■AIR CONDITIONING

1. Major Difference

The cooler compressor assembly for models with 2GR-FE engine has been changed to the TSB19C type cooler compressor assembly. The following types of operation are used for the TSB19C type cooler compressor.

- Air Conditioning Mass Flow Sensor Operation
- Oil Separator Operation
- Variable Suction Side Throttle Operation
- Crank Chamber to Suction passage (CS) valve Operation

The air conditioning system has the following equipments:

●: Standard OP: Option —: Not Equipped

Destination		**Australia**		**Russia**	
Grade		N	GRANDE	N	LIMITED
Front Air Conditioning	Manual	●	—	—	—
	Automatic	OP	●	●	●
Rear Air Conditioning	Manual	OP	—	—	—
	Automatic	OP	●	●	●

2. Performance and Specification

Performance

Front Air Conditioning (Manual and Automatic)			
Heater	Heater Output	W (Kcal/h)	6000 (5159)
	Air Flow Volume	m^3/h	340
	Power Consumption	W	210
Air Conditioning	Cooling Capacity	W	6100
	Air Flow Volume	m^3/h	510
	Power Consumption	W	260
Rear Air Conditioning (Manual and Automatic)			
Heater	Heater Output	W (Kcal/h)	2500 (2150)
	Air Flow Volume	m^3/h	120
	Power Consumption	W	40
Air Conditioning	Cooling Capacity	W	3600
	Air Flow Volume	m^3/h	320
	Power Consumption	W	160

Specification

▶ Ventilation and Heater ◀

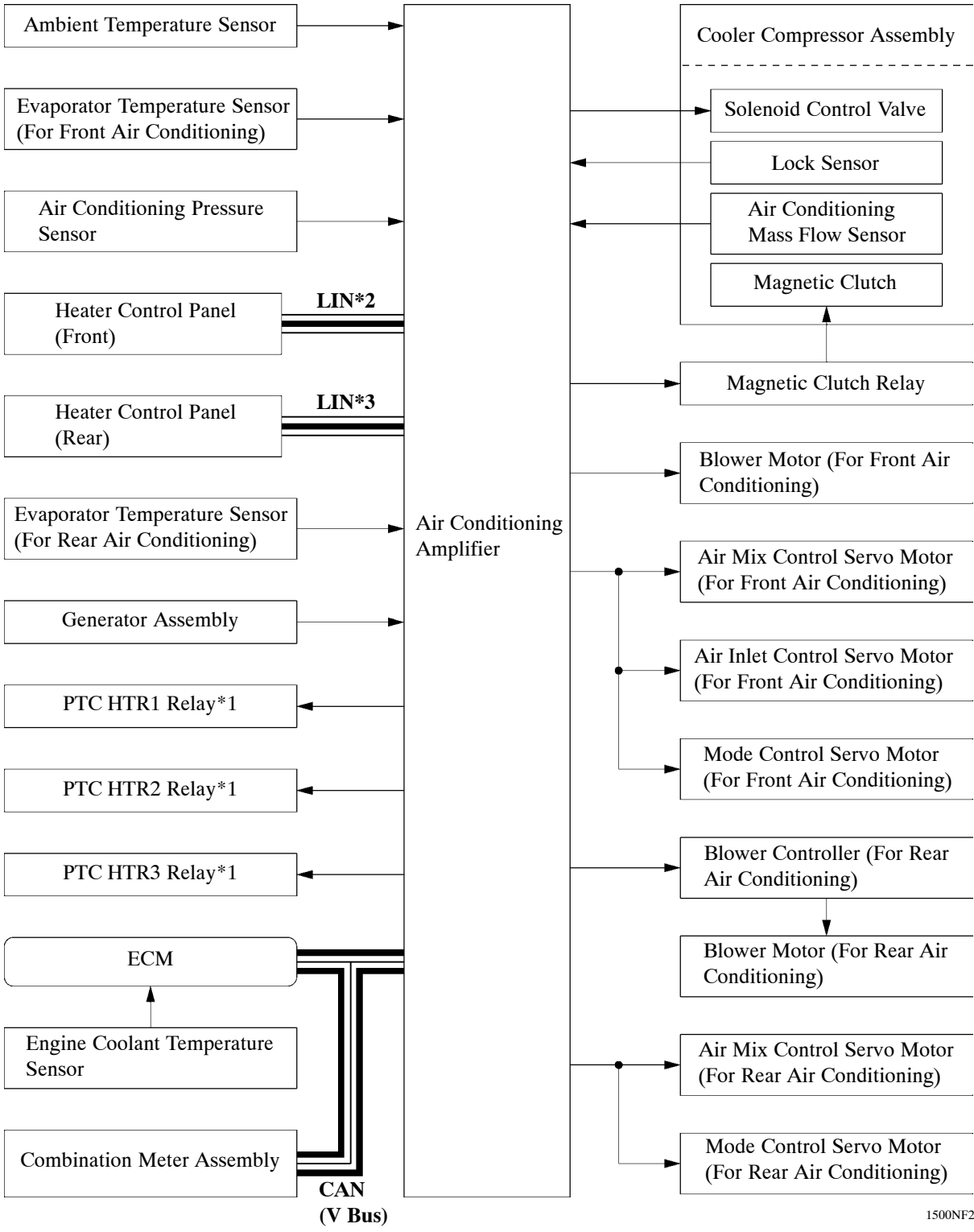
Front Air Conditioning			
Heater Core	Type		Straight Flow Aluminum (SFA)-II
	Size W × H × L	mm (in.)	201.6 × 150 × 27 (7.9 × 5.9 × 1.1)
	Fin Pitch	mm (in.)	1.5 (0.06)
Blower	Motor Type		K70-11T
	Fan Type		Semi Sirocco
	Fan Size (Dia. × H)	mm (in.)	165 × 70 (6.5 × 2.8)
Rear Air Conditioning			
Heater Core	Type		Straight Flow Aluminum (SFA)-II
	Size W × H × L	mm (in.)	130 × 191 × 21 (5.1 × 7.5 × 0.8)
	Fin Pitch	mm (in.)	1.8 (0.07)
Blower	Motor Type		K62-11.5T
	Fan Size (Dia. × H)	mm (in.)	140 × 70 (5.5 × 2.8)

