

Cooling system components, removing and installing

Note:

- ◆ *When engine is warm, cooling system is under pressure. Release any pressure before starting repair work.*
- ◆ *A new coolant additive, G12, is being used in production from 07.96. G12 is identified by its red color. Never mix G12 with any other coolant additive! You can see contamination of G12 with other color coolants by its color (brown, purple, etc.). This mixture causes a foamy deposit in the expansion tank and radiator.*
- ◆ *G12 coolant additive may be used in older vehicles when original coolant is drained and the cooling system is flushed.*
- ◆ *Contaminated coolant must be drained immediately and the cooling system flushed.*
- ◆ *Hoses are secured with spring-type clips. When performing repairs only use spring-type clips.*
- ◆ *VAG 1921 pliers are recommended for*

installing spring-type clips.

- ◆ *When installing coolant hoses, always route them stress-free, so they don't come into contact with other components (observe markings on coolant connection and hose).*
- ◆ *Check cooling system for leaks using cooling system tester VAG 1274 and adapter VAG 1274/3.*

Cooling system components (body side) ⇒ [Page 19-3](#)

Cooling system components (engine side) ⇒ [Page 19-6](#)

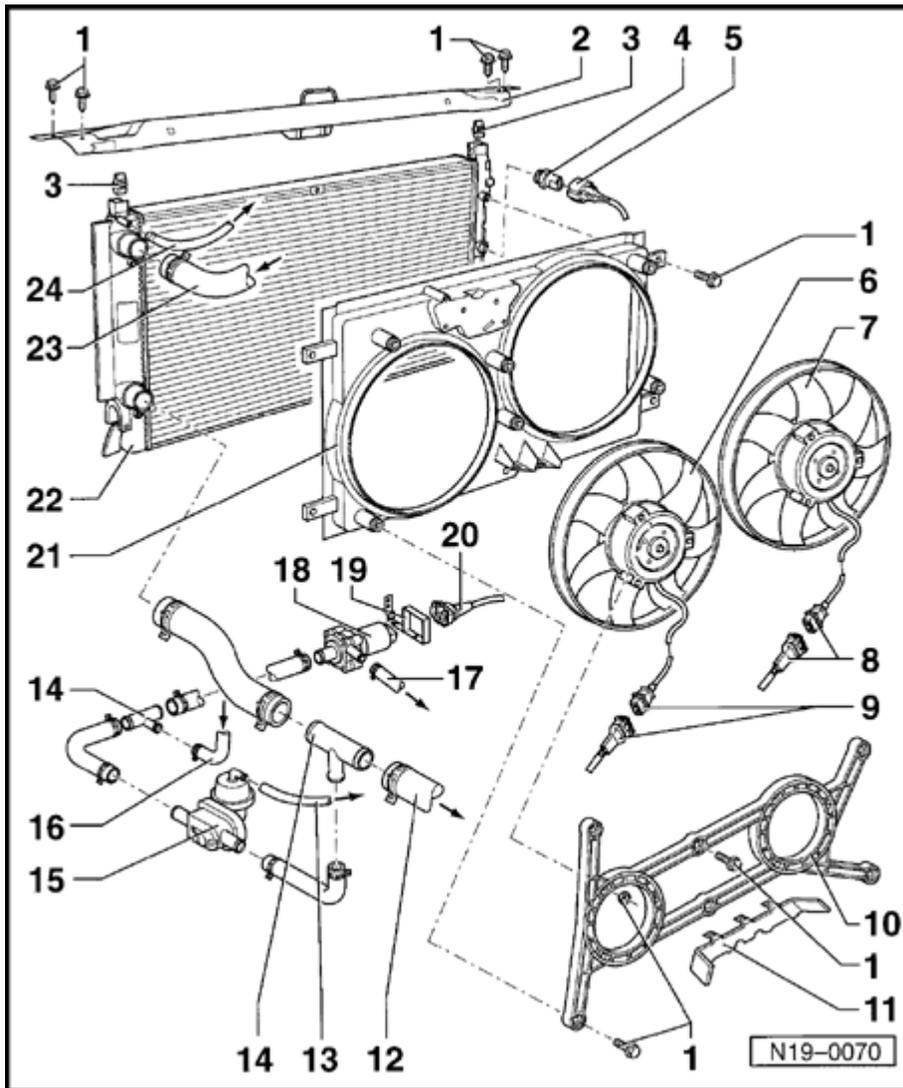


Coolant hose connections, diagram ⇒ [Page 19-10](#)

Coolant system, draining and filling ⇒ [Page 19-14](#)

Coolant mixing ratios ⇒ [Page 19-14](#)

Coolant system, flushing ⇒ [Page 19-18](#)



Cooling system components (body side)

1 - 10 Nm (7 ft lb)

2 - Lock carrier

3 - Securing rubbers

4 - Coolant Fan Control Thermal switch -F18-

◆ 35 Nm (26 ft lb)

◆ Switching temperatures:

Stage 1:

ON: 84 to 89 °C (183 to 192 °F)

OFF: 76 to 83 °C (169 to 181 °F)

Stage 2

ON: 90 to 95 °C (194 to 203 °F)

OFF: 82 to 89 °C (180 to 192 °F)

5 - 3-pin harness connector

◆ Black

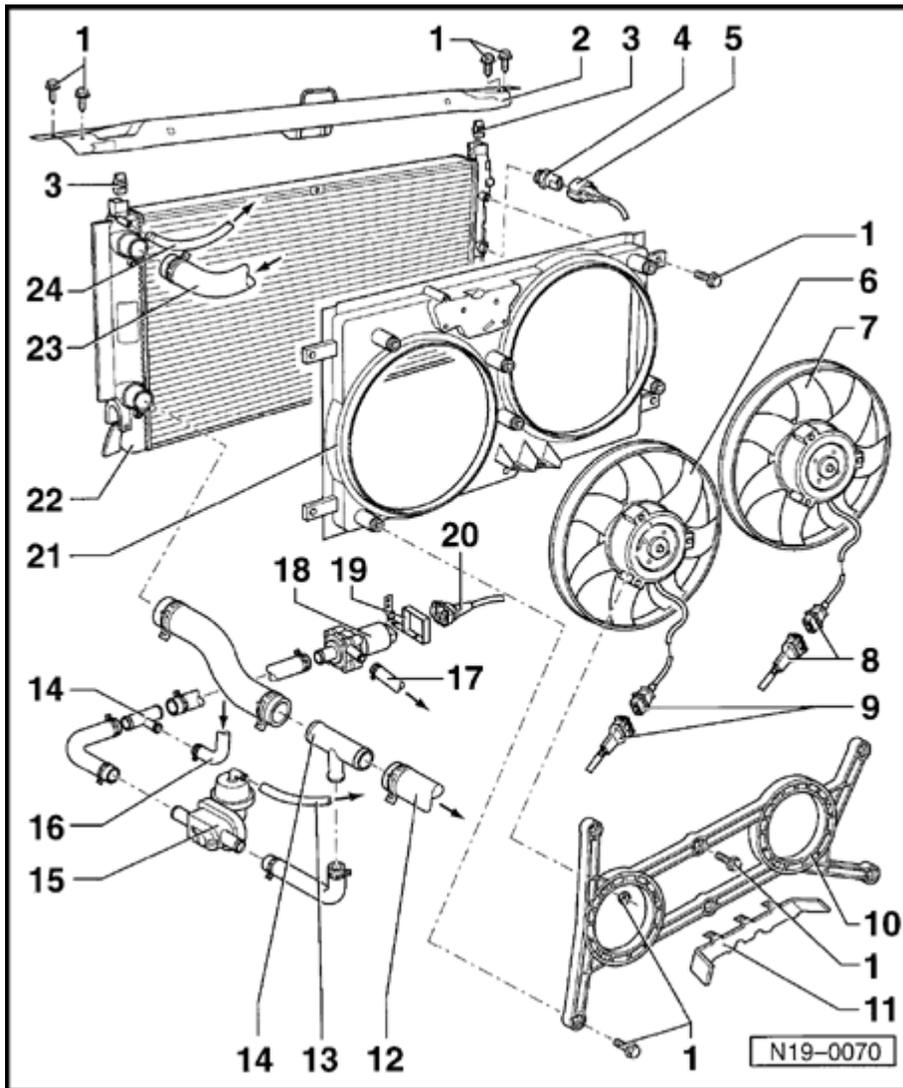
◆ For Coolant Fan Control Thermal switch - F18-

