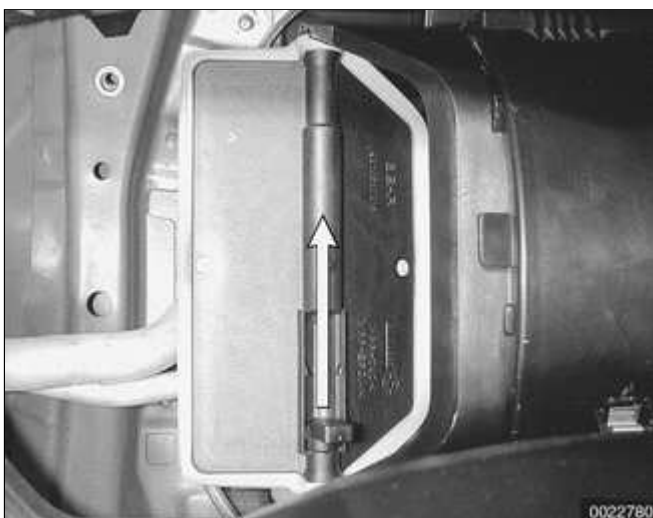


- Blow out excess coolant from heater core using compressed air at coolant lines.
- Following manufacturer's instructions, connect approved refrigerant recovery/recycling/recharging unit to A/C system and discharge system.



Working in right rear of engine compartment, detach A/C lines:

- ◆ Remove A/C recharging port bracket mounting nut (A).
- ◆ Remove allen bolts (B) at bulkhead.
- ◆ Using BMW special tool 64 5 102 or equivalent, detach and plug A/C lines.



Working inside right side of cowl, pull up on lever (**arrow**) and detach right air intake flap from blower housing.

- Working in right front of IHKA housing, detach double pipe (A/C line) from expansion valve.
- ◆ Lay double pipe aside.
- ◆ Plug up open A/C ports.



Remove IHKA housing mounting nuts (**arrows**) at bulkhead.

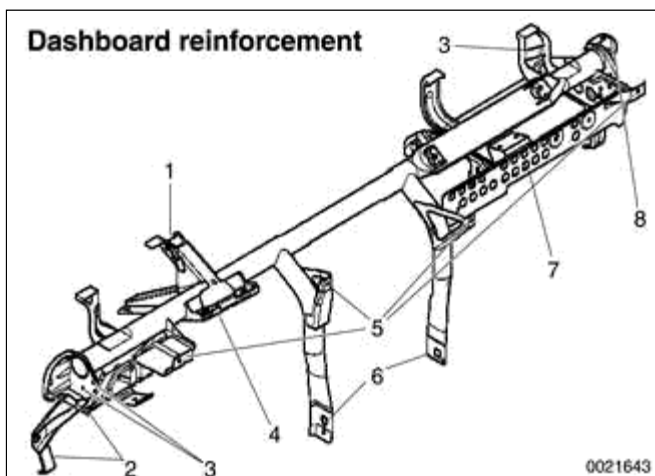
- Remove center console and dashboard. See ⇒ [513 Interior Trim](#).



- Working inside passenger compartment below steering column, drill out steering column shear bolt. See ⇒ [320 Steering and Wheel Alignment](#).

◆ Remove steering column mounting bolts.

◆ Lower column.

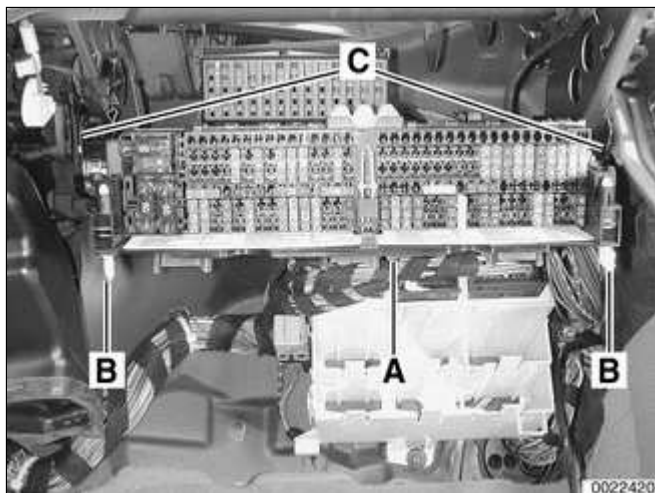


✦ Under dash attachments

- 1 - Bulkhead
- 2 - Left A-pillar
- 3 - Head protection airbag
- 4 - Steering column
- 5 - Dashboard mounts
- 6 - Center tunnel
- 7 - Relay panel
- 8 - Right A-pillar

