THEME COMMON FAILURES IN AC SYSTEM SERVICING ADDITIVES HARMFUL TO THE COMPRESSOR

PROBLEM IRREVERSIBLE AC COMPRESSOR DAMAGE OCCURING SHORTLY AFTER COMMON SERVICE PROCEDURES

CAUSE IMPROPER USE OF AC SYSTEM ADDITIVES IMPAIRING THE COMPRESSOR LUBRICATION

BULLETIN CONTENT

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A. ADDITIVES - COMMON CAUSES OF AC COMPRESSOR LUBRICATION PROBLEMS

Correct lubrication is a crucial factor for the compressor's proper and long operation. All inner moving parts are fitted with millimeter precision and the lubrication is essential for their friction-free movement. A thin oil film between the pistons and cylinders ensures their smooth operation and proper refrigerant sealing. Furthermore, the lubricant works as a cooling agent, extracting heat from the compressor and preventing overheating.

One of the common issues encountered in the typical compressor failures is the lubricant being impaired by additives. In many cases these type of failures occure just after performing a standard AC service procedure or a new component replacement. As only proper flushing prior to the final charge can ensure the correct inner cleanliness of the system, contaminants or contaminated lubricant not removed or flushed totally out of the system are the source of the problem.

In general, it is not wrong to use additives, but improper use can be harmful. Excessive use or application of improper quality addivites is one of the most common causes for serious compressor failures.

Common lubrication problems:

Lubrication problem	Additive related	Details	Impact on AC Compressor
IMPROPER TYPE OF LUBRICANT		Lubricant characteristics not matching the compressor requirements in terms of chemical structure, viscosity, hygroscopy and miscibility	Overheating Seizure
LACK OF LUBRICANT		Caused by system leakage or improper AC system service	Overheating
LUBRICANT OVERDOSE		Too much lubricant added compared to the vehicle's manufacturer recommendation	Overpressure > Overheating Seizure
SYSTEM LEAKAGE		Due to lack of refrigerant or no circulation of the lubricant	Overheating Seizure
IMPROPER USE OF ADDITIVES	YES	Use of some AC system additives may impair the lubricant's characteristics, specifically improper use of UV dye and AC system leak-stop agents	Overpressure Overheating Seizure
POOR-QUALITY ADDITIVES	YES	Use of non OE-approved, poor-quality AC system additives impairs the lubrication and can cause uncontrolled chemical reactions inside the system. Applicable specifically for: UV dye and AC system leak-stop agents	Inner stoppages > impaired control Overheating Seizure
MOISTURE IN THE SYSTEM	YES	Moisture impairs the lubricant's characteristics. If a polymerizing leak-stop agent applied moisture can lead to further chemical reactions in the system thus complete breakdown of the compressor.	Inner stoppages > impaired control Overheating Seizure Inner corrosion
SYSTEM CONTAMINATION	YES	 System contamination impairs the lubricant's characteristics. particles created in chemical reactions between additives & other system components carbonized oil particles due to overheating poymerizing leak-stop agents reacting with moisture 	Inner stoppages > impaired control Overheating Seizure Inner corrosion

Various scenarios spotted in a visual diagnostic tool. Improper look of the AC loop contents with the lubricant affected:







DARK GREEN COLOR

Visibly too much UV dye in the system

RED / ORANGE COLOR

Visibly too much red leak-tracing dye in the system

VISIBLE BUBBLES / PEARLS

Moisture in the system, contamination caused by bad quality additives, improper vacuum pulled during last services







JELLY-LIKE, CRYSTALLIZED CONSISTENCY

Bad quality leak-stop agents reacting with refrigerant/oil or UV dye, no/improper vacuum was pulled before leak-stop application

MILKY, UNCLEAR CONSISTENCY

Aggressive flushing agent residues reacting with aluminum and Tefton coating the compressor's inner parts, improper flushing and no proper vacuum pulled after flushing

UNEVEN LIQUIDS MIXTURE

Application of universal/improper oils, uneven, non-homogeneous mixture of different oils







B. ADDITIVES INVOLVED IN COMMON AC SERVICE FAILURES

B.1. Possible Failure Scenarios Polymer-based leak-stop agents



Outcome





IDENTIFIED

Jelly-like or crystallized sticky substance inside of the compressor and other system components

WHAT HAPPENED?

Uncontrolled moisture reaction with a leak-stop agent. The agent reacts excessively, and instead of treating small leakages causes an uncontrolled crystallization. This causes stoppages inside the compressor and inside other components of the system.

IMPACT ON COMPRESSOR

Inner blockages - wobble plate / pistons / valves / ECV/MCV stuck:

- abnormal operation mainly lack of performance
- no or limited displacement control
- piston/cylinders cannot move in the proper way

Impaired lubrication leading to overheating thus the compressor to seize

IMPACT ON THE SYSTEM

Inner flow blockages causing overpressure and overheating - limited flow through condenser/evaporator channels

Inner flow blockages causing improper operation - EXV valve/expansion device stuck



B.2. Possible Failure Scenarios UV dye



Outcome





IDENTIFIED

Oil tapped out of AC compressor characterized by an intense green or a dark green color indicating an extensive amount of UV dye in the system.

Visibly intense green color spotted on compressor charge/discharge ports or other couplings of the AC loop.