▶ Air Conditioning ◀

Front and Rear Air Conditioning Common Parts			
Condenser	Type		Multi-Flow (MF)-IV
	Size W × H × L	mm (in.)	720 × 440.6 × 16 (28.3 × 17.3 × 0.6)
	Fin Pitch	mm (in.)	3.15 (0.12)
Cooler Compressor Assembly	Type		TSB19C
	Pulley		Steel with Magnetic Clutch
	Oil Volume	Without Rear Air Conditioning	100 to 115 cc
		With Rear Air Conditioning	140 to 155 cc
Refrigerant	Type		HFC 134a
	Charge Volume	Without Rear Air Conditioning	550 to 650 g
		With Rear Air Conditioning	720 to 820 g
Front Air Conditioning			
Evaporator	Type		Revolutionary super-slim Structure (RS)
	Size W × H × L	mm (in.)	266.3 × 251 × 38 (10.5 × 9.9 × 1.5)
	Fin Pitch	mm (in.)	2.6 (0.10)
Rear Air Conditioning			
Evaporator	Type		Revolutionary super-slim Structure (RS)
	Size W × H × L	mm (in.)	145.7 × 251 × 50 (5.7 × 9.9 × 2.0)
	Fin Pitch	mm (in.)	3.4 (0.13)

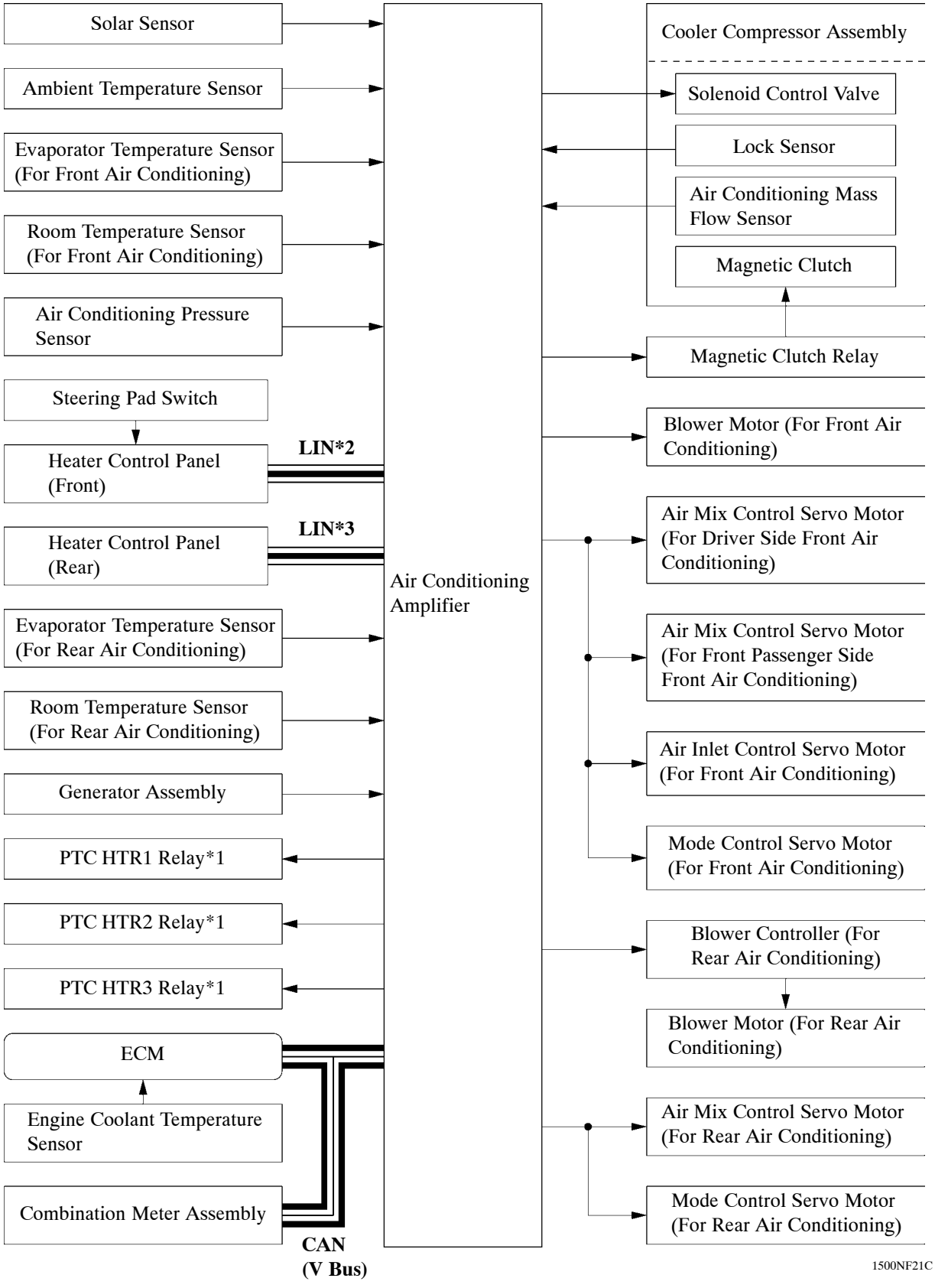
3. System Diagram

Manual Air Conditioning



*1: Models with PTC Heater
*2: Front Air Conditioning Bus
*3: Rear Air Conditioning Bus

Automatic Air Conditioning



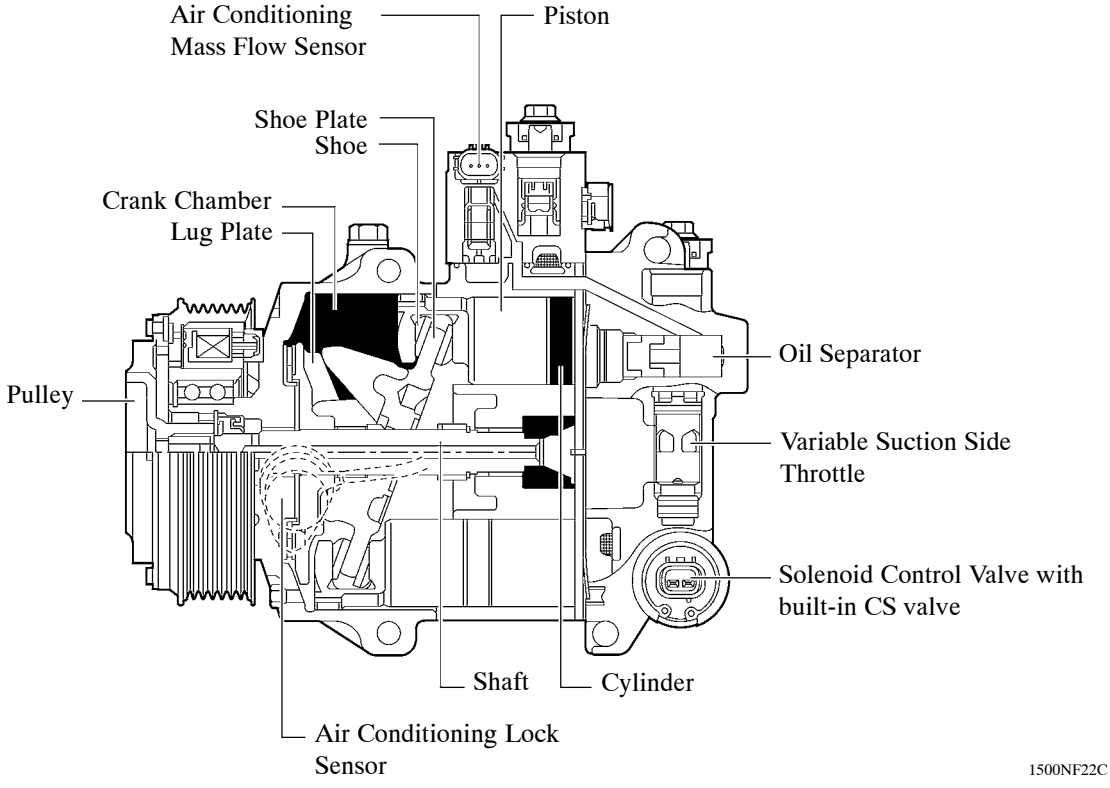
*1: Models with PTC Heater
*2: Front Air Conditioning Bus
*3: Rear Air Conditioning Bus