Remove dashboard reinforcement fasteners:

- ◆ Detach bulkhead brace (1).
- ◆ Detach left and right A-pillar braces (2 and 8).
- ◆ Detach head protection airbag (3).
- ◆ Remove center tunnel mounting bolts (6).
- Detach heater housing electrical harness connectors.



✈ Working at right side of dash:

- ◆ Cut wire tie (**A**) at dashboard reinforcement support for relay panel.
- ◆ Turn fuse panel lock tabs (**B**) 90° and swing fuse panel down.
- ◆ Detach fuse panel pivots (**C**) from dashboard reinforcement.

- Lift off dashboard reinforcement, making sure all electrical harnesses and hoses are free.
- Remove IHKA housing, making sure all electrical harnesses and hoses are free.
- Installation is reverse of removal. Note the following:

- ◆ Make sure A/C condensate drain is routed correctly.
- ◆ Replace wire ties, sealing O-rings and hose clamps.
- ◆ Use new shear bolt at steering column mounting. Tighten bolt until head shears off.
- ◆ Evacuate and recharge A/C system using specialized equipment.
- ◆ Fill and bleed cooling system. See ⇒ [170 Radiator and Cooling System](#).

CAUTION!

***Replace heater and A/C flange
O-rings and tighten fasteners to
specified torques.***

Tightening torques	
Coolant hose clamp 32 - 48 mm (2 1/4 - 4 in.)	2.5 Nm (22 in-lb)
Steering column to dashboard reinforcement	22 Nm (16 ft-lb)

Air Conditioning Components

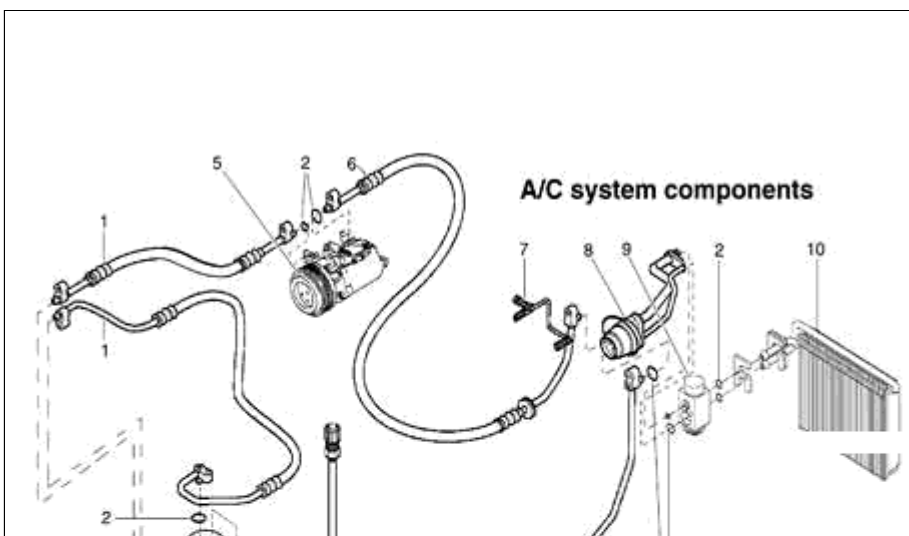
This section covers removal and installation of air conditioning refrigerant components. A/C testing and diagnosis, refrigerant discharge, evacuation and recharge are not covered here.

The A/C condenser, compressor, receiver dryer, pressure sensor, refrigerant lines and expansion valve are either installed in the engine compartment or accessible from the engine compartment.

The A/C evaporator is located in the IHKA housing. Removal of the IHKA housing involves dashboard removal. Before starting work, disconnect the battery negative (-) cable in the trunk. Be sure to read the battery disconnection cautions on page viii and the airbag warnings in ⇒ [721 Airbag System \(SRS\)](#).