6 - Left Coolant fan -V7-

◆ Removing and installing ⇒ [Page 19-22](#)

7 - Right Coolant fan -V35-

- ◆ Removing and installing ⇒ [Page 19-22](#)



8 - 2-pin harness connector

- ◆ Black
- ◆ For Right Coolant fan -V35-

9 - 2-pin harness connector

- ◆ Black
- ◆ For Left Coolant fan -V7-

10 - Fan ring

11 - Cable guide

12 - Lower coolant hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

13 - Vacuum line

- ◆ To brake servo vacuum line

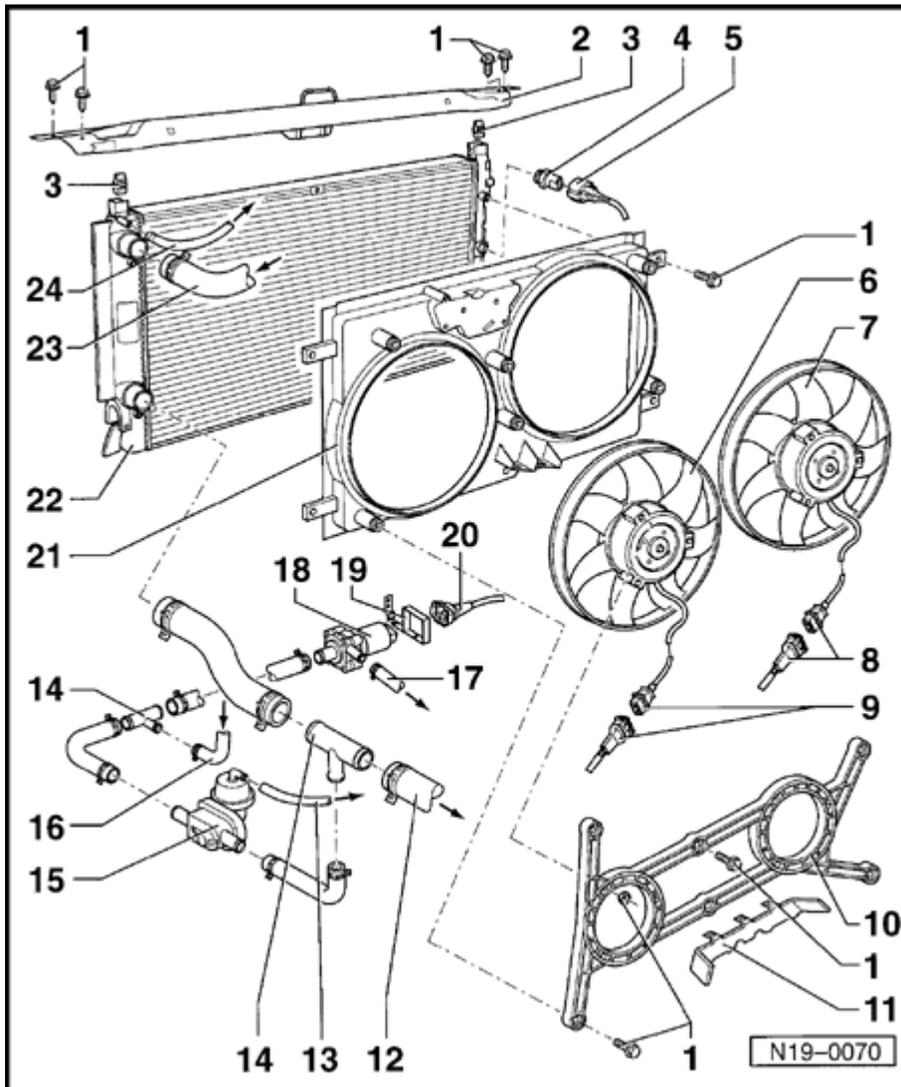
14 - Junction piece

15 - Vacuum unit

- ◆ Arrow on vacuum valve points to After-run Coolant pump.
- ◆ |Checking ⇒ [Page 19-30](#)

16 - Coolant hose

- ◆ Coolant hose connections, diagram ⇒



17 - Coolant hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

18 - After-run Coolant pump -V51-

- ◆ Checking ⇒ [Page 19-27](#)

19 - Retainer

- ◆ For After-run Coolant pump

20 - 2-pin harness connector

- ◆ Black
- ◆ For After-run Coolant pump

21 - Air intake duct

22 - Engine Coolant radiator

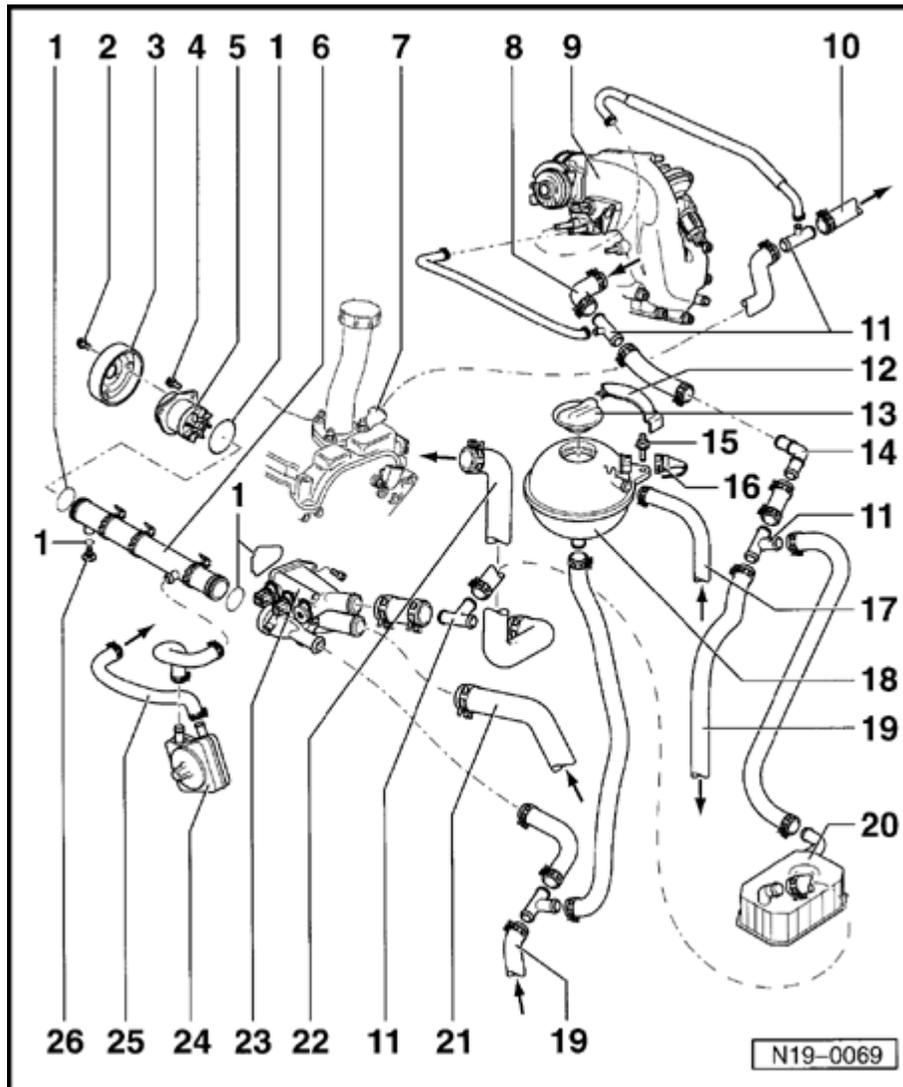
- ◆ Removing and installing ⇒ [Page 19-22](#)
- If replaced, replace coolant mixture.