4. Construction and Operation

Cooler Compressor Assembly

1) General

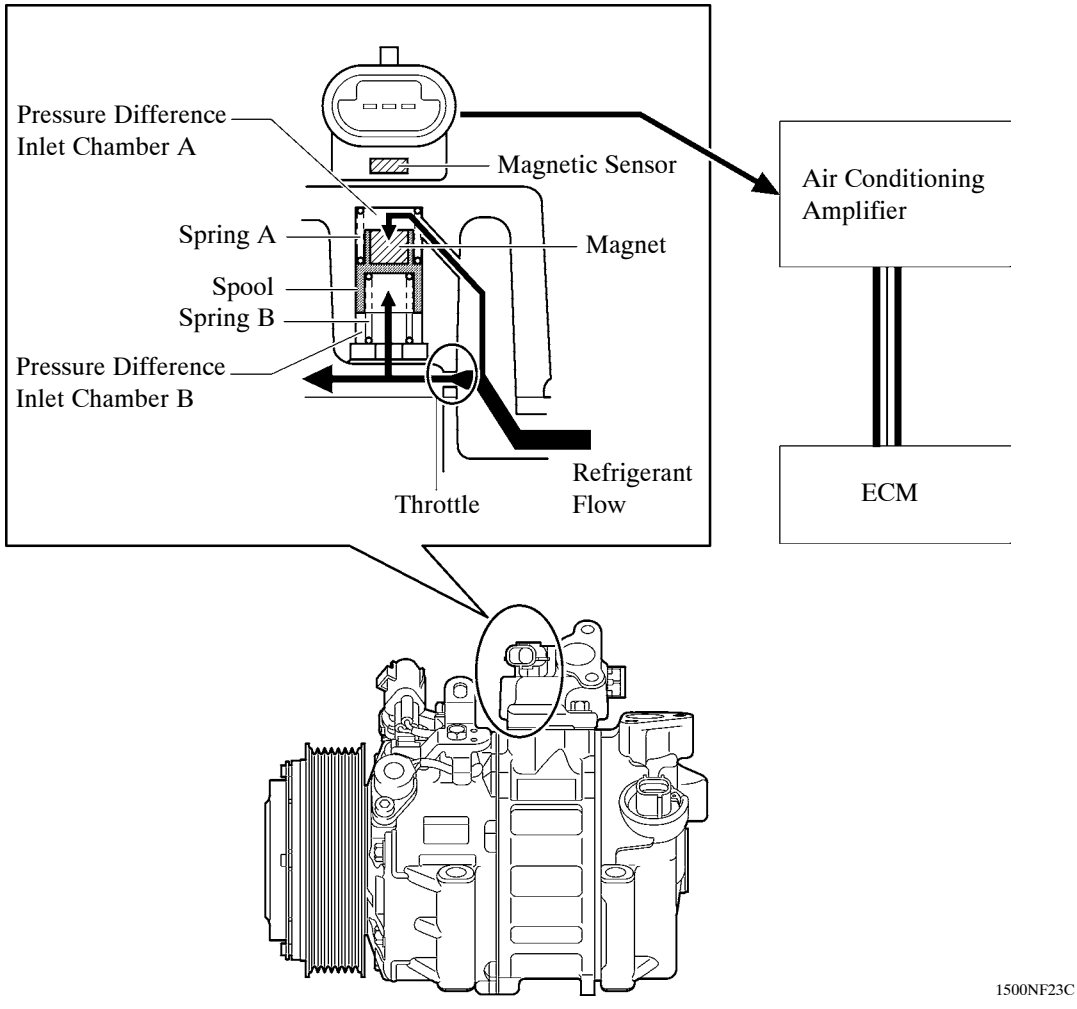
- The cooler compressor assembly is a continuously variable capacity type air conditioning compressor. Its capacity can be varied in accordance with the cooling load of the air conditioning system.
- The cooler compressor assembly consists of a pulley, shaft, lug plate, swash plate, piston, shoe, crank chamber, cylinder, air conditioning lock sensor, solenoid control valve with built-in Crank chamber to Suction passage (CS) valve, air conditioning mass flow sensor, oil separator and variable suction side throttle.
- The oil separator consists of an oil separator chamber and an oil separator cylinder.



