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E70 Climate Control Workbook

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Subject

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Climate Control Workbook

Model: E70

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

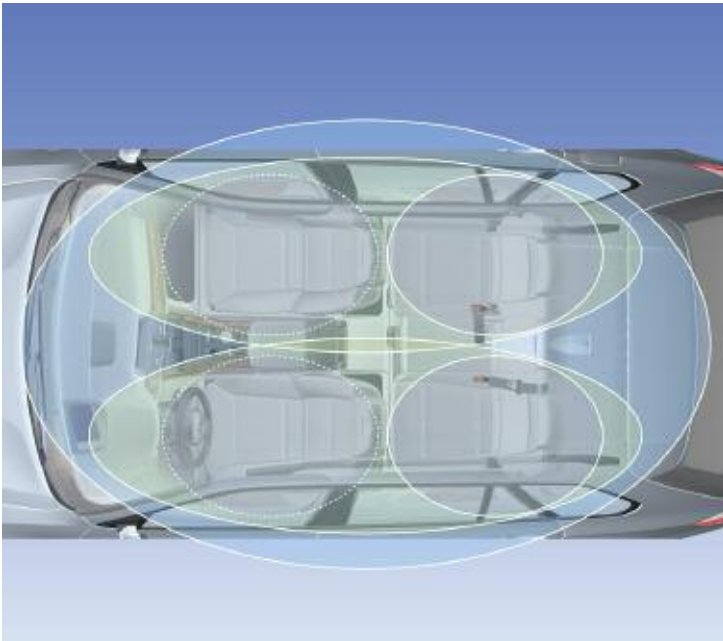
- Demonstrate the function and operation of IHKA and IHKA w/FKA systems.
- Identify and locate the different components in the IHKA and IHKA w FKA systems.

Climate Control System

The E70 X5 climate control system has been extensively enhanced and re designed compared with that of the E53 X5. The overall performance of the system was increased with respect to cooling and heating output. The E70's Climate Control system is designed as a water based temperature control and has Four Temperature Zone capability, depending on equipment variant.

There are three equipment options available for U.S. vehicles:

- IHKA, integrated automatic heating / air conditioning system (2-zone)
- IHKA with FKA rear automatic air conditioning system (4-zone)
- Optional 3rd row heating and ventilation system on the 5+2 seat package



IHKA allows the temperature and the air flaps at the left and right sides of the vehicle to be controlled separately for the driver and the front passenger. The vehicle interior is controlled in two zones (2-zone) in accordance with these individual settings.

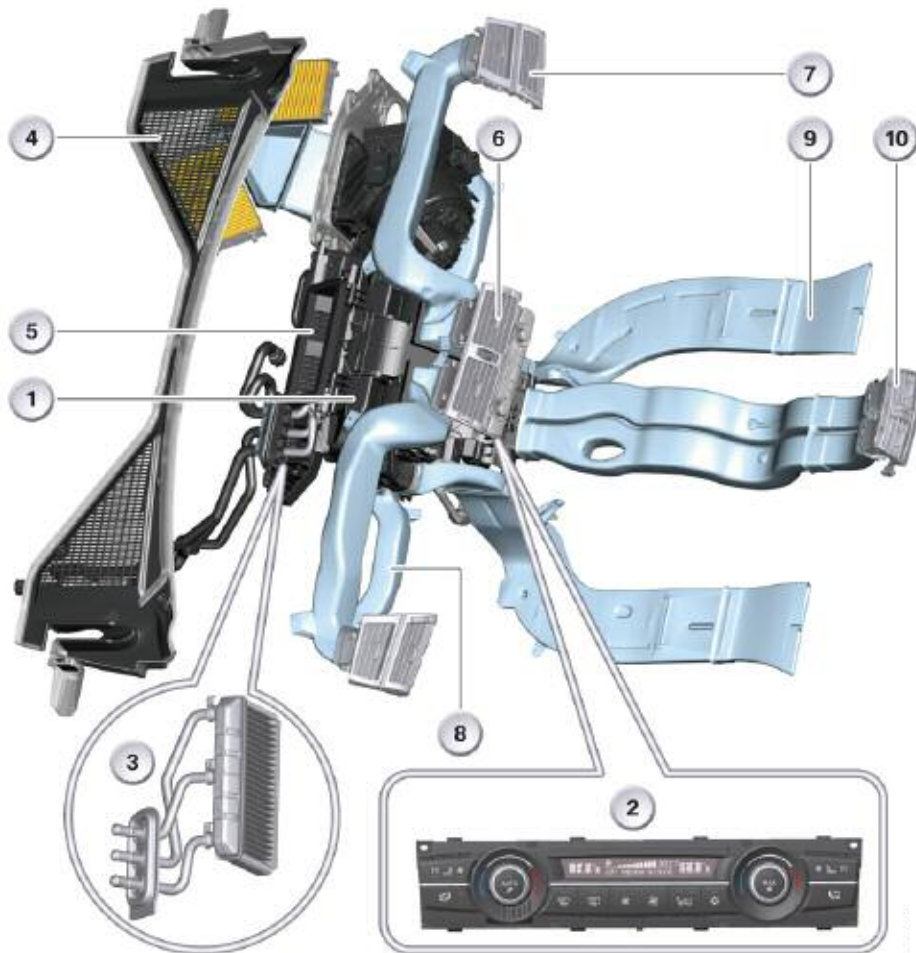
FKA is the rear automatic air conditioning system and has its own operating and control module in the rear. This control module is used to operate individual heating/air conditioning adjusting facilities for the rear passengers.