23 - Upper coolant hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

24 - Coolant overflow hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)



Cooling system components (engine side)

1 - O-ring

- Replace

2 - 25 Nm (18 ft lb)

- To loosen and tighten pulley, counter-hold using a punch inserted through holes.

3 - Pulley

◆ For coolant pump

4 - 20 Nm (15 ft lb)

5 - Coolant pump

- Check shaft for ease of movement.

◆ Removing and installing ⇒ [Page 19-25](#)

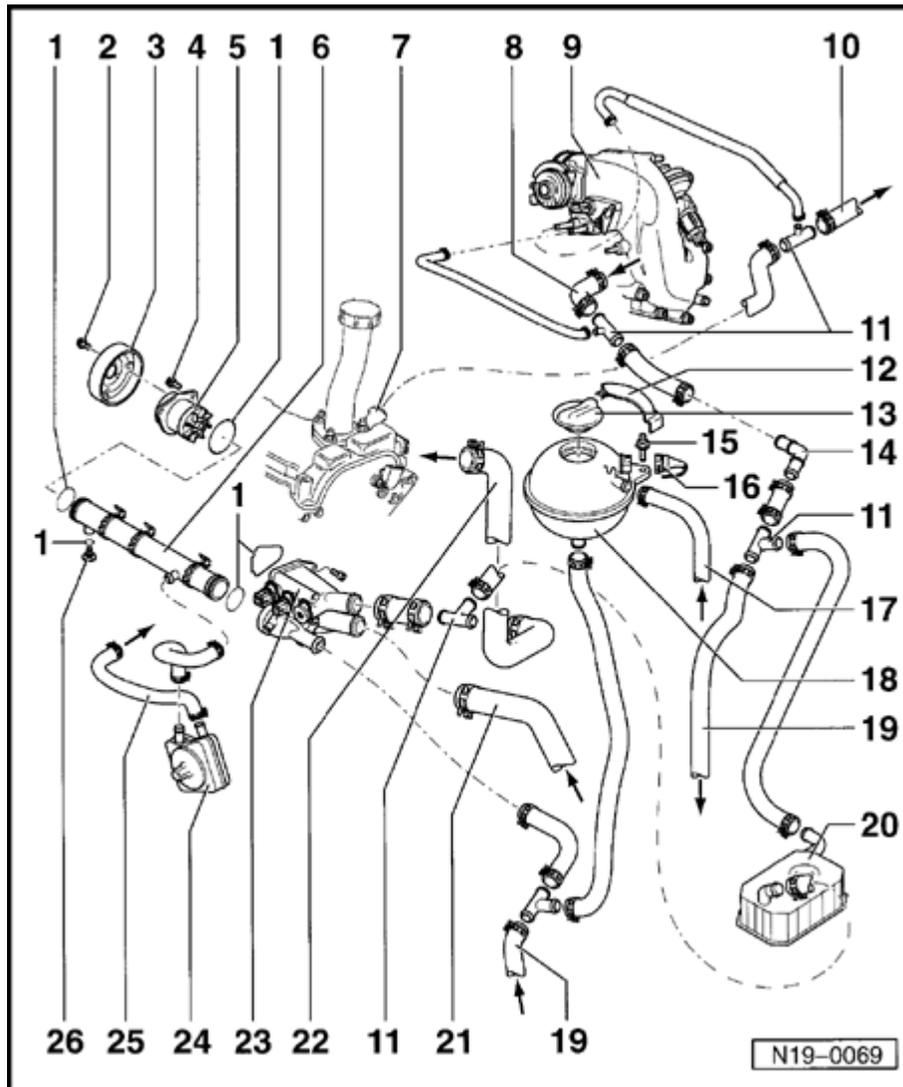
6 - Coolant pipe

7 - Connection

◆ On cylinder head

8 - Hose from heat exchanger

◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)



9 - Throttle Valve Control Module

- ◆ Heated by coolant

10 - To heat exchanger

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

11 - Junction piece

12 - Cover

13 - Cap

- Check cooling system using VAG 1274 tester and VAG 1274/4 adapter.

- Test pressure: 1.2 to 1.5 bar

14 - Angle piece

15 - 10 Nm (7 ft lb)

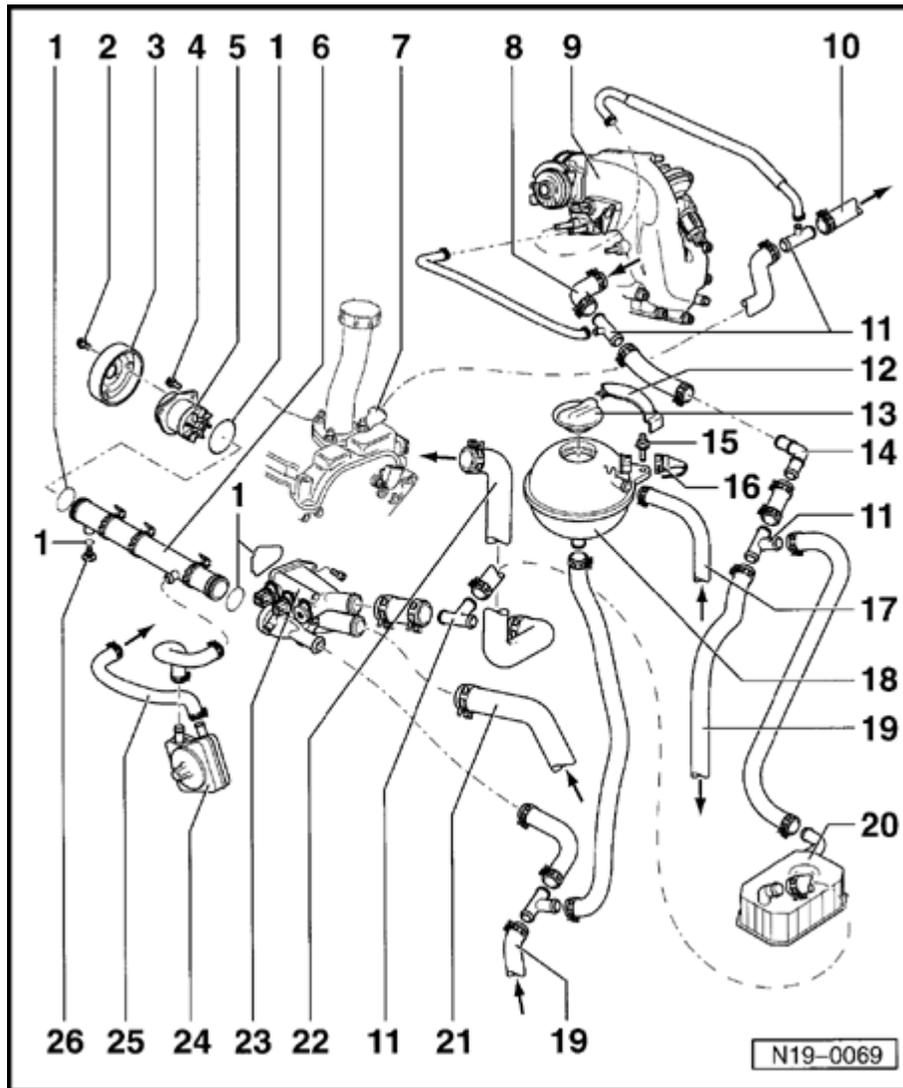
16 - 2-pin harness connector

- ◆ Black

17 - Coolant overflow hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

18 - Expansion tank



19 - Coolant hose

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

20 - ATF cooler

- ◆ Removing and installing:
⇒ [Repair Manual, 4 Spd. Automatic Transmission 01P, Repair Group 37](#)