2) Operation

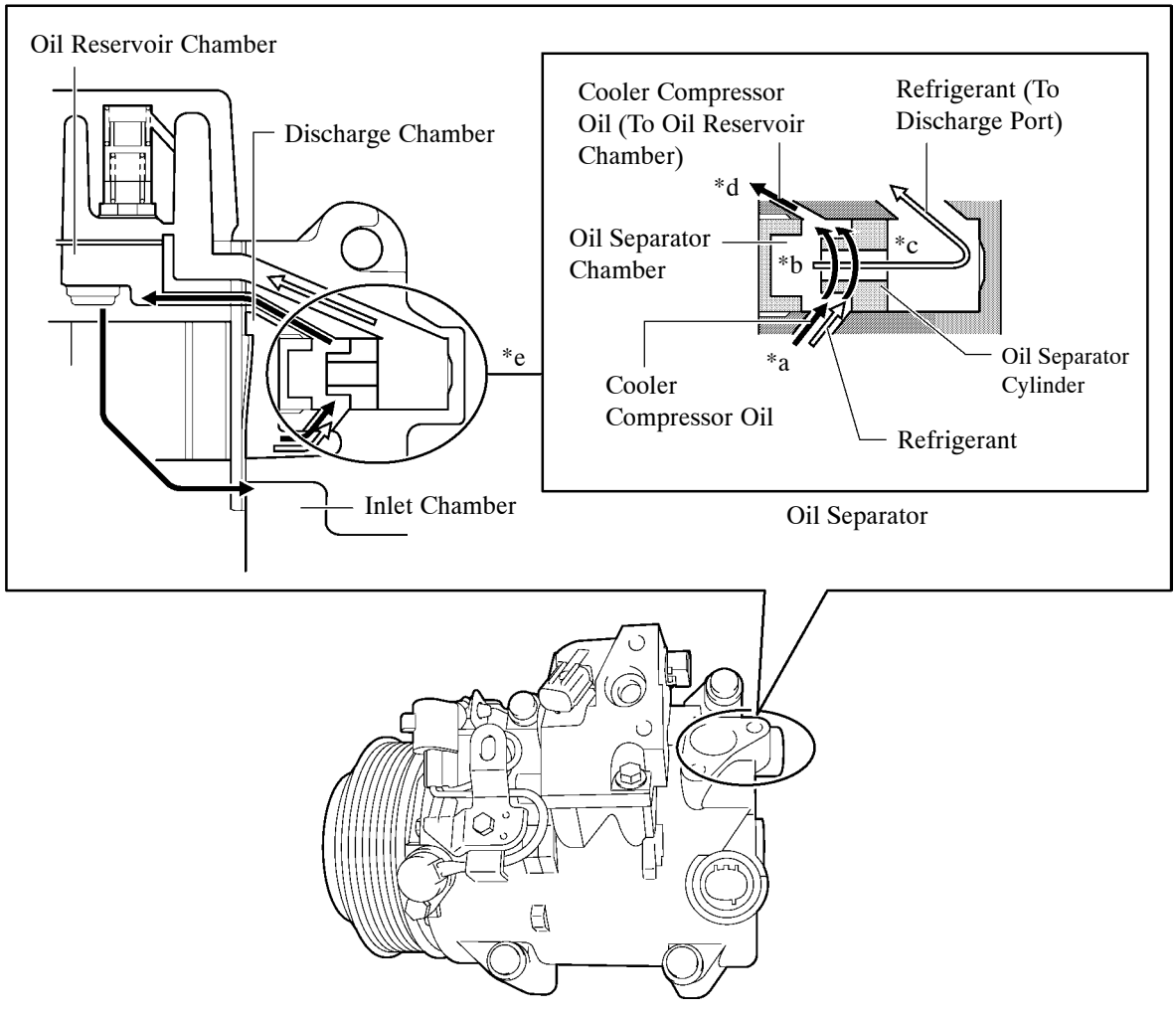
a. Air Conditioning Mass Flow Sensor Operation