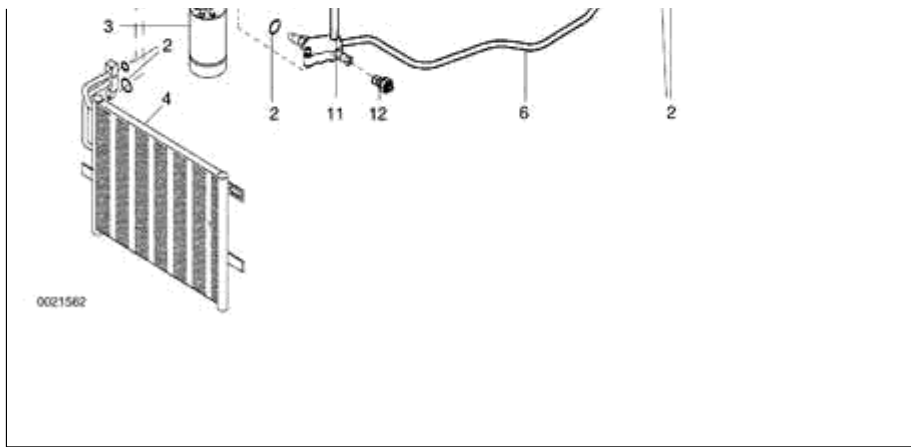
Note:

The air conditioning system is filled with R-134a refrigerant.



A/C system components

- 1 - High pressure line
- 2 - Sealing O-ring (always replace)
- 3 - Receiver-dryer
- 4 - Condenser



- 5 - Compressor
- 6 - Low pressure line
- 7 - Access port
- 8 - Double pipe
- 9 - Expansion valve
- 10 - Evaporator
- 11 - Access port
- 12 - Pressure sensor

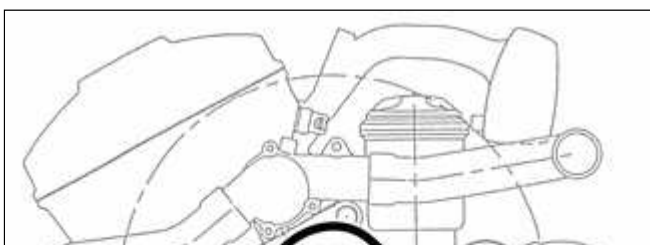
A/C compressor, replacing

- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling/recharging unit to A/C system and discharge system.

WARNING!

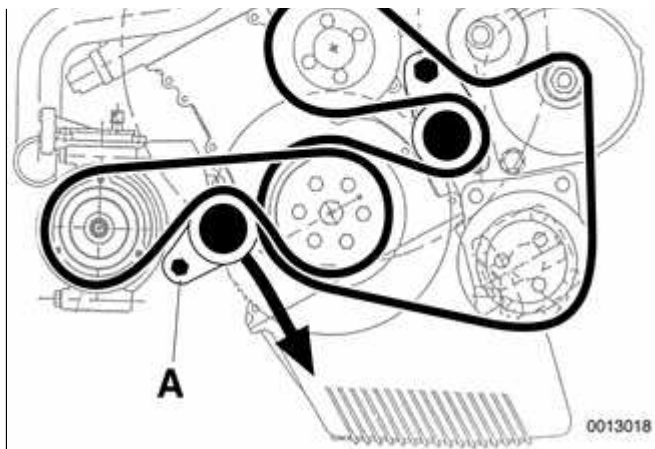
Do not discharge/charge the A/C system without proper equipment and training. Damage to the vehicle and personal injury may result.

- Remove splash shield from under engine.
- Mark A/C drive belt with direction of rotation.



