

## Applied Failure Analysis

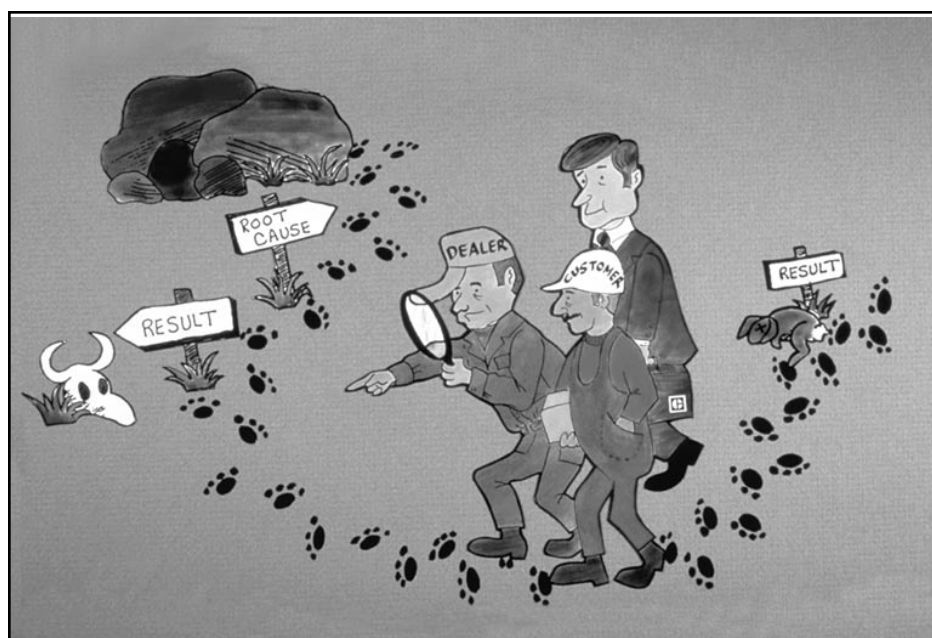
Service Training Meeting Guide 020

SESV8020

September 2000

# CATERPILLAR

## TECHNICAL PRESENTATION



# APPLIED FAILURE ANALYSIS PRINCIPLES OF LUBRICATION

# LUBRICATION FAILURE ANALYSIS

## MEETING GUIDE

## SLIDES AND SCRIPT

### AUDIENCE

Service, service support and administrative staff personnel who are or may be involved in investigating lubrication related failures.

### CONTENT

This presentation describes function, classification, structure, characteristics, common failure modes, and testing of lubricants.

### OBJECTIVES

After learning the information in this presentation, the student will be able to:

1. identify the primary functions of lubricants used in Caterpillar products;
2. describe the key elements of, and differences between, (SAE) viscosity classifications and (API) service classifications;
3. identify key characteristics of lubricant base stock and describe the effect each has on lubricant performance;
4. identify key characteristics of viscosity, lubricity, degradation/contamination additive types, and describe the effect each has on lubricant performance;
5. identify common lubrication modes of failure (wrong ingredients, degradation, contamination);
6. describe common field tests of lubricants, how the tests are performed, and what information the tests reveal.

### REFERENCES

Principles of Lubrication Applied Failure Analysis Reference Book SEBV0567

### PREREQUISITES

AFA STMG 013 Failure Analysis Management	SERV8013
AFA STMG 017 Basic Metallurgy	SERV8017
AFA STMG 014 Principles of Fractures	SERV8014
AFA STMG 015 Principles of Wear	SERV8015