- Using a spool that changes its position according to the amount of refrigerant flow, the air conditioning mass flow sensor detects the amount of refrigerant flow.
- The air conditioning mass flow sensor outputs a voltage by converting the change of magnetic flux that occurs due to the magnet that is installed on the spool.
- The spool changes its position according to the pressure difference between the pressure before and after the refrigerant flow throttle.
- If the amount of refrigerant flow is small, the pressure difference between pressure difference inlet chamber A and B is low, allowing the force of spring B to push up the spool.
- If the amount of refrigerant flow is large, the pressure difference between pressure difference inlet chamber A and B is high. The pressure difference overwhelms the force of spring B, and the spool moves down.
- Based on the amount of refrigerant flow detected by the air conditioning flow sensor, the air conditioning amplifier and ECM cooperatively control the cooler compressor assembly and the engine.



b. Oil Separator Operation

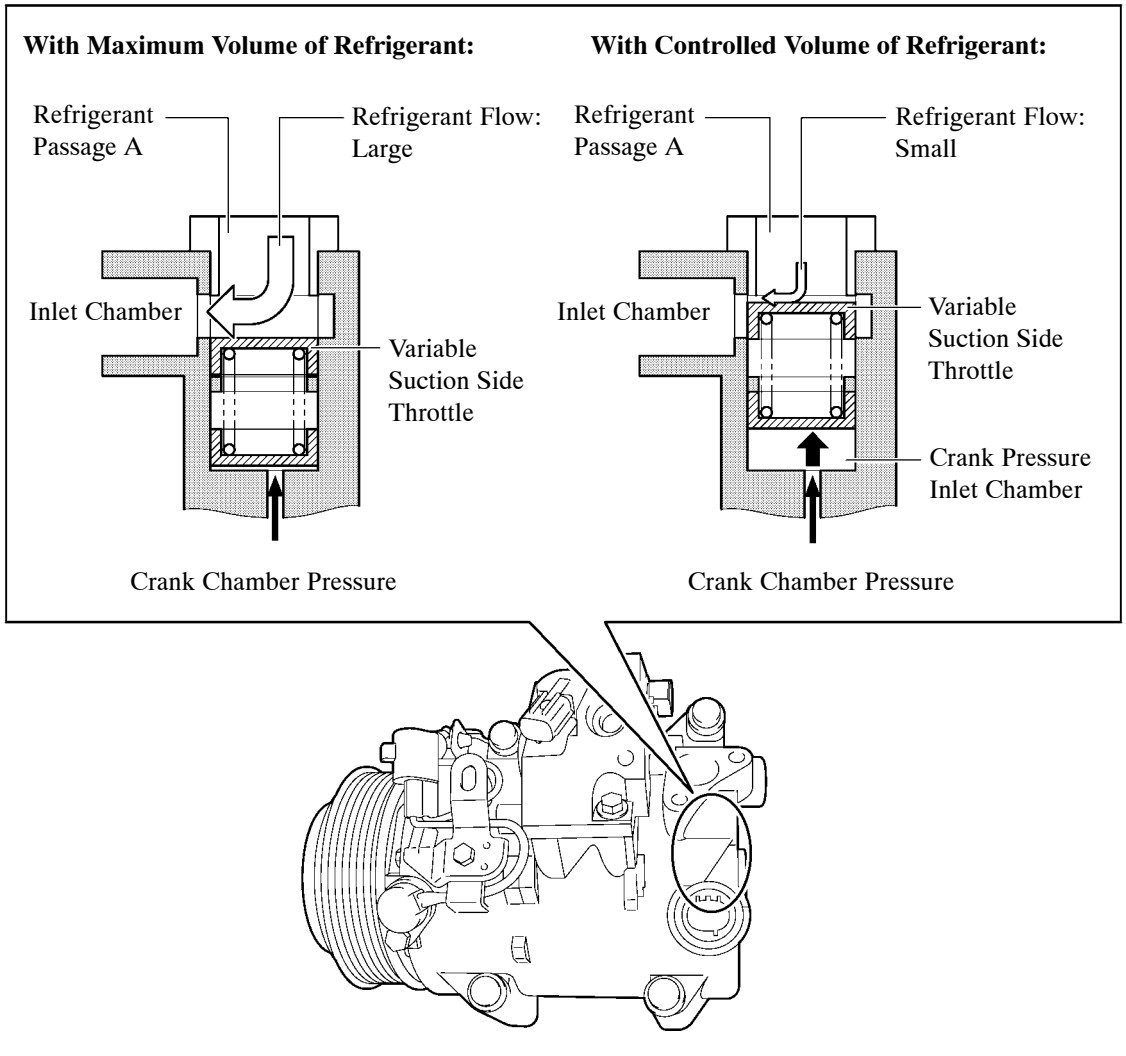
- A mixture of refrigerant and cooler compressor oil flows into the oil separator chamber from the discharge chamber (*a).
- The force of the refrigerant and oil mixture flow turns the oil separator cylinder, allowing the oil and refrigerant to be centrifugally separated (*b).
- The separated refrigerant flows to the condenser through the discharge port (*c).
- The separated oil circulates and lubricates the inside of the cooler compressor by flowing through the oil reservoir chamber, inlet chamber, cylinder and discharge chamber. In addition, the amount of oil that is discharged by the cooler compressor is suppressed (*d).
- The oil separator is installed in the refrigerant passage to separate cooler compressor oil from the refrigerant that is discharged. This helps to prevent the cooler compressor oil from flowing into the air conditioning system and reducing cooling effectiveness (*e).