21 - Lower coolant hose

- ◆ From bottom of radiator
- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

22 - Upper coolant hose

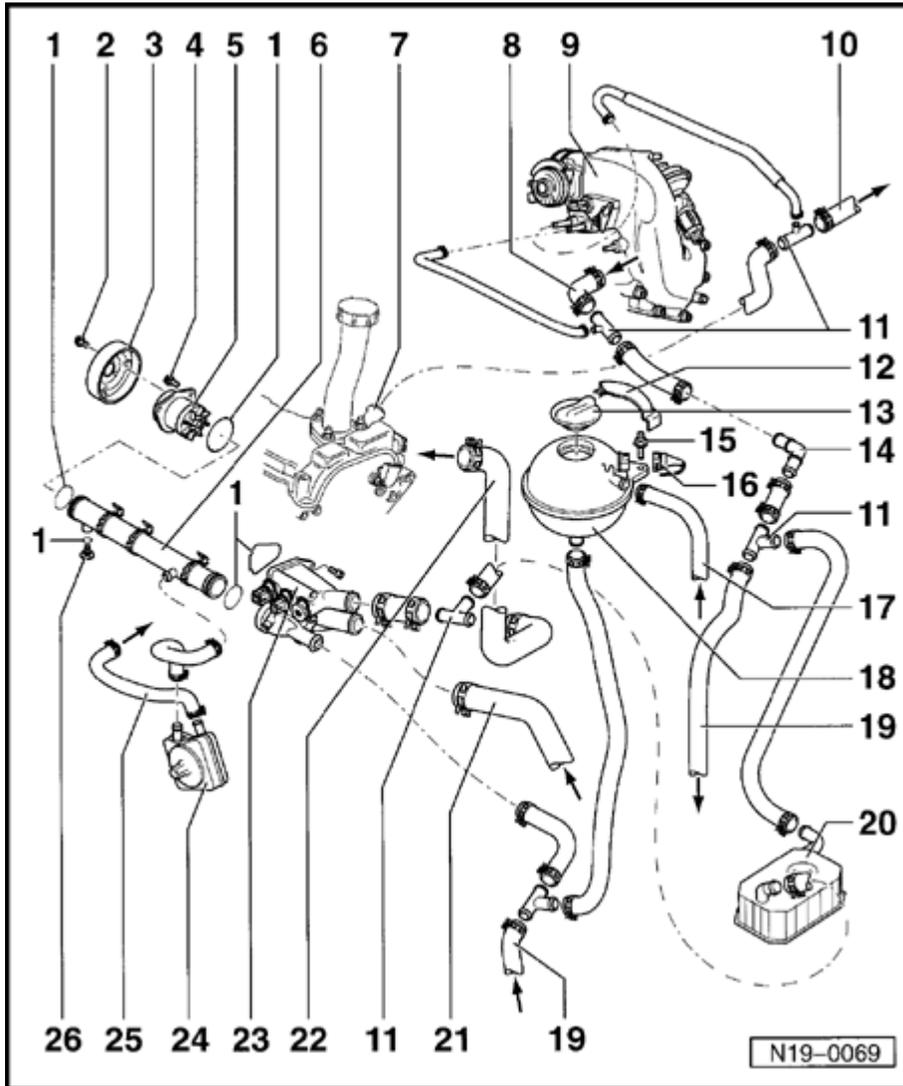
- ◆ To top of radiator
- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

23 - Thermostat housing

- ◆ Disassembling and assembling ⇒ [Page 19-12](#)

24 - Oil cooler

- ◆ Removing and installing ⇒ [Page 17-5](#) (item 17)

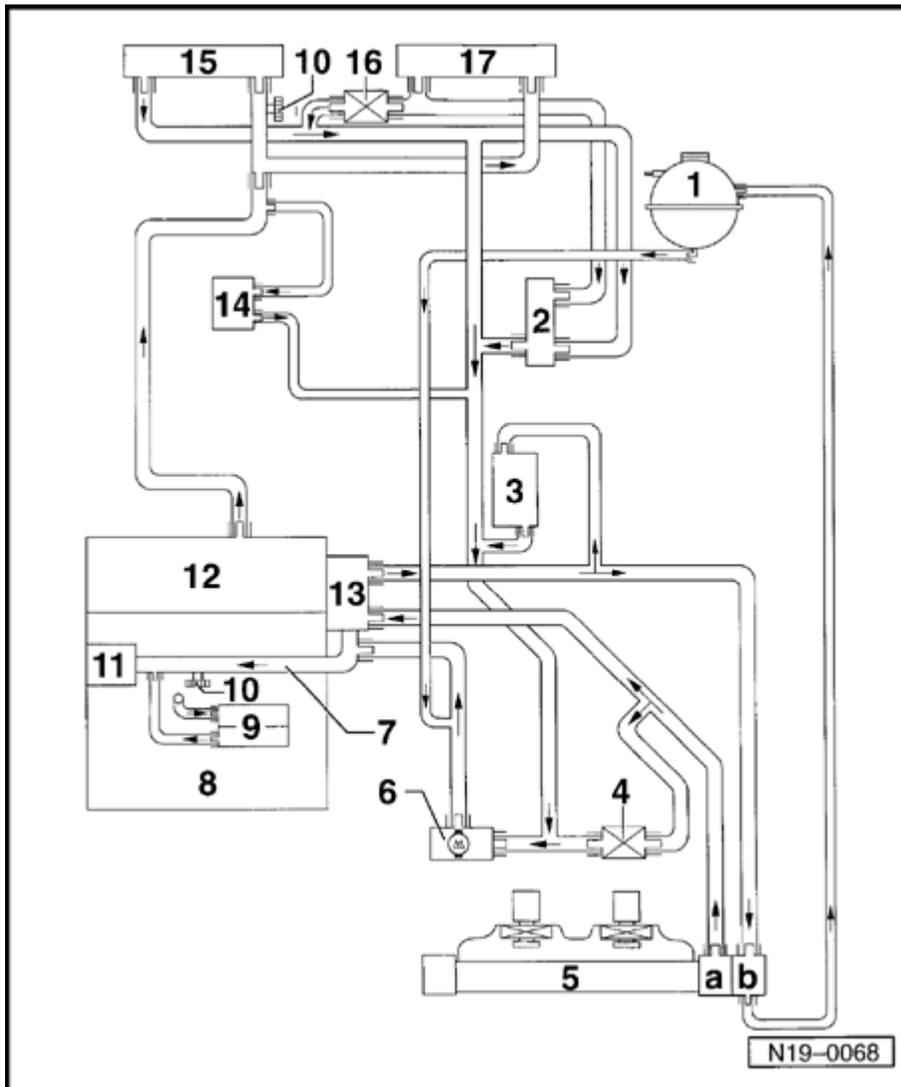


25 - To cylinder block

- ◆ Coolant hose connections, diagram ⇒ [Page 19-10](#)

26 - Drain screw

- ◆ 10 Nm (7 ft lb)
- ◆ Coolant, draining and filling ⇒ [Page 19-14](#)



Coolant hose connections, diagram

1 - Expansion tank

2 - Control valve

◆ Option

3 - ATF cooler

◆ Only installed in vehicles with Auto Trans.