The optionally available FKA gives the rear passengers the opportunity to make separate temperature settings for the left and right sides of the vehicle and control the blower in the rear. The vehicle interior is controlled in four zones (4- zone) in accordance with these four individual settings.

Stand-alone heating and ventilation system for the third row of seats is also available for the optional 5+2 seat package. Heating is realized with the use of a PTC electrical heater and ventilation through the use of a blower fan located inside the 3rd row heating and ventilation unit.

Note: In efforts to reduce CO2 emissions, all E70 vehicles will be fitted with A/C compressors with magnetic clutches. Vehicles with the N62 engine will initially be equipped with clutchless A/C compressors, but in later production will come with magnetic clutches.

IHKA



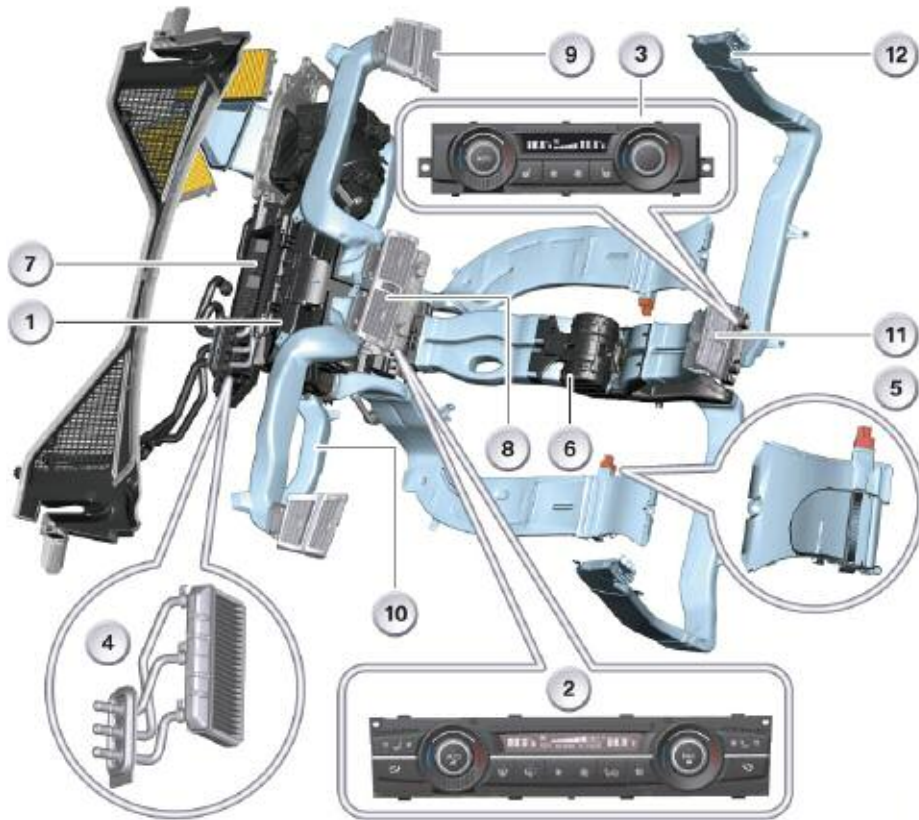
IHKA has ten actuator motors in total with four separate motors for air flap control.

Fresh air or recirculated air can be routed directly to the air ducts via the evaporator and appropriate bypass, without being routed through the system's heater core. The air flow (fresh air or recirculated air) is first routed via the evaporator in the heating/ air-conditioning housing, provided that the A/C compressor has been activated, cooled and then heated to the required temperature via the heating system.

Due to its dual section heater core, the IHKA allows separate and individual 2- zone, right/left temperature control. This is achieved in part, through the use of left and right temperature sensors. The desired temperature is fine tuned via two water control valves (left/right). The water flow through the heater core is aided with the use of an auxiliary water pump in the case of vehicles with the N62 engine (the N52 engine has an electric water pump thus no auxiliary pump is needed)

Index	Explanation	Index	Explanation
1	IHKA, 2-zone	6	Ventilation air outlet, front center, left/right
2	IHKA controls module, temperature setting for two zones	7	Ventilation air outlet, front left/right
3	Two inlet pipes to HWT, 5two water valves	8	Footwell air outlet, front left/right
4	Fresh air intake	9	Footwell air ducts, rear left/right
5	Defrost air outlet	10	Ventilation air outlet, rear left/right

IHKA with FKA



Index	Explanation	Index	Explanation
1	IHKA with rear automatic air conditioning system, 4-zone.	7	Defrost air outlet
2	IHKA, dual front temperature controls	8	Ventilation air outlet, front left/right
3	FKA, dual rear temperature controls	9	Ventilation air outlet, front left/right
4	Two inlet pipes to heater core, two water valves	10	Footwell air outlet, front left/right
5	PTC heating element in footwell air ducts rear left/right	11	Rear ventilation air outlet, center, left/right
6	Rear blower (FKA)	12	Ventilation air outlet, B-pillar left/right

IHKA with FKA Rear Automatic Air Conditioning System (4-zone)

The 4-zone air conditioning system consists of the standard 2-zone IHKA plus:

- Its own FKA controls
- Four additional outlet temperature sensors
- A separate rear blower
- Air ducts and outlets in the B-pillars
- Two separate PTC heating elements in the rear footwell air ducts
- Three additional actuator motors for air flap control of the system (IHKA with FKA, total of thirteen actuator motors)

The Climate Control Menu allows us to activate or de-activate the FKA rear climate control via the controller. A checked box next to "Activate Rear Climate Control" function will show the system activated. The FKA control settings can be taken over by selecting the "Use Driver Settings" function that synchronizes FKA settings with the driver-side IHKA system settings. However, as soon as the FKA controls are operated by the rear occupants the rear controls become active once again.



