AIR-CONDITIONING SERVICE
COMPRESSOR REPLACEMENT
AND FLUSHING THE AIR-
CONDITIONING SYSTEM
The air conditioning compressor is driven by the vehicle engine via a ribbed or V-ribbed belt. It compresses and transports the refrigerant in the system. There are different types of compressor design.

How it works
The refrigerant is sucked in as a gas at low pressure and low temperature from the evaporator; it is then compressed and sent to the condenser as a gas at high temperature and high pressure.

Effects of failure
A damaged or failed compressor can manifest itself as follows:
- Leakage
- Development of noise
- Insufficient or no cooling performance
- Error code in the air-conditioning control unit or engine / central control unit

There are a number of possible causes of failure:
- Bearing damage caused by a defective tensioner or by wear
- Leaks in the compressor shaft or the housing
- Mechanical damage to the compressor housing
- Contact (electrical connections)
- Electrical control valve
- Lack of refrigerant oil
- Lack of refrigerant
- Solids (e.g. swarf)
- Humidity (corrosion etc.)
- Defective tensioning elements and ancillary units

Troubleshooting
Function test and pressure measurement of the system:
- Does the compressor switch on? Is the connector plug securely in place? Is power applied?
- Check the electrical control valve and/or the activation circuit.
- Check that the drive belt is positioned correctly, undamaged, and that there is power.
- Check visually for loss of sealing.
- Check that refrigerant hoses are securely in place.
- Compare the pressures on the high and low-pressure sides.
- Read out the event memory in newer systems.

NOTE!
Before installing a new compressor, you must check the oil quantity and the viscosity according to the manufacturer’s instructions and refill as needed! (see also: workflow on the following page).
COMPRESSOR CROSS-SECTION

Screw connections  Gear wheel  Oil filler cap

Mounting hole  Driving shaft

Suction pressure valve  Cylinder head  Seal

Lifting pin  Wobble plate
IS THE COMPRESSOR DEFECTIVE?
WORKFLOW FOR ERROR ANALYSIS AND REPLACEMENT

IDENTIFY CAUSES:
- a) Refrigerant circuit error
- b) Electrical error
- c) Error in the vicinity of the compressor (drive belt, ancillary units)

OK

Not OK

Check the installed compressor

PRACTICAL TIP
- a) Magnetic coupling
- b) Mechanical damage
- c) Electrical control valve
- d) Leakage

Drain off the refrigerant

Remove the compressor

Install a new or repaired compressor

Replace the expansion/throttle valve/filter-dryer/accumulator and O-rings

Using the service station
1. Generate a vacuum
2. Carry out leak detection
3. Fill with refrigerant

1. System pressure test
2. Leak detection
3. System check

Attach service sticker
Carry out a test drive
Document completed work

EXTREMELY IMPORTANT!
The entire air-conditioning system must be flushed and any consumables or components that cannot be flushed must be replaced when the compressor is replaced.

EXTREMELY IMPORTANT!
Before installing a new compressor, you must check the oil quantity and the viscosity according to the manufacturer’s instructions and refill as needed: The compressor must be emptied and then refilled with the amount specified by the manufacturer. Replace the O-rings during assembly.

EXTREMELY IMPORTANT!
Filling the air-conditioning system Run-in specification

PRACTICAL TIP
- If necessary, install a filter screen in the suction line on the compressor before assembly

PRACTICAL TIP
Follow the manufacturer’s instructions:
- a) Duration of vacuum
- b) Refrigerant filling quantity

PRACTICAL TIP
Pour in leak detector

See the following page
1. **THOROUGH FLUSHING**

Particles of dirt in the air-conditioning circuit can only be removed by flushing the entire system thoroughly. Depending on the level of contamination, R134a refrigerant can be used or a special flushing solution such as the one in the Hella Gutmann Solutions product range. Compressors, dryers (accumulators), expansion valves and throttle valves cannot be flushed. Since you must always assume that the system is contaminated (abrasion, swarf) when a compressor is defective and this possibility cannot be ruled out, the system must always be flushed when this component is replaced.