4 - Vacuum valve

5 - Radiator

◆ b = Bottom

◆ a = Top

6 - After-run Coolant pump -V51-

7 - Coolant pipe

8 - Cylinder block

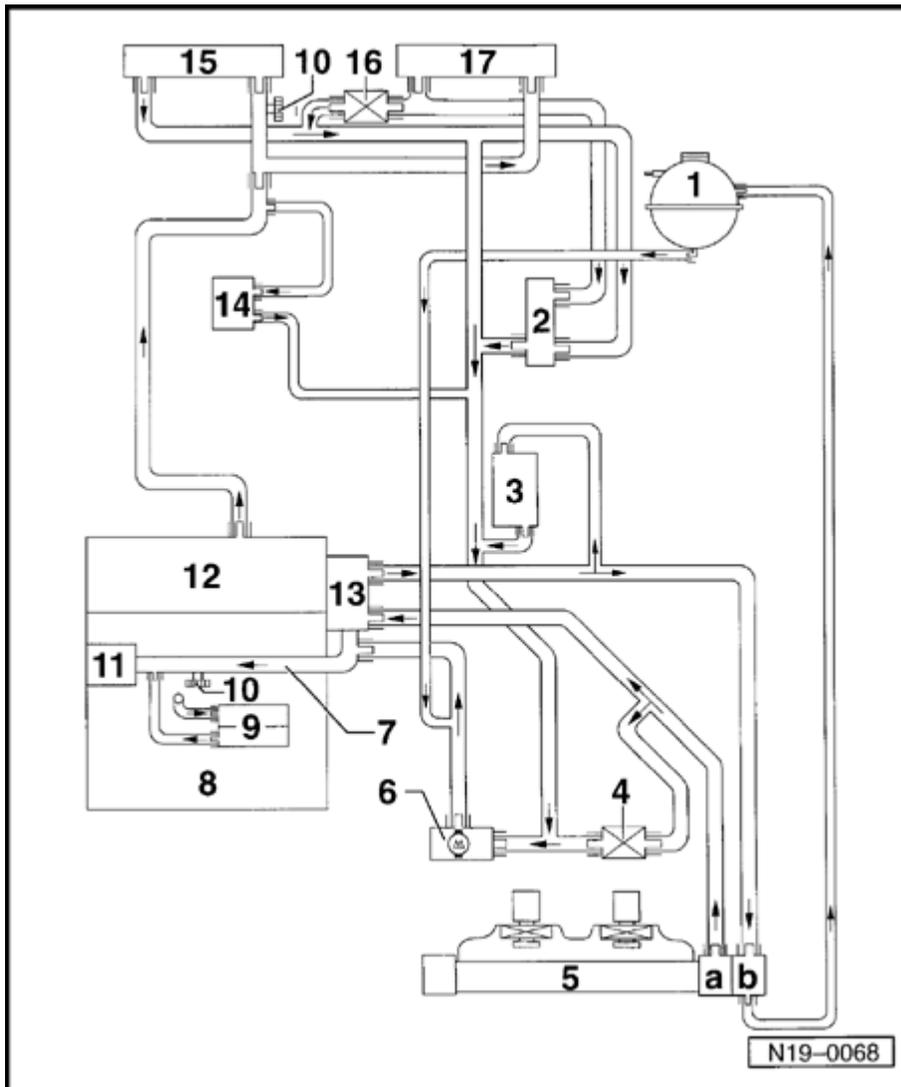
9 - Oil cooler

10 - Drain screw

◆ 10 Nm (7 ft lb)

11 - Coolant pump

12 - Cylinder head



13 - Thermostat housing

14 - Throttle Body/Throttle Valve Control Module -J338-

15 - Heat exchanger

◆ For heating system

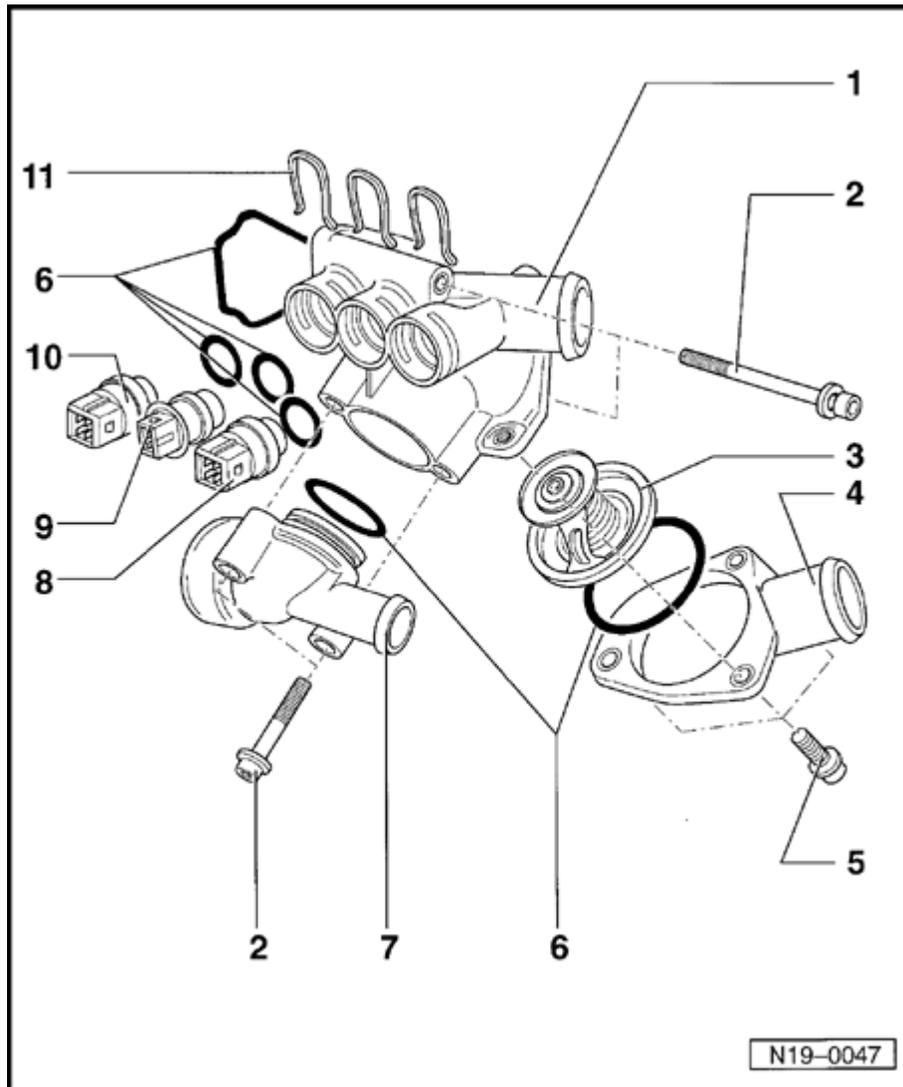
16 - Solenoid valve

◆ Optional

17 - Auxiliary heat exchanger

◆ Optional

N19-0068



Engine coolant thermostat housing, disassembling and assembling

Note:

Connecting coolant hoses to thermostat housing ⇒ [Page 19-6](#)

1 - Thermostat housing

2 - 10 Nm (7 ft lb)

3 - Coolant thermostat

- ◆ Installed position: breather slot/valve uppermost
- ◆ Checking:
 - Heat-up thermostat in water
- ◆ Opening starts approx. 80 °C (176 °F)
- ◆ Ends approx. 105 °C (221 °F)
- ◆ Opening lift 7 mm minimum

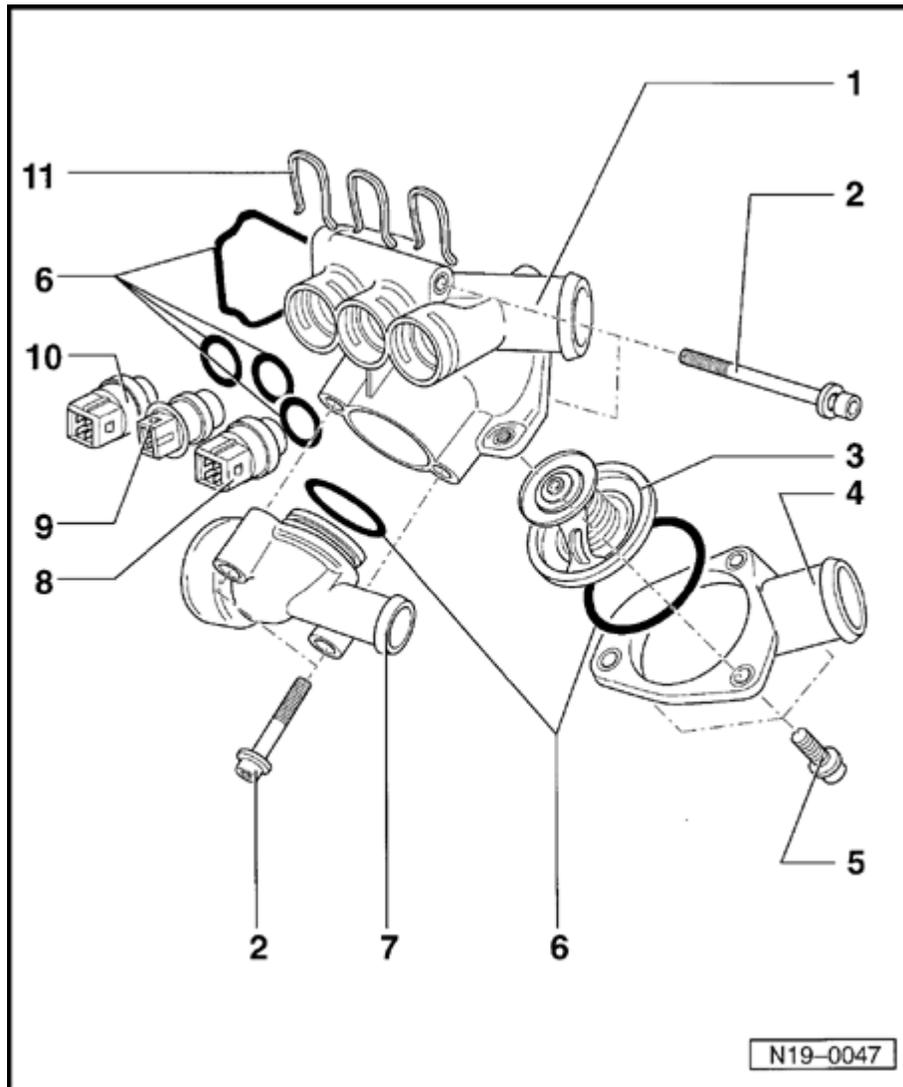
4 - Connection

5 - 10 Nm (7 ft lb)

6 - O-ring

- Replace

7 - Connection



8 - A/C Cut-out Thermal switch -F163- / Third Speed Coolant Fan Control Thermal switch -F165-

- ◆ Brown, 4-pin
- ◆ For vehicles with A/C

⇒ [Repair Manual, Heating & Air Conditioning m.y. 1992-1996, Repair Group 87](#) ⇒ [Repair Manual, Heating & Air Conditioning from m.y. 1997, Repair Group 87](#)

- ◆ Vehicles w/o A/C are plugged

9 - Engine Coolant Temperature (ECT) sensor -G62-

- ◆ Blue, 2-pin
- ◆ For Motronic system
- ◆ Checking:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 01](#)

10 - After-run Coolant Thermal switch -F95- / Engine Coolant Temperature sensor -G2-

- ◆ Yellow, 4-pin
- ◆ Checking ⇒ [Page 19-27](#)

11 - Retaining clip

- Make sure proper seating.



Cooling system, draining and filling

Note:

- ◆ *A new coolant additive, G12, is used in production from 07.96. G12 is identified by its red color. Never mix G12 with any other coolant additive. You can see contamination of G12 with other color coolants by discoloration (brown, purple, etc.). This mixture causes a foamy deposit in the expansion tank and radiator.*

- ◆ *G12 coolant additive may be used in older vehicles when the original coolant is drained and the system is flushed.*

- ◆ *Contaminated coolant must be drained immediately and the system flushed.*

Special tools and equipment

- ◆ VAG 1306 Drip tray

Draining

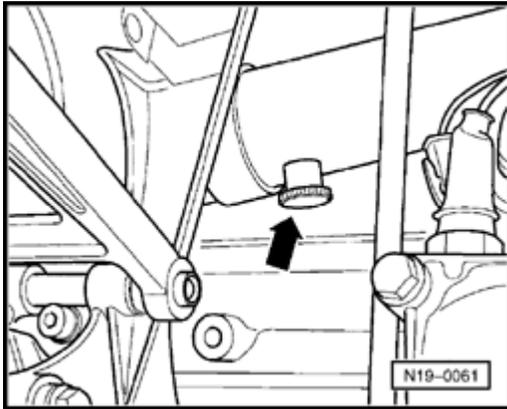
- Remove coolant expansion tank cap.

- Remove sound dampening tray.

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)



- Remove coolant line drain screw -arrow-.





Filling

Note:

- ◆ *The cooling system is filled year-round with a mixture of water, anti-freeze and corrosion protection agent G11 or G12. G11 or G12 and coolant additives marked as being "in accordance with TL VW 774 C" prevent frost and corrosion damage, formation of chalk and in addition raise coolant boiling point. For these reasons the cooling system must be filled year-round with an anti-freeze and corrosion protection agent. Because of the higher boiling point, coolant helps to run the engine efficiently at high loads, particularly in tropical climates.*
- ◆ *If you replace the radiator, heat exchanger, cylinder head or cylinder head gasket, completely replace engine coolant.*

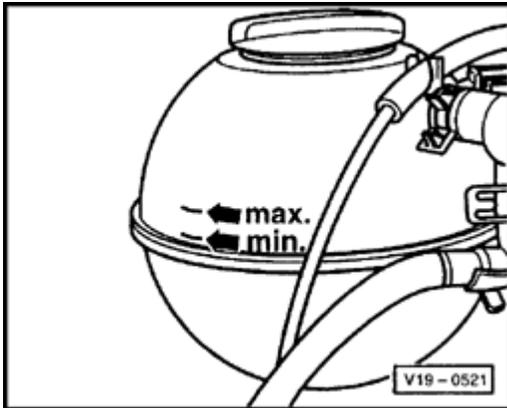


Recommended mixture ratios:

Equipment:	Protection to:	Anti-freeze quantity: 1)	G11 or G12: 2)	H ₂ O
One heat exchanger	-25 °C (-13 °F)	40%	3.6 ltr. (3.8 qt)	5.4 ltr. (5.7 qt)
	-35 °C (-31 °F)	50%	4.5 ltr. (4.8 qt)	4.5 ltr. (4.8 qt)
Two heat exchangers	-25 °C (-13 °F)	40%	4.3 ltr. (4.5 qt)	6.5 ltr. (6.9 qt)
	-35 °C (-31 °F)	50%	5.4 ltr. (5.7 qt)	5.4 ltr. (5.7 qt)
Two heat exchangers and additional water heater	-25 °C (-13 °F)	40%	4.6 ltr. (4.9 qt)	6.8 ltr. (7.2 qt)
	-35 °C (-31 °F)	50%	5.7 ltr. (6.0 qt)	5.7 ltr. (6.0 qt)

1) Anti-freeze must not exceed 60%. Frost protection and cooling efficiency will decrease if the percentage of anti-freeze is too high.

