



Chapter 5

ENGINE LUBRICATION SYSTEM

Learning Objectives:

As a result of this chapter, you will be able to:

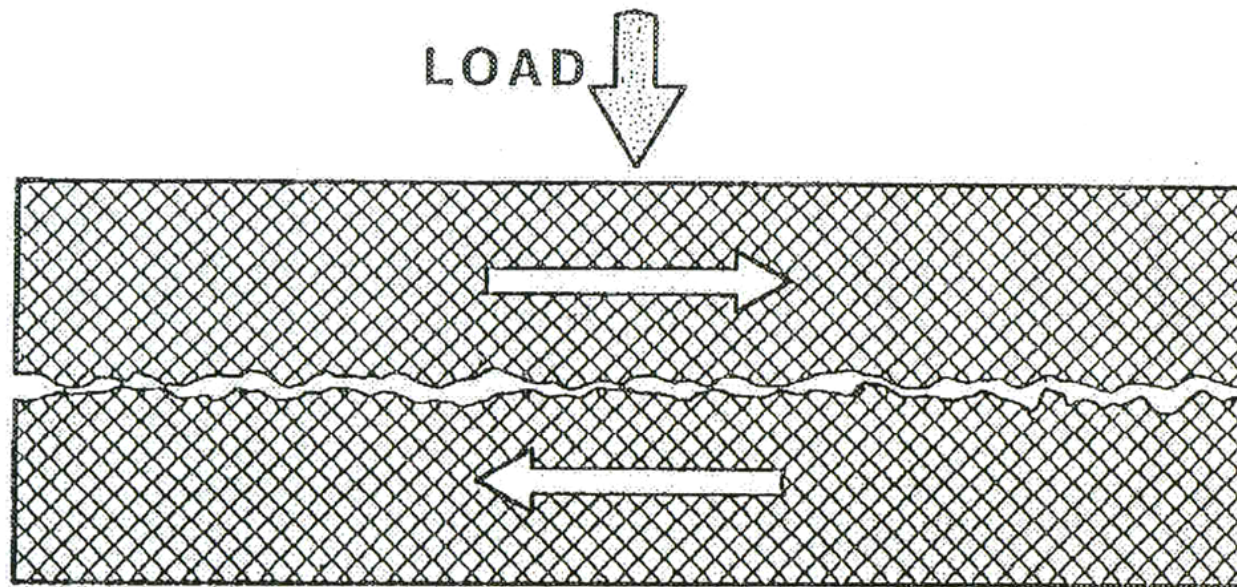
1. Define lubrication and the types of friction.
2. State the function of the diesel engine lubrication system.
3. Identify the major components of the typical diesel engine lubrication system and trace the flow path of the lubricating oil through the engine.
4. State the purpose and describe the operation of the lubrication oil keep warm and pre-lube system(s) as are commonly used on nuclear plant diesel engines.

Lubrication Fundamentals

- Lubrication is defined as the application of lubricants to minimize friction between moving contact surfaces.
- Friction is the force that acts at the contact surface between two bodies which causes resistance to their relative motion.
- Forced movement of adjacent surfaces can wear away the surfaces and also create heat as illustrated in Figure 5-1. Types of friction are illustrated in Figures 5-2 and 5-3.



FRICTION

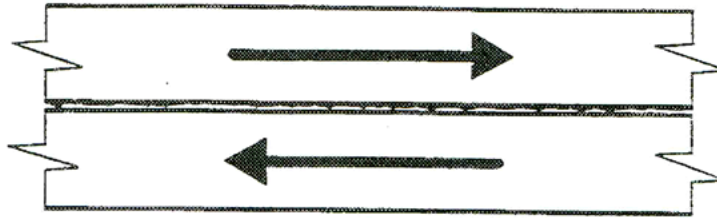


FRICTION - "The force that acts at the surface of contact between two bodies which causes resistance to their relative motion."