Air Distribution Adjustment

When the rocker button for the vent selection is operated, an "Air distribution" pop-up menu appears on the control display. The air distribution may be tailored to preference

The air stratification (ventilation temperature) can also be adjusted via the controller in this menu at the same time as the air distribution is being adjusted.

Air Distribution / Ventilation



Automatic Programs (Gentle, Medium, Intensive)

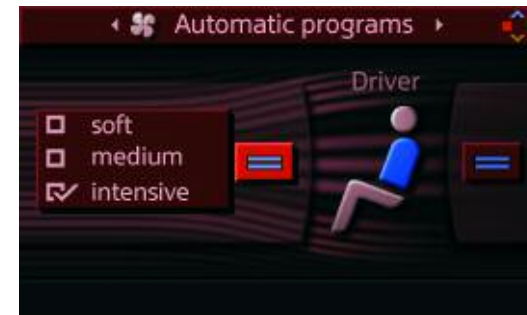
The IHKA control module can be used to select and adjust the automatic program using the AUTO button as a rocker button or via the controller.

The three different automatic programs:

- Gentle
- Medium
- Intensive

Each have their own characteristic curves for blower control, air distribution and air flap control. This enables the occupant to select between three different IHKA programs that achieve the requested climate change at different levels of performance in automatic mode without having to switch to manual mode.

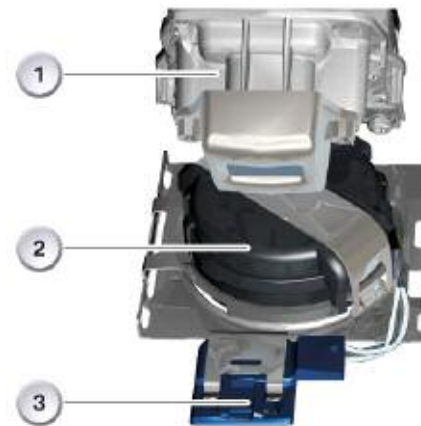
Automatic Programs



Rain/Light Solar Sensor

The new rain/light solar sensor RLSS of the E70 is clipped into a retaining ring beneath the windshield mirror base cover. The rain/light solar sensor separately records the insolation acting upon the vehicle occupants for the left and right halves of the vehicle.

It generates two signals that are proportional to the insolation acting upon the vehicle occupants. The sensor signal is read by the FZD via the LIN bus and relayed to the IHKA via the K-CAN.



Index	Explanation
1	Front window mirror base
2	RLSS rain/driving light solar sensor
3	BSS mist sensor



Workshop Exercise - Heating Air Conditioning Systems E70

Operate the 4-zone Heating and Air Conditioning System (IHKA High with FKA).

Which two operations activate the AUTO program? _____

How can the residual heat function be activated? _____

Name the three modes of the AUTO program? _____

Which prerequisites are needed to activate the rest feature?

What do these modes signify? _____

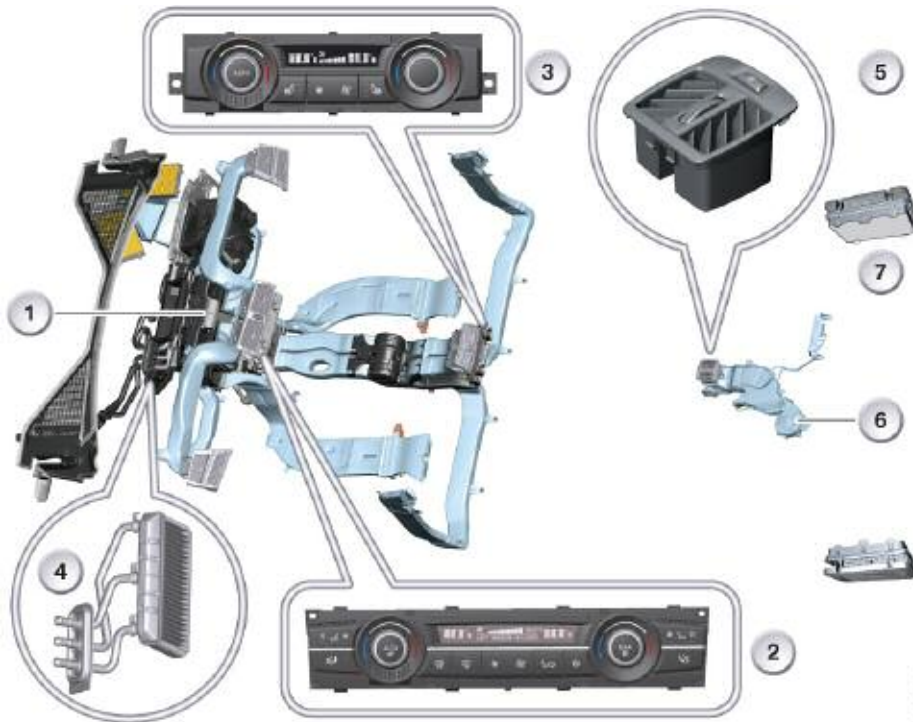
How can the FKA be shut off? _____

Which settings can be set individually for the 4- zone heating/air conditioning system?