2) Coolant quantities shown are for vehicles with manual transmission. For vehicles with an automatic transmission, increase both coolant additive and water by 0.1 ltr. (0.1 qt).



A

- Press down on top radiator hose.
- Fill expansion tank with coolant up to max. mark.
- Start engine and run at approx. 2500 rpm while filling with coolant up to overflow hole on expansion tank.
- Install expansion tank cap.
- Run engine until radiator fan starts running.
- Run engine for an additional 10 minutes at approx. 2500 rpm.
- Check coolant level and top off if necessary.
 - ◆ With engine at normal operating temperature; coolant level must be on max. mark.
 - ◆ With engine cold, coolant level must be between the min. and max. marks.



Cooling system, flushing

Note:

- ◆ *A new coolant additive, G12, is used in production from 07.96. G12 is identified by its red color. Never mix G12 with any other coolant additive. You can see contamination of G12 with other colored coolants by discoloration (brown, purple, etc.). This mixture causes a foamy deposit in the expansion tank and radiator.*

- ◆ *G12 coolant additive may be used in older vehicles when original coolant is drained and cooling system is flushed.*

- ◆ *Contaminated coolant must be drained immediately and cooling system flushed.*

- ◆ *Engine must be at operating temperature and heater turned on.*

Special tools and equipment

- ◆ VAG 1306 Drip tray

Draining

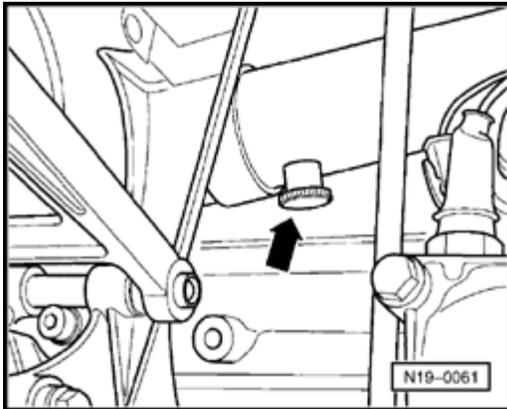
- Remove coolant expansion tank cap.

- Remove sound dampening tray.

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)

▲

- Remove coolant line drain screw -arrow-.





Flushing procedure

- Apply compressed air to expansion tank and blow out remaining coolant.
- Close cooling system, fill with distilled water.
- Run engine for a minimum of 2 minutes.
- Drain water and apply compressed air as before.

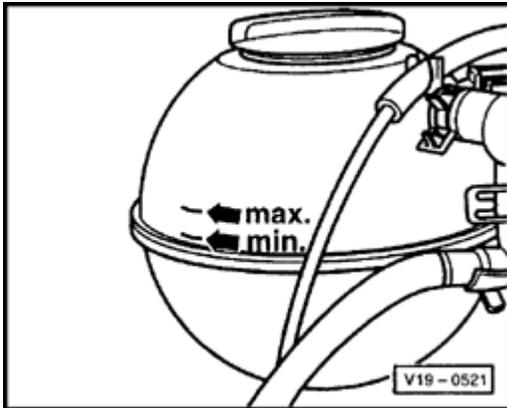


Filling after flushing, recommended mixture ratios

Equipment:	Protection to:	Anti-freeze quantity: 1)	G 11 or G 12: 2)	H ₂ O
One heat exchanger	-25 °C (-13 °F)	40%	3.6 ltr. (3.8 qt)	5.4 ltr. (5.7 qt)
	-35 °C (-31 °F)	50%	4.5 ltr. (4.8 qt)	4.5 ltr. (4.8 qt)
Two heat exchangers	-25 °C (-13 °F)	40%	4.3 ltr. (4.5 qt)	6.5 ltr. (6.9 qt)
	-35 °C (-31 °F)	50%	5.4 ltr. (5.7 qt)	5.4 ltr. (5.7 qt)
Two heat exchangers and additional water heater	-25 °C (-13 °F)	40%	4.6 ltr. (4.9 qt)	6.8 ltr. (7.2 qt)
	-35 °C (-31 °F)	50%	5.7 ltr. (6.0 qt)	5.7 ltr. (6.0 qt)

1) Anti-freeze must not exceed 60%. Frost protection and cooling efficiency will decrease if percentage of anti-freeze is too high.

2) Coolant quantities shown are for vehicles with manual transmission. For vehicles with an automatic transmission, start with quantities shown and top off as needed.



A

- Press down on top radiator hose.
- Fill expansion tank with coolant up to max. mark.
- Start engine and run at approx. 2500 rpm while filling with coolant up to overflow hole on expansion tank.
- Install expansion tank cap.
- Run engine until radiator fan starts running.
- Run engine for an additional 10 minutes at approx. 2500 rpm.
- Check coolant level and top off if necessary.
 - ◆ With engine at normal operating temperature; coolant level must be at max. mark.
 - ◆ With engine cold, coolant level must be between the min. and max. marks.



Radiator and radiator fan, removing and installing

Special tools and equipment

- ◆ VAG 1921 Pliers for spring type clips
- ◆ VAG 1306 Drip tray

Removing

- Remove sound tray:

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)

Vehicles with A/C

- Remove ribbed belt ⇒ [Page 13-22](#) .
- Remove power steering pump with bracket and secure to body with wire. Leave hoses connected.

⇒ [Repair Manual, Suspension, Wheels, Brakes, Steering m.y. 1992-1996, Repair Group 48](#)

⇒ [Repair Manual, Suspension, Wheels, Steering](#)

from m.y. 1997, Repair Group 48

- Remove A/C compressor:

⇒ Repair Manual, Heating & Air Conditioning
m.y. 1992-1996, Repair Group 87

⇒ Repair Manual, Heating & Air Conditioning
from m.y. 1997, Repair Group 87

CAUTION!

Do not open A/C refrigerant circuit !

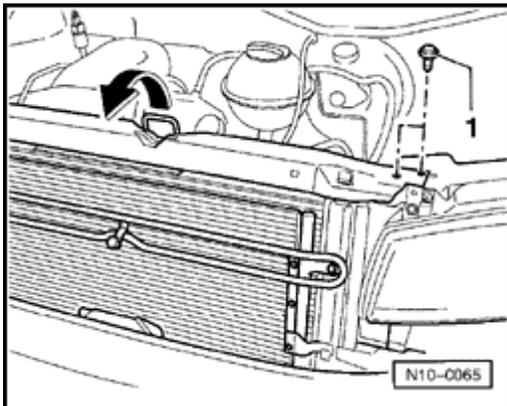
**Note:**

- Observe additional information. ⇒ [Page 19-24](#)

All vehicles

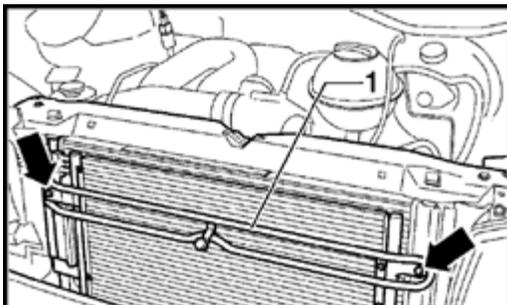
- Remove radiator grille.