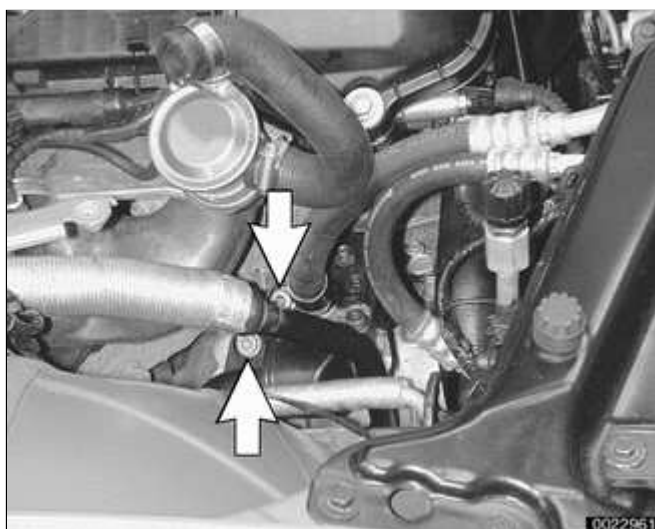
Release tension on A/C belt:

- ◆ Use long-handled wrench to turn tensioner pulley release lug (A) clockwise (against spring tension).



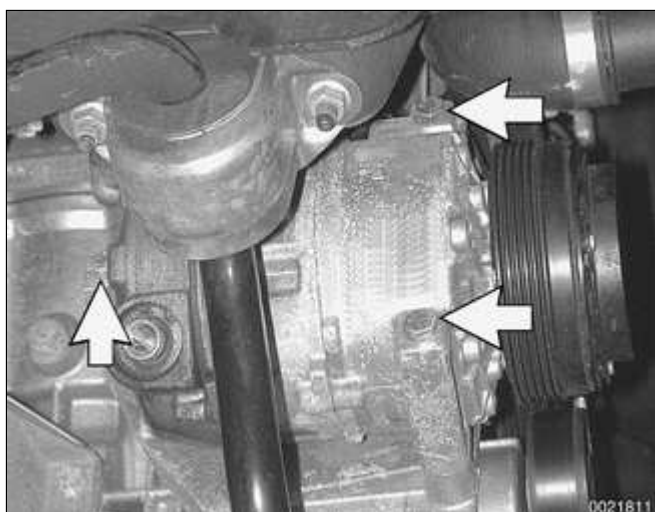
◆ Remove drive belt.

- Detach and set aside front washer fluid reservoir. See ⇒ [611 Wipers and Washers](#).
- Disconnect electrical harness connector from compressor.



◀ Remove A/C pressure hose and suction hose flange bolts (**arrows**) from compressor. Plug hoses immediately.

- All-wheel-drive model: Unbolt and lower front stabilizer bar. See ⇒ [310 Front Suspension](#).



◀ Support compressor while removing compressor mounting bolts (**arrows**). Remove compressor.

- Installation is reverse of removal.

CAUTION!

- ◆ **Always replace O-rings when reconnecting refrigerant lines.**
- ◆ **When installing a new compressor always replace receiver/drier unit.**

Tightening torque

A/C line to A/C compressor	20 Nm (15 ft-lb)
----------------------------	------------------

- Recharge system following equipment manufacturer's instructions. See ⇒ [Table e](#) for A/C system fluid specifications.

Table e. A/C system fluid specifications

Fluid	Quantity
R-134a refrigerant	740 ± 25 g (2 lb ± 1 oz.)
Refrigerant oil	PAG oil

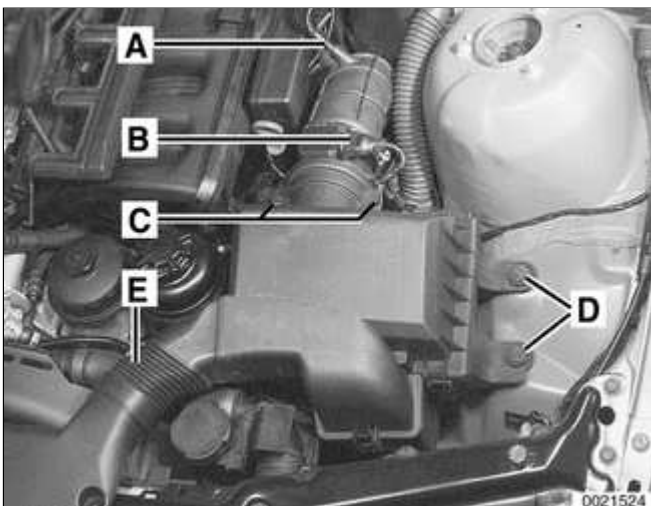
A/C condenser, replacing

The A/C condenser is located in front of the radiator.

- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling /recharging unit to A/C system and discharge system.

WARNING!

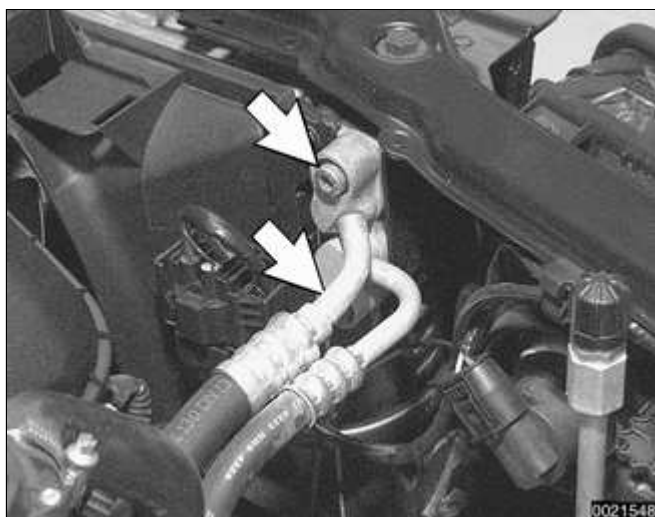
Do not discharge/charge the A/C system without proper equipment and training. Damage to the vehicle and personal injury may result.



Remove complete air filter housing:

- ◆ Detach vacuum line at intake boot (A).
- ◆ Disconnect electrical harness connector on mass air flow sensor (B).
- ◆ Release mass air flow sensor clips (C).

- ◆ Remove filter housing mounting screws (D).
- ◆ Detach air duct connections (E) and lift complete air filter housing out of engine compartment, pulling it forward away from mass air flow sensor.
- Remove intake hood, cooling fan and shroud, and radiator, as described in ⇒ [170 Radiator and Cooling System](#).



- ◀ Detach A/C lines from upper right corner of condenser. Plug lines immediately.
- Remove fastener (expansion rivet) from top left corner of condenser.
- Remove Torx screw from top right corner of condenser, just below refrigerant line flange.
- Lift up condenser to disengage from plastic bracket and remove from above.
- Installation is reverse of removal.

CAUTION!

- ◆ ***Always replace O-rings when reconnecting refrigerant lines.***
- ◆ ***When installing a new condenser always replace receiver/drier unit.***
- Recharge system following equipment manufacturer's instructions.

A/C system fluid specifications	
Fluid	Quantity
R-134a refrigerant	740 ± 25 g (2 lb ± 1 oz.)
Refrigerant oil	PAG oil

A/C receiver/drier, replacing

The receiver/drier is mounted in the front right corner of the engine compartment behind and below the headlight assembly.

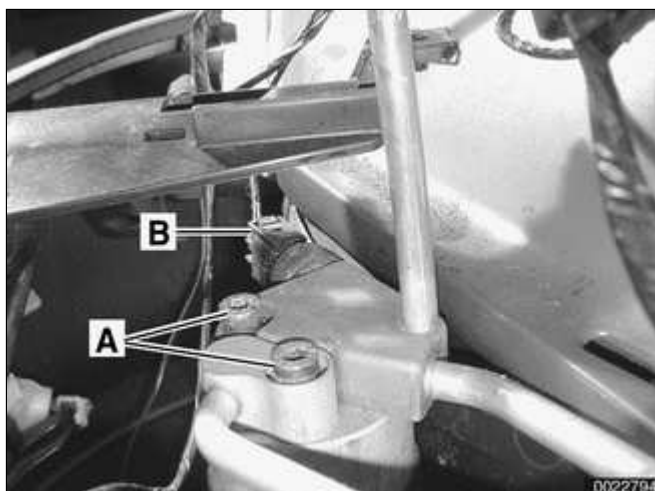
- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling/recharging unit to A/C system and discharge system.

CAUTION!

The receiver/drier must be replaced when

- ♦ ***There is dirt in the A/C system***
- ♦ ***The compressor has seized or has been replaced for any reason***
- ♦ ***The condenser or evaporator are replaced for any reason***
- ♦ ***The A/C system is leaking and there is no more refrigerant***
- ♦ ***The A/C system was open for 24 hours or more.***

- Remove right headlight assembly.
See ⇒ [630 Lights](#).