Please check the correct answer(s).

- Temperature
- Blower speed
- Air stratification
- Air distribution

IHKA with FKA and 3rd Row Heating /Ventilation



Index	Explanation	Index	Explanation
1	IHKA FKA, 4-zone	5	Controls for heating and ventilation for 3rd row seats, HB3SR
2	IHKA control module, dual front temperature controls.	6	Heating and ventilation 3rd row of seats (blower, PTC heating element, adjusting flap for air distribution)
3	FKA control module, dual rear temperature controls.	7	Vehicle interior ventilation
4	Two inlet pipes to heater core, two water valves		

Heating/Ventilation for Third Row of Seats

The optional 3rd row heating/ ventilation blower is activated using a button located on the 3rd row center air outlet vent between the third row seats.

The air distribution of the auxiliary unit can be selected up for the center air vent and down for the footwell (floor) air vents using a knurled wheel with control flap.

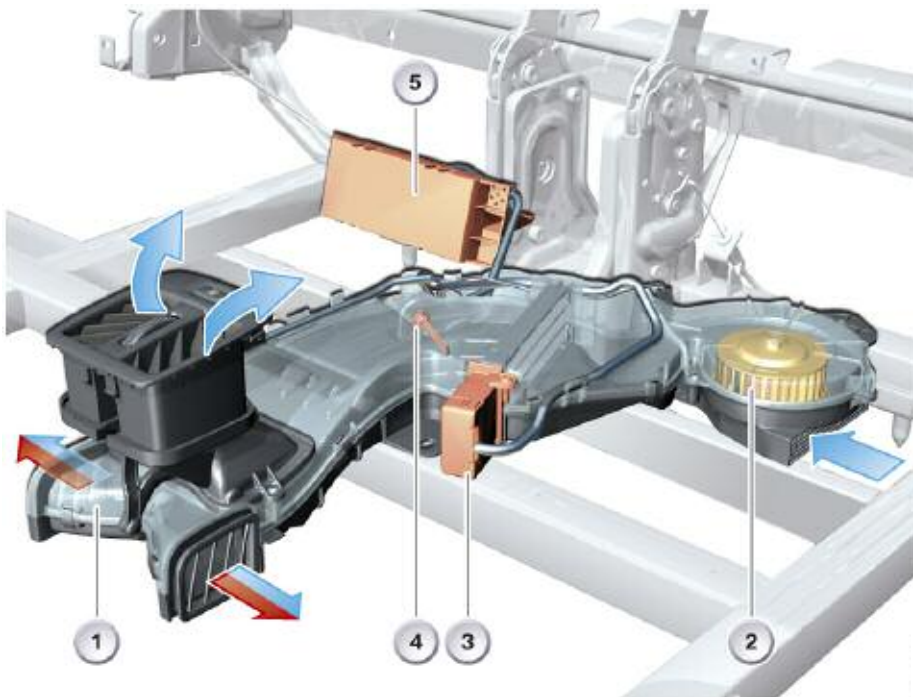
A PTC heating element in the air duct is activated by a micro-switch when the DOWN limit stop of the air outlet knurled wheel is reached.

- The heated air flows out the footwell vents of the 3rd row area.
- The heating function can only be activated with the blower switched on.
- The air volume cannot be controlled.

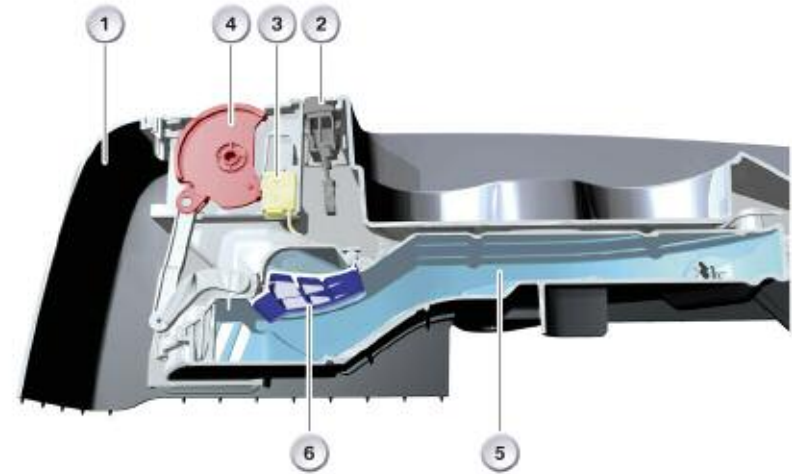


Index	Explanation	Index	Explanation
1	Controls for the 3rd row heating and ventilating system	3	Knurled wheel for air distribution flap with end stop switch to activate the PTC heating element
2	Blower for 3rd row of seats ON/OFF button	4	Heating and ventilating control module

The control module for heating and ventilating the 3rd row of seats is connected to the IHKA via the LIN bus and controls the electrical heating element (output 300W)



Index	Explanation	Index	Explanation
1	Air delivery unit of the 3rd row heating and ventilation system	4	Auxiliary heating temperature sensor
2	Ventilation blower and recirculated air intake	5	HB3SR control module
3	PTC heating element		



Index	Explanation	Index	Explanation
1	Housing for heating and ventilating the 3rd row of seats	4	Air distribution flap knurled adjusting wheel
2	Blower ON/OFF button	5	Air duct
3	Limit position switch for knurled adjusting wheel to turn ON/OFF the PTC heating element	6	Lower warm air routing flap