2. **REFRIGERANT OILS**

Follow the manufacturer’s instructions and instruction leaflets / note the viscosity.

1. **Distribution of the oil**

There is refrigerant oil in every component of the air-conditioning system. The oil is removed with the replaced component during repairs. It is therefore essential to refill the appropriate quantity of oil. The graphic shown below shows the average distribution of the quantities of oil within the system.

2. **Observe the quantity and specification of the oil**

Before installing a new compressor or refilling refrigerant oil, check the oil quantity and the viscosity in the vehicle manufacturer’s instructions.

3. **Correct the quantity of system oil in the compressor**

Since the same compressor can potentially be used for different vehicles or systems, you must check or correct the oil filling quantity before installing the compressor. All the oil must be siphoned off and collected. The compressor must then be refilled with the entire oil quantity specified by the vehicle manufacturer (system oil quantity). The compressor must be spun 10 x by hand before being installed to ensure the oil is distributed evenly. This also complies with the instructions from Sanden, the compressor manufacturer. The instructions of other vehicle manufacturers must be followed in each case.

3. **COMPRESSOR FILTER SCREENS**

Every air-conditioning system must be flushed when the compressor is replaced in order to remove contamination and foreign bodies from the system. If there is still contamination in the circuit despite flushing, damage can be prevented by the use of filter screens in the suction line; see the Hella Gutmann Solutions tool catalogue.
EXTREMELY IMPORTANT!
Replace all O-rings and wet them with refrigerant oil before installation. Before installing a new compressor, you must check the oil quantity and the viscosity according to the manufacturer’s instructions and refill as needed! The entire air-conditioning system must be flushed and the consumables and any components that cannot be flushed must be replaced when the compressor is replaced!

FILLING THE AIR CONDITIONING SYSTEM WITH REFRIGERANT

Run-in specification for the compressor:
➔ Only fill the refrigerant using the air-conditioning service station via the high-pressure side service connection to prevent pressure surges of refrigerant in the compressor.
➔ Only the correct refrigerant in the quantity/specificatio defined by the vehicle manufacturer may be used.
➔ Set the air distribution to “centre vents” and open all centre vents.
➔ Set the switch for the fresh air fan to medium.
➔ Set the temperature to maximum cooling.
➔ Start the engine (without running the air-conditioning) and run the engine for at least 2 minutes without interruption at idle speed.
➔ While at idle speed, turn on the air conditioning for approx. 10 seconds, then turn off the air conditioning for approx. 10 seconds. Repeat this procedure at least 5 times.
➔ Carry out a system check.

LEAK DETECTOR
Compressor damage can also be caused by a lack of refrigerant. It is recommended that air-conditioning maintenance be carried out regularly and that contrasting agent be added to the system for this reason, if necessary. There are various methods for doing this – see the Hella Gutmann Solutions tool catalogue. Document the use of contrast agents in the vehicle. This prevents the system from being overfilled, which in extreme cases can cause damage to the compressor.
FLUSHING THE AIR-CONDITIONING SYSTEM
THE METHODS
There are two methods for flushing air-conditioning systems:

- **Flushing method A:**
  Flush with refrigerant and service stations

- **Flushing method B:**
  Flush with flushing liquid (step 1),
  Blow out / dry using nitrogen (step 2)

**CAUTION!**
The entire air-conditioning system must be flushed and any consumables or components that cannot be flushed must be replaced when the compressor is replaced!

Flushing air-conditioning systems is extremely important when repairs are carried out or if a compressor is damaged. Flushing removes contaminants and harmful substances from the air-conditioning circuit.

Flushing is required for repairs to be performed properly and in order to avoid expensive subsequent repairs. In addition, flushing ensures warranty claims can be made against suppliers—and guarantees customer satisfaction.