◀ Remove refrigerant pressure line mounting bolts (A) from receiver/drier.

- ◆ Plug lines immediately.
- ◆ Disconnect high pressure switch harness connector (B).
- Working beneath right front of car, remove splash shield retaining screws. Remove splash shield.
- Loosen receiver/drier mounting strap bolts and slide receiver/drier down and out.
- Installation is reverse of removal.

CAUTION!

Always replace O-rings when reconnecting refrigerant lines.

- Recharge system following equipment manufacturer's instructions.

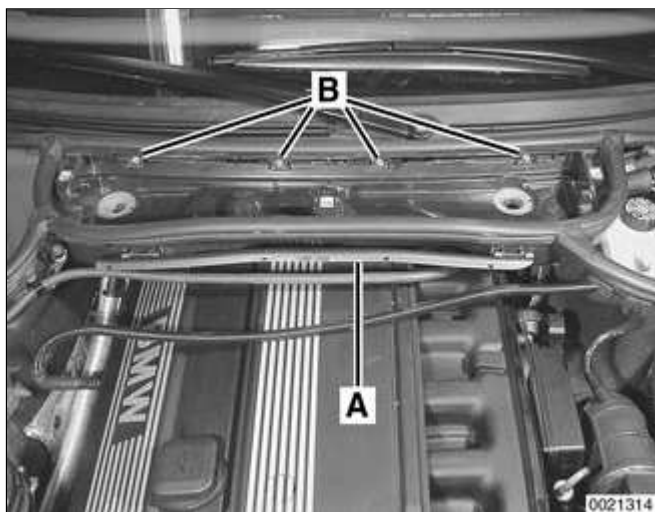
A/C system fluid specifications	
Fluid	Quantity
R-134a refrigerant	740 ± 25 g (2 lb ± 1 oz.)
Refrigerant oil	PAG oil

A/C expansion valve, removing and installing

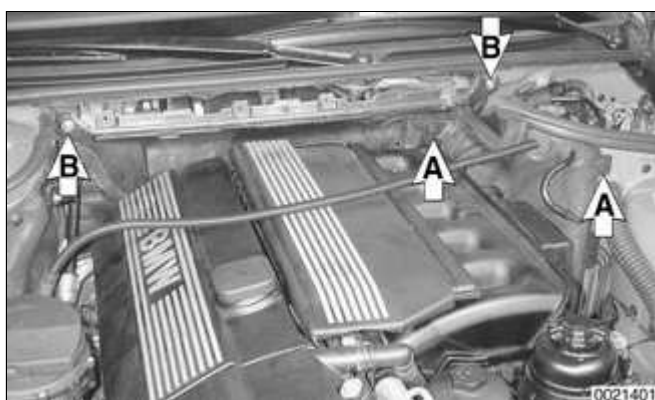
- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling /recharging unit to A/C system and discharge system.

WARNING!

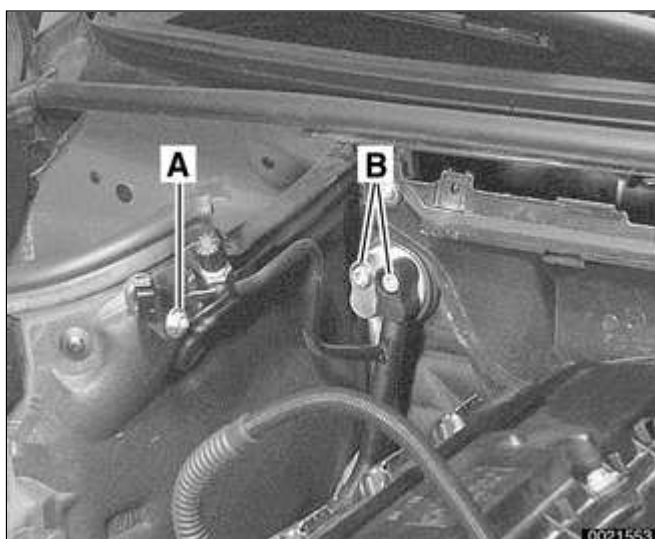
Do not discharge/charge the A/C system without proper equipment and training. Damage to the vehicle and personal injury may result.