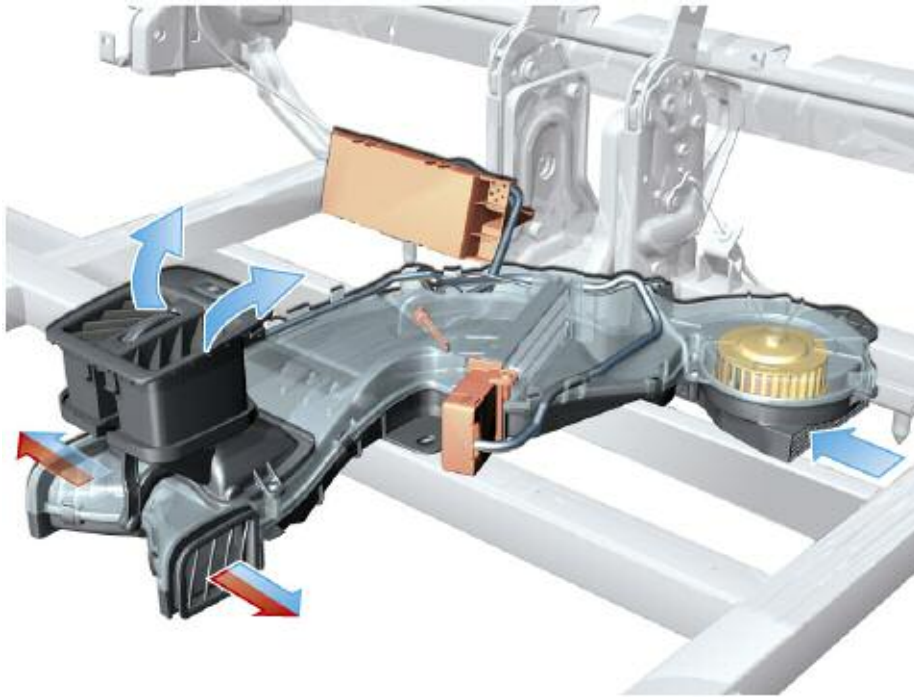
The output of the heating element is controlled depending on interior temperature in three stages from 0 - 100% (< 20°C = 100%, > 20°C = 50%, > 30°C = 0% PTC output).

The DME (ECM) (by means of a CAN signal to the IHKA and to the HB3SR control module via the LIN bus) can reduce the power of the heating element (power reduction of 50% or cut off) within the scope of power management.



Workshop Exercise - Heating Air Conditioning Systems E70

Operate and observe the Heating and Ventilation 3rd Seat Row (HB3SR).



What terminal is required to enable the blower of the Heating Ventilation 3rd Seat Row (HB3SR)?

- KL 0
- KL R
- KL 15 engine OFF
- KL 15 engine On

What terminal is required to enable the heating function of the Heating Ventilation 3rd Seat Row (HB3SR)?

- KL 0
- KL R
- KL 15 engine OFF
- KL 15 engine On

Can heat be distributed to the face vent? Why? _____

Measure the temperature at footwell outlets.