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c. Variable Suction Side Throttle Operation

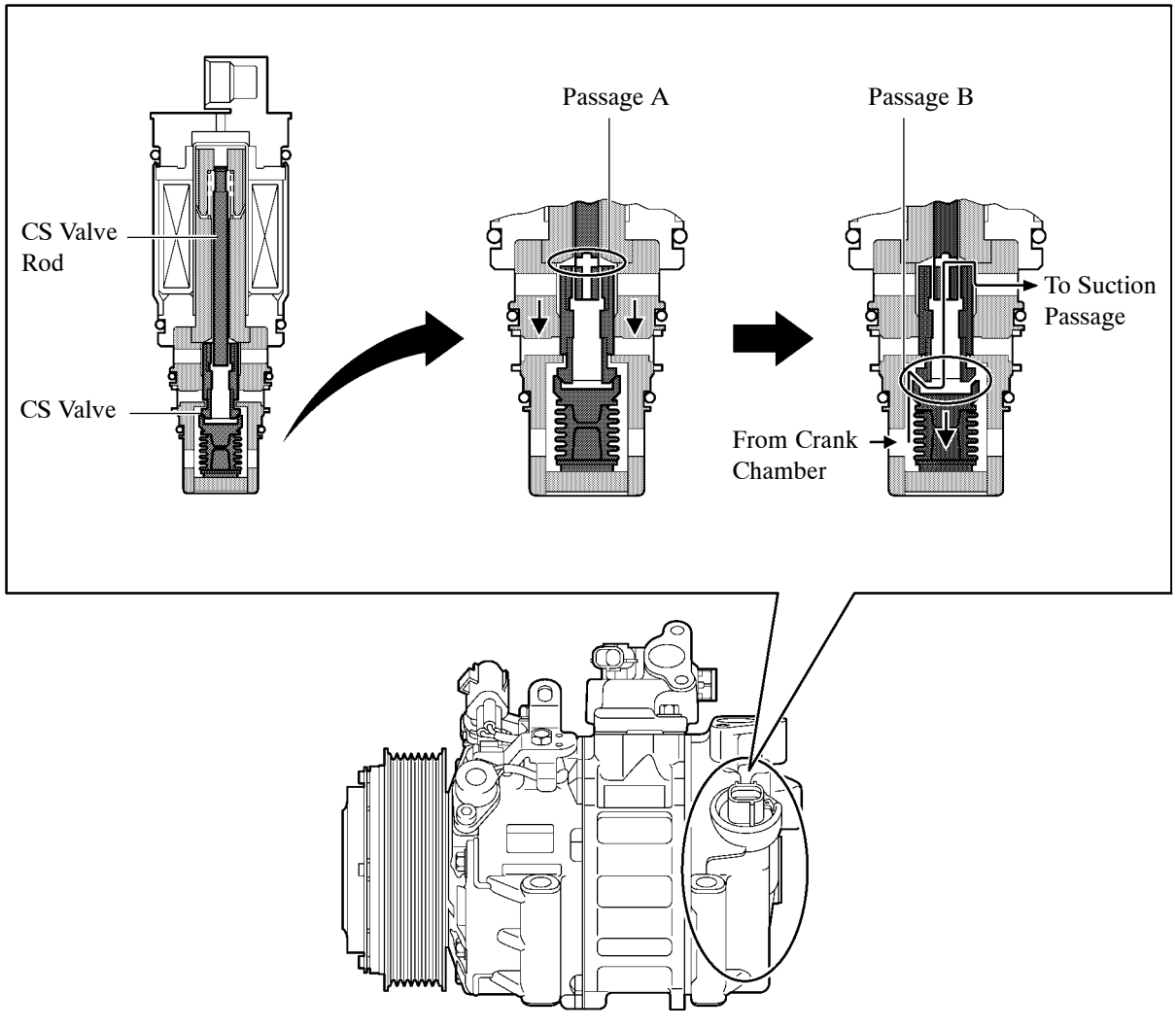
- Refrigerant inlet pressure is applied to the top of the variable suction side throttle and crank chamber pressure to the bottom of the variable suction side throttle.
- The pressure difference moves the variable suction side throttle up and down, expanding and contracting the refrigerant inlet passage.
- When the refrigerant flow is at a maximum, the refrigerant inlet pressure is greater than the crank chamber pressure. This causes the variable suction side throttle to move down, fully opening the refrigerant inlet passage and lowering the refrigerant inlet resistance.
- When the amount of refrigerant flow is controlled, the crank chamber pressure is greater than the refrigerant inlet pressure, raising the variable inlet throttle to contract the flow passage.
- These controls suppress noise by reducing pulsation from the refrigerant inlet.