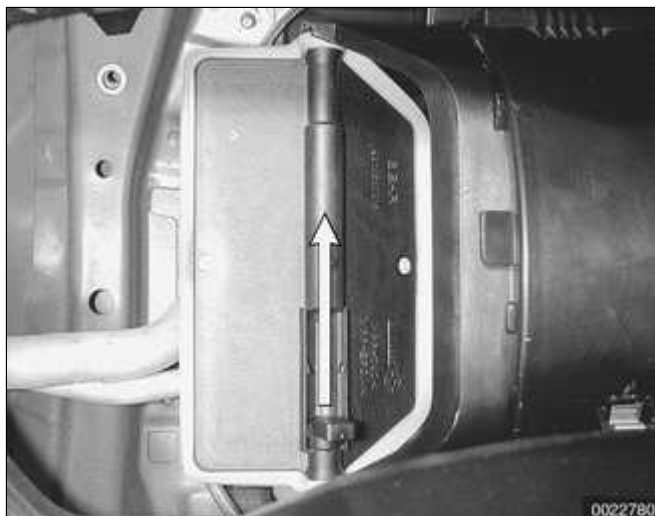
- ◀ Remove housing for interior ventilation microfilter.
 - ◆ Remove upper cover and microfilter.
 - ◆ Open wiring harness loom (A) and remove wires.
 - ◆ Unfasten screws (B) and remove lower housing.



- ◀ To remove heater bulkhead cover:
 - ◆ Remove engine compartment side trim panel. Turn locking clips (A) and slide trim panel up.
 - ◆ Remove heater bulkhead cover mounting screws (B) and lift cover off bulkhead.



- ◀ Working in right rear of engine compartment, detach A/C lines:
 - ◆ Remove A/C recharging port bracket mounting nut (A).
 - ◆ Remove allen bolts (B) at bulkhead. Release and plug open A/C lines.



◀ Working inside right side of cowl, pull up on lever (**arrow**) and detach right air intake flap from blower housing.

- Working in right front of IHKA housing, detach double pipe (A/C line) from expansion valve.
- ◆ Lay double pipe aside.
- ◆ Plug up open A/C ports.
- Remove expansion valve mounting bolts and remove valve.
- Installation is reverse of removal.

CAUTION!

Always replace O-rings when reconnecting refrigerant lines.

- Recharge system following equipment manufacturer's instructions.

A/C system fluid specifications	
Fluid	Quantity
R-134a refrigerant	740 ± 25 g (2 lb ± 1 oz.)
Refrigerant oil	PAG oil

A/C evaporator, removing and installing

- Following manufacturer's instructions, connect an approved refrigerant recovery/recycling /recharging unit to A/C system and discharge system.

- Drain engine coolant. See ⇒ [170 Radiator and Cooling System](#).
- Remove complete IHKA housing as described earlier.
- Remove heater core as described earlier.
- Working on left side of IHKA housing:
 - ◆ Detach evaporator temperature sensor electrical harness connector and pull out sensor.
 - ◆ Detach wiring harness from housing.
 - ◆ Detach linkage from fresh air distribution motor.
- Working on right side of IHKA housing:
 - ◆ Unclip and remove fresh air/recirculation motor.
 - ◆ Remove evaporator cover mounting screw and remove cover.
- Detach and remove microswitch at side of IHKA housing.
- Working in front of IHKA housing:
 - ◆ Remove blower housing mounting screws. Lift out blower housing.

- ◆ Remove double coolant pipe.
- Pry off evaporator housing retaining clips and remove cover. Pull evaporator and expansion valve out of bottom of housing.
- If installing new evaporator, switch over expansion valve. Use new sealing O-rings.

CAUTION!

Do not bend cooling fins on evaporator. If necessary, straighten with fin comb.

- Installation is reverse of removal.
- ◆ Make sure electrical harnesses are routed as before.
- ◆ Align guides and clips correctly.
- ◆ Recharge system following equipment manufacturer's instructions.

A/C system fluid specifications	
Fluid	Quantity
R-134a refrigerant	740 ± 25 g (2 lb ± 1 oz.)
Refrigerant oil	PAG oil