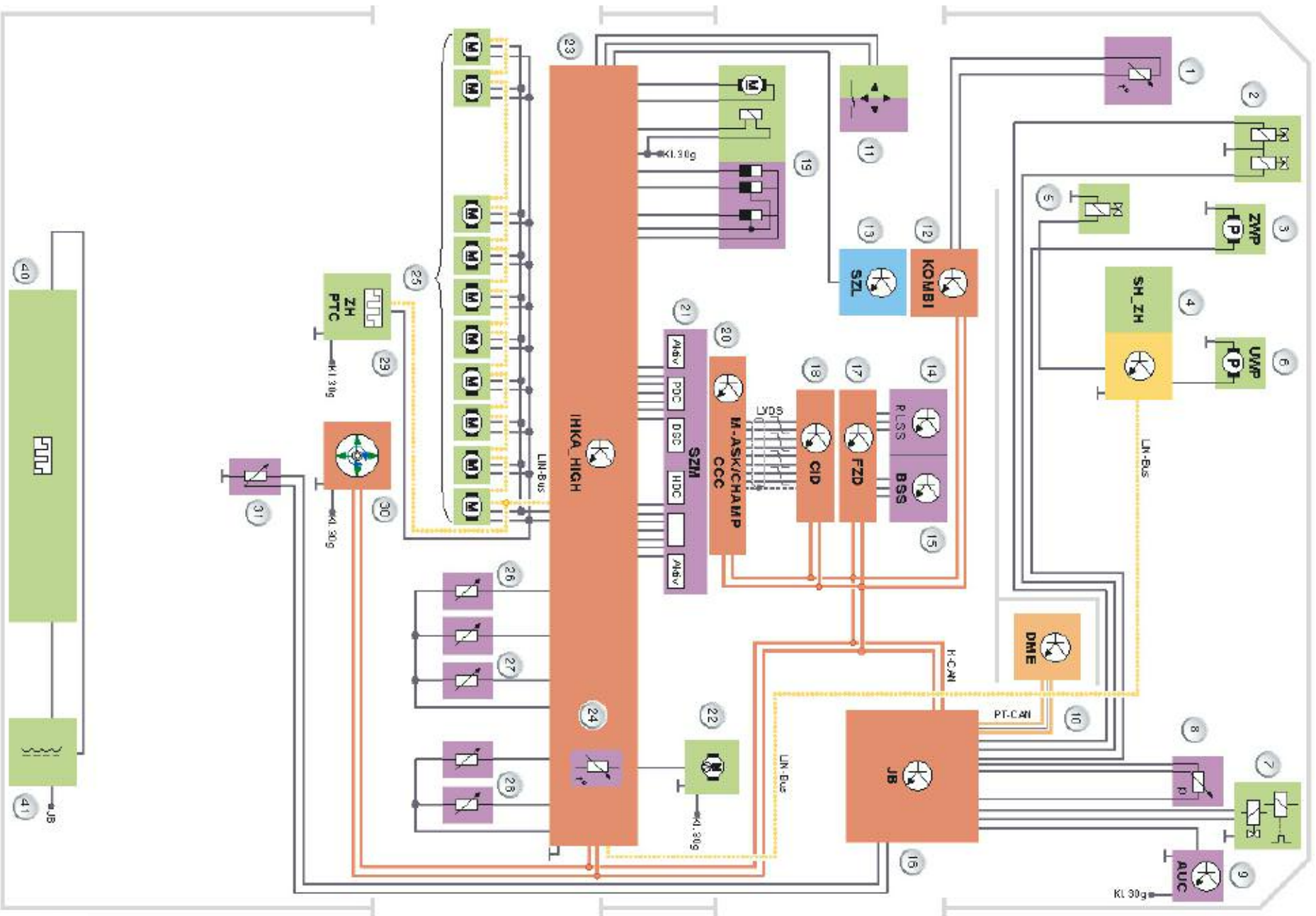
Heater OFF

_____ °F _____ °C

Heater ON (after 2 minutes)