However, do not flush compressors, expansion/throttling valves or filter dryers and/or accumulators. Use adapters to bridge these components during the flushing process. After flushing, the aforementioned valves and filters must be replaced.
METHOD A
FLUSHING WITH REFRIGERANT AND SERVICE STATION

The Hella Gutmann Solutions Husky air-conditioning service unit with integrated flushing function makes it possible to flush air-conditioning systems rapidly and economically with liquid R134a refrigerant. An external flushing device and parts from a flushing adapter set must also be used—both are available separately. After the function has started on the device, the vehicle air-conditioning system is filled with liquid refrigerant which is then drained out again. This cycle should be carried out three times to achieve maximum cleaning performance.

Besides flushing the air-conditioning system with refrigerant, it is also possible to flush the system with a special chemical flushing liquid and blow it out with nitrogen. Only the combination of these two methods is effective, as the flushing liquid is required for chemical cleaning and the nitrogen serves to remove the remnants of flushing liquid and dry the system.

Hella Gutmann Solutions Husky series for R134A

The Husky is characterised by numerous features, as e.g.:

- User-friendliness
- Vehicle database (can be updated over the Internet)
- Fully automated air-conditioning service (compliant with SAE J2788)
- Special filling process for hybrid and electric vehicles (optional)
- Robust and secure fluid weighing scales
- Moisture protection oil/UV management
- Automatic drainage of incondensable gases
- Power boost filling function for quickly filling the air-conditioning system
- Prepared for the automatic push-pull flushing process (optional) in conjunction with a flushing device
- Preparation for nitrogen pressure testing
- USB connection for data exchange with a PC
- Bluetooth connection to PC (optional)
- Temperature sensor with 5 m cable
- Cordless temperature sensor (optional)
- Straightforward maintenance and calibration
ACCESSORIES FOR METHOD A: FLUSHING WITH THE HUSKY TOOLS FROM HELLA GUTMANN SOLUTIONS

Hella Gutmann Solutions flushing device
This device supports the flushing process (R134a refrigerant) using Hella Gutmann Solutions air-conditioning service units. It is connected between the air-conditioning service unit and the vehicle air-conditioning system. This unit ensures that the liquid refrigerant flows through the entire section of the air-conditioning system that is to be flushed. The transparent containers help the user to recognise when the liquid refrigerant flows back out of the system without any contaminations, which means the flushing process can be stopped.

Part number: 8PS 351 327-641

Hella Gutmann Solutions flushing device +
This flushing device allows the air-conditioning system to be rinsed in conjunction with the Hella Gutmann Solutions air-conditioning service devices. It has a detachable glass cylinder “inspector” that can be connected individually to the air conditioning system and allows a visible inspection of the refrigerant and the oil.

Part number: 8PS 351 327-631

Hella Gutmann Solutions adapter kit
The case includes a range of different adapters. The adapters are required to bridge various components, such as expansion valves, when flushing the vehicle’s air-conditioning system. The adapters can also be used to attach the hoses from the flushing device to the various lines and components of the vehicle’s air-conditioning system. The case includes a total of 50 single parts.

Part number: 8PS 351 327-661

Hella Gutmann Solutions Husky series for R134A
The Hella Gutmann Solutions Husky air-conditioning service unit is indispensable for professional use in garages and is characterised by numerous features (see left). With an integrated flushing function, the unit makes it possible to quickly and inexpensively flush air-conditioning systems with liquid refrigerant R134a.

Part number: 8PS 179 500-021
**METHOD B**

**STEP 1: FLUSHING WITH FLUSHING LIQUID**

In this method, the air-conditioning system is cleaned with a special flushing liquid (in combination with compressed air). After the flushing process, the system must be dried with nitrogen. This method is particularly suitable for the conversion of R12 to R134a and for R1234yf air conditioning systems. R1234yf refrigerant is still quite expensive, which means that chemical rinsing is an inexpensive alternative.