⇒ [Repair Manual, Body Exterior, Repair Group 66](#)



A

- Remove lock carrier bolts -1- on left and right.
- Pivot lock carrier with radiator in forward direction -arrow-.



A

- Disconnect power steering line -1- from radiator -arrows- and lay to one side.
- Pull connectors off thermal switch and radiator fan.
- Drain coolant ⇒ [Page 19-14](#) .
- Disconnect coolant hoses from radiator.

- Lift out radiator assembly (complete with fan cowl and fan) in upward direction.



Installing

Installation is in reverse sequence. When installing, note the following:

- Fill system with engine coolant ⇒ [Page 19-14](#) .
- Route wiring and connect electrical connectors.

⇒ [Repair Manual, Electrical Equipment through July 1998, Repair Group 97](#)

⇒ [Repair Manual, Electrical Equipment from August 1998, Repair Group 97](#)

- Check headlight adjustment, adjust if necessary:

⇒ [Repair Manual, Maintenance](#)

Vehicles with A/C, additional information

CAUTION!

Do not open A/C refrigerant circuit.

CAUTION!

To prevent damage to condenser and refrigerant lines and hoses, be sure lines and hoses are not stretched, kinked or bent. Secure these parts with wire.

- Remove retaining clamp(s) from refrigerant lines.
- Remove condenser from radiator and pull forward as far as possible.
- Remove radiator in an upward direction.



Coolant pump, removing and installing

Special tools and equipment

- ◆ VAG 1331 Torque wrench 5 to 50 Nm (0 to 50 ft lb)
- ◆ Punch
- ◆ VAG 1306 Drip tray

Removing

- Remove ribbed belt ⇒ [Page 13-22](#)
- Drain coolant ⇒ [Page 19-14](#)
- Remove coolant pump bolts through holes in pulley and remove coolant pump.

Installing

Installation is in reverse sequence. When installing, note the following:

- Replace coolant pump O-ring.

- Install ribbed belt ⇒ [Page 13-22](#)
- Fill with coolant ⇒ [Page 19-14](#)



Tightening torques

Bolted connections:	Tightening torque:
Coolant pump to cylinder block	20 Nm (15 ft lb)
Coolant pump pulley	25 Nm (18 ft lb)
Drain plug in coolant line	10 Nm (7 ft lb)



After-run coolant thermal switch and after-run coolant pump, checking

Special tools and equipment

- ◆ VW 1594 Adaptor kit
- ◆ VAG 1527B LED tester
- ◆ Fluke 83 or VAG 1526 multimeter
- ◆ Wiring diagram

Checking conditions

- Fuse 19 OK

Test sequence

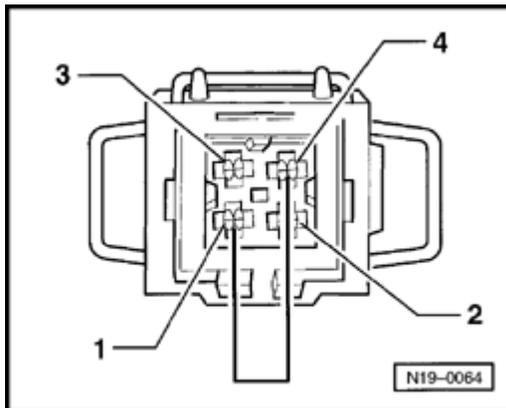
- Remove sound tray.

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)



A

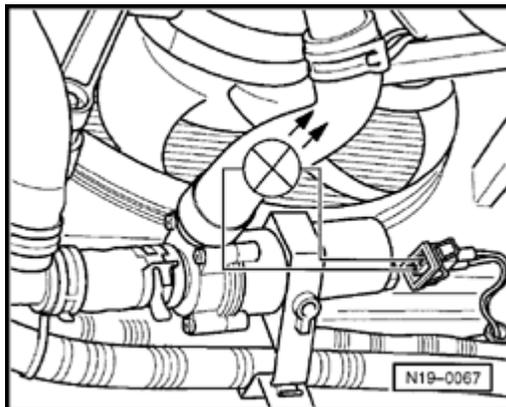
- Disconnect 4-pin connector -arrow- from Engine Coolant Temperature sensor -G2- -yellow- and After-run Coolant Thermal switch -F95-.



A

- Bridge connector terminals -1- (grey) and -4- (brown/green) using jumper wires from VW 1594 adaptor kit.
 - ◆ After-run Coolant pump must run.

If pump does not run:



A

- Disconnect 2-pin connector from After-run Coolant pump -V51- -1- and connect LED tester to disconnected harness connector using jumper wires from VW 1594 kit.
 - ◆ LED must light up.

If LED lights up (voltage supply OK.):

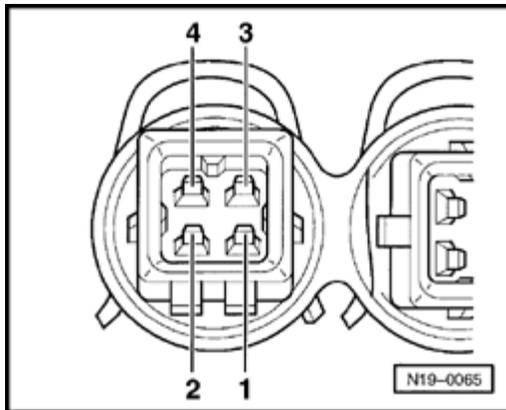
- Replace After-run coolant pump.

If LED does not light up:

- Locate and eliminate open circuit using wiring diagram.



After-run Coolant Thermal switch, resistance checking



A

- Connect VAG 1526 multimeter between terminals 1 and 4 of Thermal switch using jumper cables from VW 1594 adaptor kit.

◆ Specifications:

Below approx. 103 ° C (217 ° F) = ∞ Ω (open)

Above approx.: 104 ° C (219 ° F) = 0 Ω (closed)

If specifications are not obtained:

- Replace After-run Coolant Thermal switch -F95- / Engine Coolant Temperature sensor -G2-.



Vacuum valve, checking

Special tools and equipment

- ◆ VAG 1921 Pliers for spring type clips
- ◆ VAG 1306 Drip tray
- ◆ US 8012 Hand vacuum pump

- Remove insulation tray:

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)

- Drain coolant ⇒ [Page 19-14](#)

- Disconnect vacuum hose from vacuum valve.

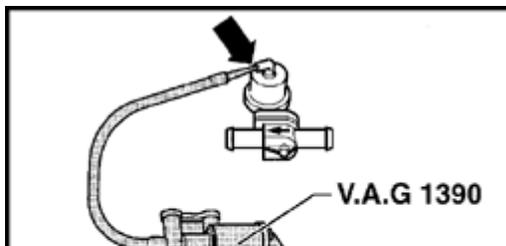
- Remove vacuum valve.

A

- Connect US 8012 hand pump to vacuum valve -arrow-.

- Operate hand vacuum pump.

- ◆ Vacuum valve must close



If vacuum valve does not close:

- Replace vacuum valve.

Note:

Note installed position (arrow on vacuum valve points to After-run coolant pump).