_____ °F _____ °C

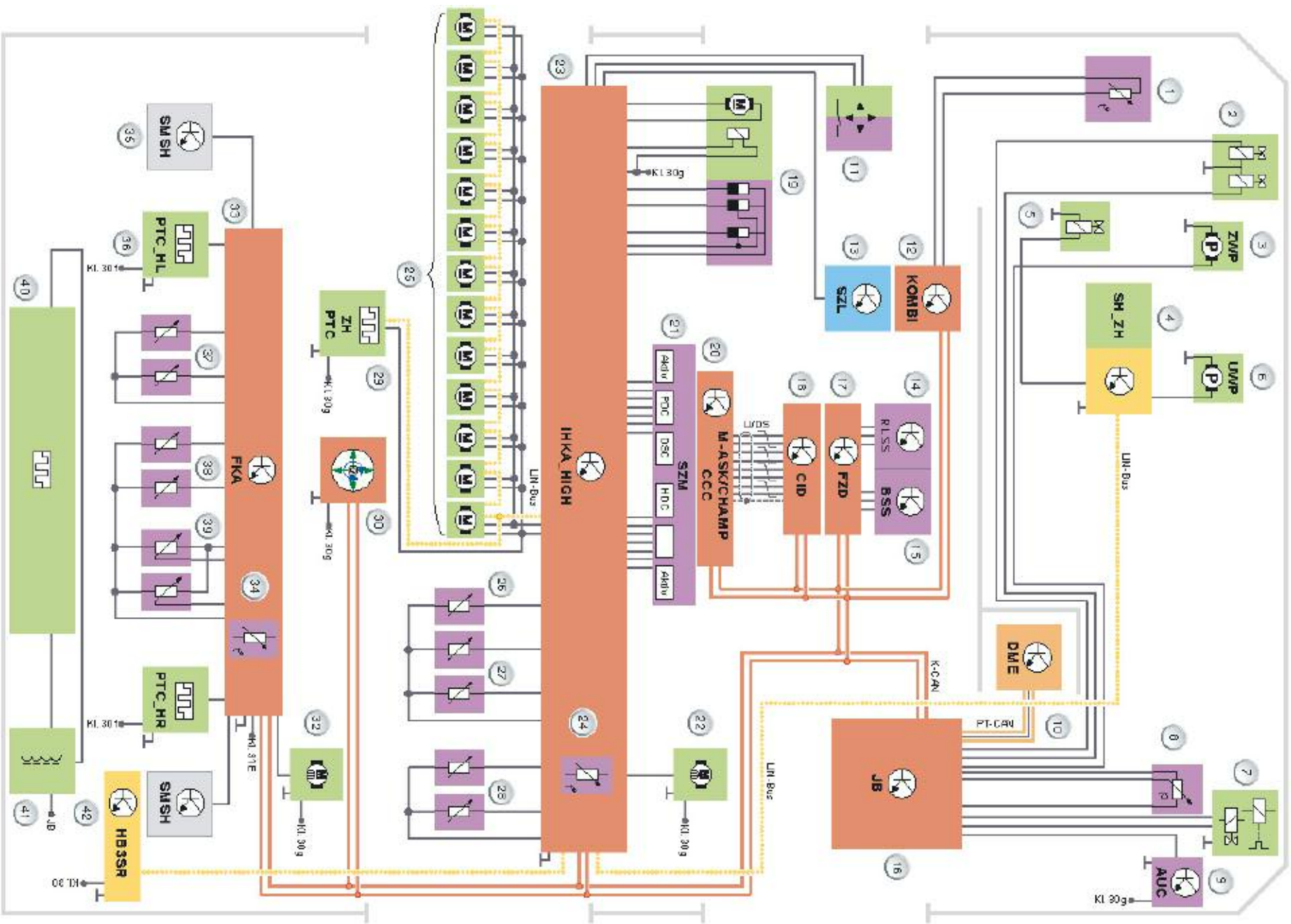
System Circuit Diagram - IHKA 2-zone



System Circuit Diagram Legend for IHKA and IHKA w/FKA

Index	Explanation
1	Ambient temperature sensor
2	Left/right heater valves to heater heat exchanger
3	Electric auxiliary water pump (omitted in SHZH option)
4	SHZH independent heater/auxiliary heater optionally installed (Not for US vehicles)
5	SHZH changeover valve optionally installed (Not for US vehicles)
6	SHZH circulating pump optionally installed (Not for US vehicles)
7	A/C compressor with solenoid coupling and external control valve
8	Air conditioning system refrigerant circuit pressure sensor
9	AUC automatic recirculated air control sensor
10	DME (ECM) engine control module
11	Optional eLSV electric steering column adjustment switch
12	Instrument cluster ambient temperature signal
13	SZL steering column switching center, optionally in combination with LHZ steering wheel heating
14	Rain/driving light solar sensor RLSS
15	BSS window misting sensor
16	Junction box JB
17	FZD roof function center
18	Central information display CID
19	Electric steering column adjustment eLSV
20	M-ASK/CHAMP/CCC
21	SZM center console switch cluster
22	Heating/air conditioning system blower motor
23	IHKA control module
24	Front interior temperature sensor with forced ventilation
25	Actuator motors*
26	Evaporator temperature sensor
27	Heater core temperature sensor (one or two, left/right)
28	Center front ventilation temperature sensors (one or two, left/right)
29	Electric PTC auxiliary heater for vehicles with diesel engines (Not for US Vehicles)
30	I-drive controller
31	Center rear ventilation stratification adjuster (IHKA without FKA)
32	Rear automatic air conditioning blower motor
33	FKA rear automatic air conditioning operating and control module
34	Rear interior temperature sensor with forced ventilation
35	Rear left/right seat heating seat module
36	Left/right rear footwell air duct PTC heating element
37	Left/right rear footwell air duct temperature sensors
38	Center rear ventilation temperature sensors left/right
39	Right/left rear center ventilation stratification adjuster
40	Heated rear window HHS
41	Filter with blocking circuit
42	HB3SR ventilation heater for 3rd row of seats, optional

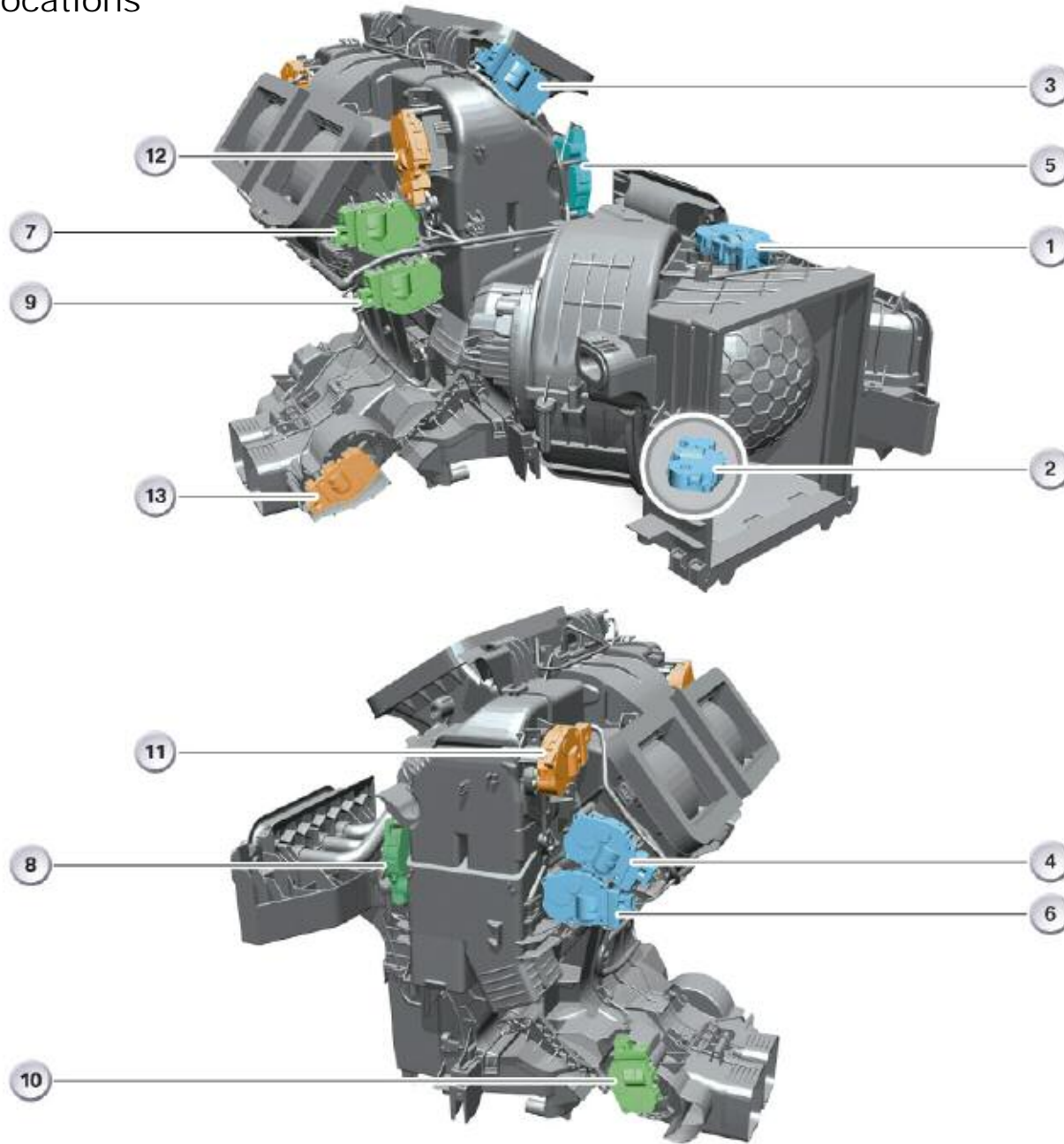
System Circuit Diagram - IHKA FKA, 4-zone