**Hella Gutmann Solutions flushing set 100**  
For cleaning with flushing liquid (in combination with compressed air)

**Set includes:**
- Flushing gun with tapered connector resistant to oil and acids
- 1-litre supply bottle (pressure relief valve, quick connection with pressure gauge, ventilation valve), spiral hose and wall bracket (an additional 1/4" adapter with a right-hand thread is required for connecting the compressed air specifically at the garage)
- 5-litre plastic tank (to collect the flushing liquid used), connection cover, clear hose and connection cone
- 2 fastening clips for cone adapter

Part number: **8PE 351 310-001**

Note: Nitrogen must be used to dry the system after flushing with the flushing liquid.

**STEP 2: BLOWING OUT / DRYING WITH NITROGEN**

In this method, the connection lines and system components must be blown out individually with nitrogen. Ensure that the maximum pressure during blowing out does not exceed 12 bar.

**Hella Gutmann Solutions air-conditioning system nitrogen set 150**  
For blowing out and drying with nitrogen

- Nitrogen pressure reducer
- Universal flushing adapter with connection cone
- Hose lead

Part number: **8PE 351 310-111**
ADVANTAGES AND DISADVANTAGES OF FLUSHING METHODS A AND B:

**METHOD A**

Refrigerant

**FLUSHING METHOD**
System components are flushed using the Hella Gutmann Solutions air-conditioning service unit and an additional flushing device with filter and adapters (both available separately).

**ADVANTAGES:**
- No costs for the flushing agent
- No disposal costs for the flushing agent
- Removes oil and loose particles of dirt
- Method approved by various vehicle manufacturers

**DISADVANTAGES**
- Cleaning is not optimum for stubborn dirt
- The filter element of the flushing device has to be replaced regularly
- The air-conditioning service unit is not available during the procedure

**METHOD B**

Flushing liquid

**FLUSHING METHOD**
System components are flushed using the Hella Gutmann Solutions air-conditioning service unit and an additional flushing device with filter and adapters (both available separately).

**ADVANTAGES:**
- Removes oil as well as loose and persistent particles
- Excellent cleaning results

**DISADVANTAGES**
- Costs for the flushing agent
- Disposal costs for the flushing agent
CONTAMINATION EFFECTS

What contaminants can be removed by flushing?
What are the consequences of these types of contamination?

➔ Abrasion when the compressor is damaged
   The particles from materials block expansion valves, throttle valves (orifice tubes) or multi-flow components (condenser and evaporator).

➔ Humidity
   Expansion valves and orifice tubes can freeze up. Acids that make hoses and O-rings porous can form as the result of chemical reactions between refrigerants / refrigerant oils and humidity. The system components are then damaged by corrosion.

➔ Elastomers (rubber)
   The elastomer particles block expansion valves, orifice tubes or multi-flow components.

➔ Contaminated refrigerant oil or refrigerant
   Contaminated refrigerant or a mixture of different refrigerants can cause acids to form. The acids can make hoses and O-rings porous. Other system components can then be damaged by corrosion.

ADDITIONAL PROTECTION PROVIDED BY COMPRESSOR FILTER SCREENS

Hella Gutmann Solutions filter screen tool set
To provide the compressor with even better protection from damage caused by impurities, Hella Gutmann Solutions provides a filter screen tool set comprising the following:

➔ Installation and removal tool
➔ 20 different sizes of filter screen (3 each)
➔ Sticker to indicate that the suction line contains a filter screen

Part number: 8PE 351 231-701

The filter screens may be purchased in a total of 24 different sizes in sets of 5 pieces.
Alongside Behr Hella Service, with Hella Gutmann Solutions you have yet another strong partner to help with matters concerning thermal management.

**Behr Hella Service gives you:**
- Air-conditioning system spare parts
- Liquids and oils

**Hella Gutmann Solutions gives you:**
- “Husky” air-conditioning service device
- Tools e.g. flushing devices, flushing liquids
- Consumables e.g. O-rings, filter screens

Refer to the last page for contact information.
HELLA Limited
Unit 6 Appletree Industrial Estate
Chipping Warden
Banbury, Oxon
OX17 1LL
England, UK
Tel.: (01295) 662400
Fax: 0800 7832571
E-mail: hella.sales@hella.com
Website: www.hella.co.uk

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