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d. CS Valve Operation

- The Crank chamber to Suction passage (CS) valve, built into the solenoid control valve, operates in accordance with the suction pressure. The CS valve consists of passage A and passage B.
- If the vehicle is left parked for a long period, refrigerant may accumulate in the crank chamber due to the heat capacity difference.
- The solenoid control valve is controlled by the air conditioning amplifier assembly. While the cooler compressor assembly is operating, the solenoid control valve pushes down the CS valve rod and opens passage A.
- Under the above condition, only if the refrigerant accumulates in the crank chamber, the crank chamber pressure will become high. As a result, the bellows will contract because of the pressure difference with its internal pressure (vacuum), and passage B opens.
- This causes the accumulated refrigerant to be drawn in via passage A and B, clearing the accumulated refrigerant earlier and ensuring a more immediate cooling effect.



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5. Air Conditioning Control

The air conditioning system has the following controls:

Control		Outline
Neural Network Control		This control is capable of effecting complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to a human brain.
Outlet Air Temperature Control		Based on the temperature set at the temperature control dial, neural network control calculates the outlet air temperature based on the input signals from various sensors.
	Left and Right Independent Control	The temperature setting for the driver and front passenger is controlled independently in order to provide a separate vehicle interior temperature for the right and left side of the vehicle. Thus, air conditioning that accommodates the occupants' preferences has been realized.
Blower Control		Controls the blower motor in accordance with the airflow volume that has been calculated by the neural network control based on the input signals from various sensors.
Air Outlet Control		Automatically switches the air outlets in accordance with the outlet mode that has been calculated by neural network control based on the input signals from various sensors.
		In accordance with the engine coolant temperature, ambient air temperature, amount of sunlight, required blower, outlet temperature, and vehicle speed conditions, this control automatically switches the blower outlet to FOOT/DEF mode to prevent the windows from becoming fogged when the ambient air temperature is low.
Air Inlet Control		Automatically controls the air inlet control damper to help achieve the calculated outlet air temperature that is required.
		Drives the air inlet control servo motor according to the operation of the air inlet control switch and moves the dampers to the FRESH or RECIRC position.
Compressor Control		This control turns off the magnetic clutch of the compressor and pulley when the blower motor is turned off at the time the engine coolant temperature is below a predetermined value, an abnormal refrigerant pressure has been detected, or the discharge temperature of the evaporator is below a predetermined value (evaporator is too cold).
		The air conditioning amplifier turns the compressor off if the engine coolant temperature becomes abnormally hot (120°C [248°F] or above) when driving under a high load.
Rear Defogger and Mirror Heater* Control		When the ignition switch is turned on (IG), and the rear defogger switch or rear defogger and mirror heater switch is pushed, this system is activated to keep the defogger heater and mirror heaters on for approximately 15 minutes. However, the operating time of the rear defogger can be extended up to approximately 60 minutes when the following requirements are met. The operating time of the mirror heaters will not be extended. ● Ambient Temperature: 0°C or less ● Vehicle Speed: 65 km/h (40 mph) or more
Front Wiper Deicer*		Switches the front wiper deicer on for approximately 15 minutes when the deicer switch assembly is pressed.
Diagnosis		Diagnostic Trouble Codes (DTC) are stored in memory when the air conditioning amplifier detects a problem with the air conditioning system.

*: Models for Russia