Estimated Time: 4 Hours

Visuals: 184 electronic images

Student Handouts: None

Form: SESV8020

Date: 9/2000

## TABLE OF CONTENTS

INTRODUCTION .....	5
LUBRICANT TYPES .....	14
LUBRICANT FUNCTIONS .....	24
LUBRICANT CLASSIFICATIONS .....	39
Viscosity.....	41
Service Classification.....	53
Other Classifications.....	56
LUBRICANT STRUCTURE .....	57
LUBRICANT CHARACTERISTICS .....	68
Base Stocks .....	69
Additives .....	90
SEMI-SOLID LUBRICANTS.....	121
LUBRICATION FAILURE MODES .....	130
Wrong Ingredients.....	131
Degradation.....	132
Contamination.....	145
OTHER FACTORS.....	173
FIELD TESTS .....	178
CONCLUSION.....	185
SLIDE LIST .....	190

## **INSTRUCTOR NOTES**



1

- **Background information**

## INTRODUCTION

Good failure analysis often requires background information about products, especially about working environments and system conditions.

Many times it is an environment or system condition that is the root cause of the failure. Of all the systems which cause failures, the lubrication system is most frequently involved.

# *BASICS OF LUBRICATION*

2

- **Basics of lubrication**

- **Function**
- **Structure**
- **Operation**
- **Lubrication failure mode**
- **Field tests**

Other failure analysis presentations include some discussion about lubrication, but this presentation covers the basics of lubrication in more detail.

This presentation includes the functions of lubrication, oil classification systems, lubricant structure, characteristics, common lubrication failure modes, and field testing of lubricants.

## *Tribology*

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The science and technology  
of interacting surfaces in  
relative motion.

3

- **Tribology**

Lubrication is only a part of a bigger picture called tribology, the science and technology of interacting surfaces in relative motion.

-or-  
The contact, friction  
and wear process.

4

- **Contact, friction and wear**

In simpler words, tribology is the contact, friction and wear process.



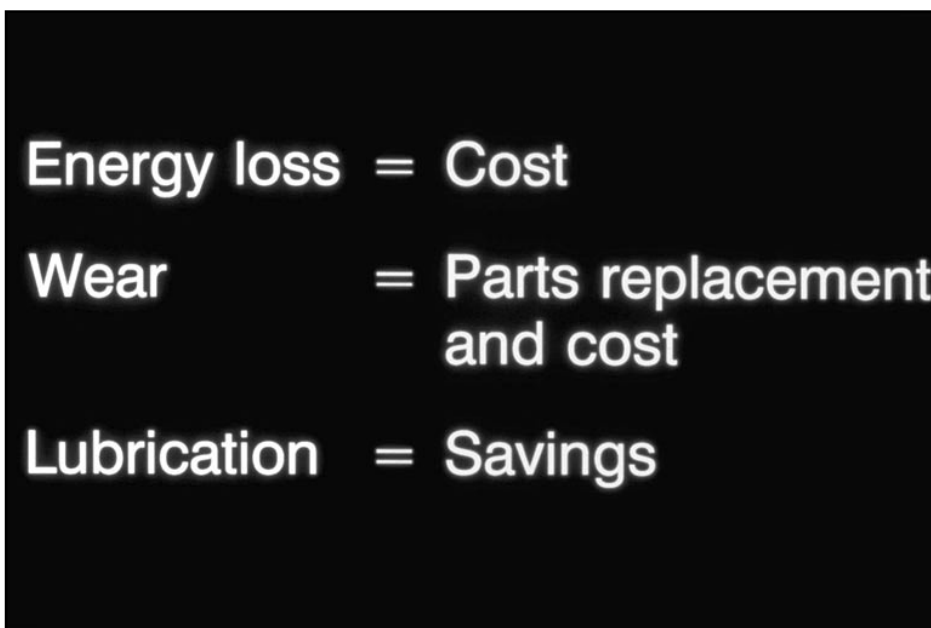
## *Friction Produces:*

- Energy loss
- Wear

5

- **Friction produces**
  - **Energy loss**
  - **Wear**

Friction is usually undesirable because it produces energy loss and accelerates wear. However, friction is sometimes desirable in steering, braking, and transmission clutches.



6

• Friction = cost

• Lubrication = savings

Both energy loss and wear increase costs and hasten parts replacement.

Careful use of friction reducing lubricants can therefore return big savings to owners and operators.