System Circuit Diagram Legend for IHKA and IHKA w/FKA

Index	Explanation
1	Ambient temperature sensor
2	Left/right heater valves to heater heat exchanger
3	Electric auxiliary water pump (omitted in SHZH option)
4	SHZH independent heater/auxiliary heater optionally installed (Not for US vehicles)
5	SHZH changeover valve optionally installed (Not for US vehicles)
6	SHZH circulating pump optionally installed (Not for US vehicles)
7	A/C compressor with solenoid coupling and external control valve
8	Air conditioning system refrigerant circuit pressure sensor
9	AUC automatic recirculated air control sensor
10	DME (ECM) engine control module
11	Optional eLSV electric steering column adjustment switch
12	Instrument cluster ambient temperature signal
13	SZL steering column switching center, optionally in combination with LHZ steering wheel heating
14	Rain/driving light solar sensor RLSS
15	BSS window misting sensor
16	Junction box JB
17	FZD roof function center
18	Central information display CID
19	Electric steering column adjustment eLSV
20	M-ASK/CHAMP/CCC
21	SZM center console switch cluster
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29	Electric PTC auxiliary heater for vehicles with diesel engines (Not for US Vehicles)
30	I-drive controller
31	Center rear ventilation stratification adjuster (IHKA without FKA)
32	Rear automatic air conditioning blower motor
33	FKA rear automatic air conditioning operating and control module
34	Rear interior temperature sensor with forced ventilation
35	Rear left/right seat heating seat module
36	Left/right rear footwell air duct PTC heating element
37	Left/right rear footwell air duct temperature sensors
38	Center rear ventilation temperature sensors left/right
39	Right/left rear center ventilation stratification adjuster
40	Heated rear window HHS
41	Filter with blocking circuit
42	HB3SR ventilation heater for 3rd row of seats, optional

Actuator Motors Locations



Actuator Motors Locations Legend

	Actuator motors	IHKA	IHKA with FKA
1	Fresh air/recirculated air, actuator motor	√	√
2	Dynamic pressure compensation, actuator motor	√	√
3	Defrost, actuator motor	√	√
4	Left/right front ventilation, actuator motor	√	√
5	Right/left front footwell, actuator motor	√	√
6	Right/left front air stratification, actuator motor	√	√
7	Right front ventilation, actuator motor	√	√
8	Left front footwell, actuator motor	√	√
9	Right front air stratification, actuator motor	√	√
10	Left/right rear air stratification, actuator motor	√	√
11	Left rear footwell, actuator motor	Not used	√
12	Right rear footwell, actuator motor	Not used	√
13	Right rear air stratification/shut-off, actuator motor	Not used	√



Workshop Exercise - E70 Heating Air Conditioning Systems

Locate the following components at the vehicle and complete the table below.

Component	Mounting Location
Condenser	
Dryer	
Compressor	
Water valves	
Expansion valve	
Evacuation & Service Port	
Pressure sensor	
Micro filter	
AUC sensor	
Solar sensor	
Condensation sensor	

Access the fresh air carbon activated filter.

Access the recirculation air particle filter.



Classroom Exercise - Review Questions

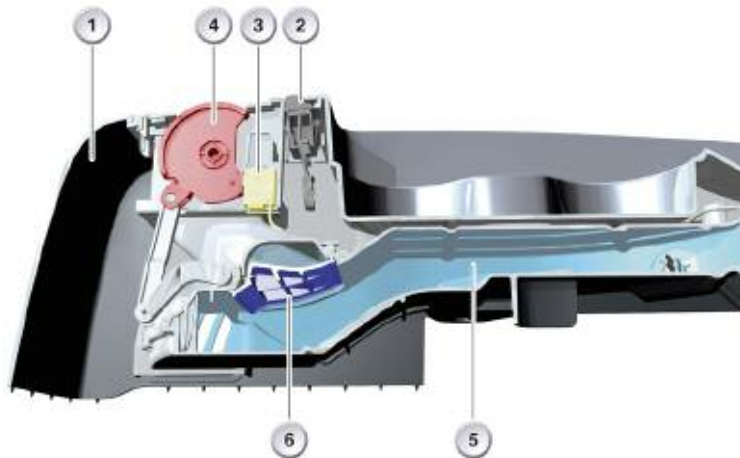
1. As a Co2 emission reduction measure, a will be installed with all engine options available on E70.

Check the best possible answer.

- Clutch-less compressor Reduction Converter Electromagnetic Clutch Harmonic Balancer
-

2. Select the component that turns on the Rear Heating and Ventilation PTC heater element.

Check the best possible answer.



3. How many blower units are there in a fully equipped E70? (Including FKA and HB3SR)

Check the best possible answer.

- Four Two One Three

4. What is the purpose for the heating elements in the FKA?

Check the best possible answer.

- Defrost function Enhance rear heating Windshield de-icing Parked car heating/ventilation
-