WHAT HAPPENED?

An extensive amount of UV dye causes oil to dilute, thus impacting its lubricative parameters, and viscosity and density specifically. The system and its components, especially the compressor, are not lubricated properly.

IMPACT ON COMPRESSOR

Poor or improper lubrication leads to:

- Increased frictions thus seizure
- Ovepressure overheating
- Overheating seizure
- Complete breakdown of the AC compressor

NB! Overheating of the oil can also lead to carbonization and creation of solid particles that further contaminate the compressor valves and limit flow and regulation of the compressor.



C. MYTHS REGARDING ADDITIVES AND OTHER SUBSTANCES IMPAIRING THE LUBRICANT

SUBSTANCE INVOLVED	MYTH	FACTUAL DATA
UV	Overdosing of the UV dye is good for better spotting of possible leak.	In fact, an excessive use of UV dye can shorten spotting of larger leakages in an untight system. However, UV dye overdosing is extremely harmful to the lubricant and leads to expensive failures of the compressor. Furthermore, UV dye will not spot leakages caused by porosity of the rubber applied on the hoses' outer lining, which often is the cause of the refrigerant loss from the system (e.g. by bending the hose causing injury to the inner lining).
UV	Quality of the UV dye does not matter	Quality of the UV dye is crucial as it may affect the lubricant characteristics. The safest choice is always a UV dye that is OE approved, matching the lubricant characteristics and being co-solvent free.
SOLDERING FLUX	Soldering flux reacts chemically with UV dye and lubricant, causing formation of a jelly-like, crystallized substance inside of the system	Flux is a term for a specific substance necessary for soldering of aluminum compounds. A thorough chemical analysis revealed that the formation of the characteristic, sticky jelly-like substance is not flux-based. Chemical analysis had not discovered any flux chemical compounds in the jelly-like substance collected from various claim samples. Furthermore, the substance's chemical characteristics eliminates the claimed reaction between the flux, lubricant and UV dye.
SOLDERING FLUX	There is a harmful amount of flux inside of non-OE condensers	The modern construction of condensers could not be produced without flux, and it is widely used by all heat exchanger manufacturers – both OE and non-OE. Flux works as an activator, etching the aluminum and allowing the formation of strong solder joints. As with any other substances, when used excessively, flux could affect the lubricant characteristics. However, independent laboratory analyses have confirmed the precise amounts of flux ingredients tracked in a number of condensers, both OE and non-OE produced. Average amounts of flux compounds recorded in condensers: OE Fluoride: 41 mg/L Aluminium: 12.860 ug/L Potassium: 70 mg/L Nissens Fluoride: 25,5 mg/L Aluminium: 8.918 ug/L Potassium: 47,9 mg/L The amount of flux residues in Nissens condensers is at a minimum level that is completely safe for the system.
LEAK-STOP	Any type of leak-stop can be used in the system	Use of specific additives, among others leak-stop agents, can be harmful to the system. Based on the additive characteristics, possible reaction with the given condition of the system may exclude it from the use recommendation. In general, use of polymerizing agents is not recommended for systems with a larger moisture contamination.



D. RECOMMENDED SOLUTIONS

D.1. Additives

UV Dye	Always use an OE approved and co-solvent free dye. Do not exceed the amount prescribed by the dye manufacturer to be added to the system. As the dye mixes and travels along with the lubricant, dosing the additive always refers to the total lubricant volume defined for the given vehicle model by its manufacturer. Flush the system to remove the lubricant and UV dye completely from the system. Notice that the automatic recovery performed by a RRR station cannot remove all of the lubricant. Flushing and charging a completely empty system is the only way to determine the correct amount of oil with dye for the given vehicle.
Leak-stop agents	Apply only additives approved by OE. Always conform with the additive dosing instructions and with the vehicle manual/OE bulletin. Avoid using polymer-based agents or agents reactive to moisture.

D.2. Service & Maintenance

Visual Inspection	Inspect the system a regular basis - control the refrigerant charge level, and inspect the loop and components for any potential leaks. Look for oil residues on component surfaces that may indicate leaks. If any leakage occurs, repair it immediately. Using a visual inspection tool (sight glass), inspect the loop contents. Pay attention to the previously applied UV dye, and in general to a look and condition of the refrigerant and oil – e.g. dark color, particles etc.
Flushing	Always flush the system whenever replacing the compressor or whenever visual inspection has revealed some serious contaminations. Residues of metal particles from a previously seized compressor, moisture, other solid particles and contamination are harmful to the lubricant, and thus destructive to the new compressor. Flush using a dedicated flushing agent or by refrigerant. After flushing by an agent, make sure that a proper and extended-time vacuum is pulled to eliminate any moisture residues. Flushing and emptying the system prior to oil charge is the only way to determine the correct lubricant volume in the system.
Eliminate moisture	 Moisture is always harmful to the system. Whenever leak-stop agents are applied, they can lead to further, uncontrolled chemical reactions. Pay specific attention to the following: Do not let the system stay open Whenever opening the system, replace the receiver-dryer Make sure your RRR station is maintained regularly and does not contaminate the refrigerant Make sure that any flushing agent, oil and other additive residues are fully removed from the system. Pull vacuum for a minimum of 45 minutes

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