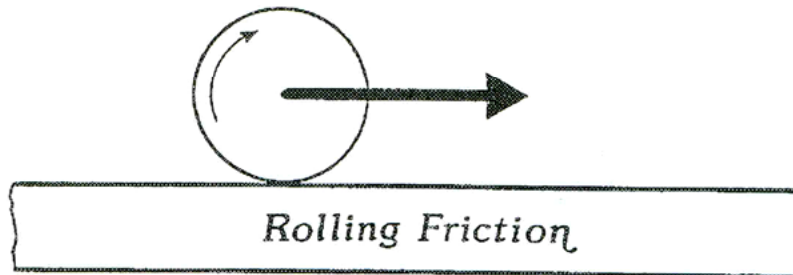
Figure 5-1

Frictional Surfaces

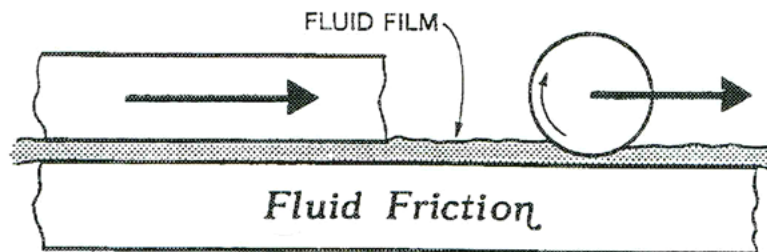
TYPES of FRICTION



Sliding Friction



Rolling Friction



Fluid Friction

Figure 5-2 Types of Friction

Figure 5-2

Types of Friction

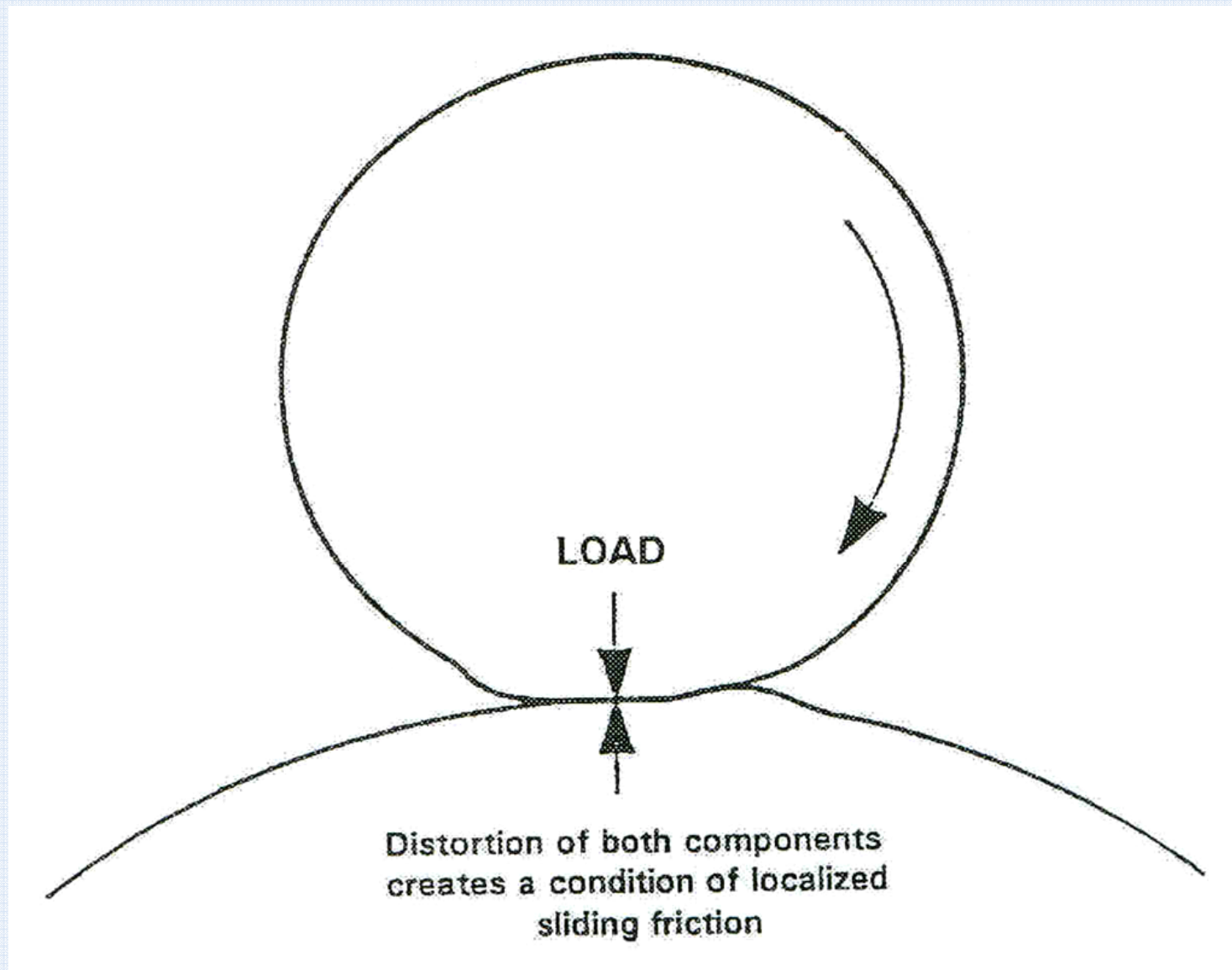


Figure 5-3 Rolling Friction

Lubrication to achieve fluid friction is accomplished by lubricant wedge formation with laminar flow of the lubricant between the surfaces, as illustrated in Figures 5-4 and 5-5. Application of this principle to the crankshaft is illustrated in Figure 5-6.

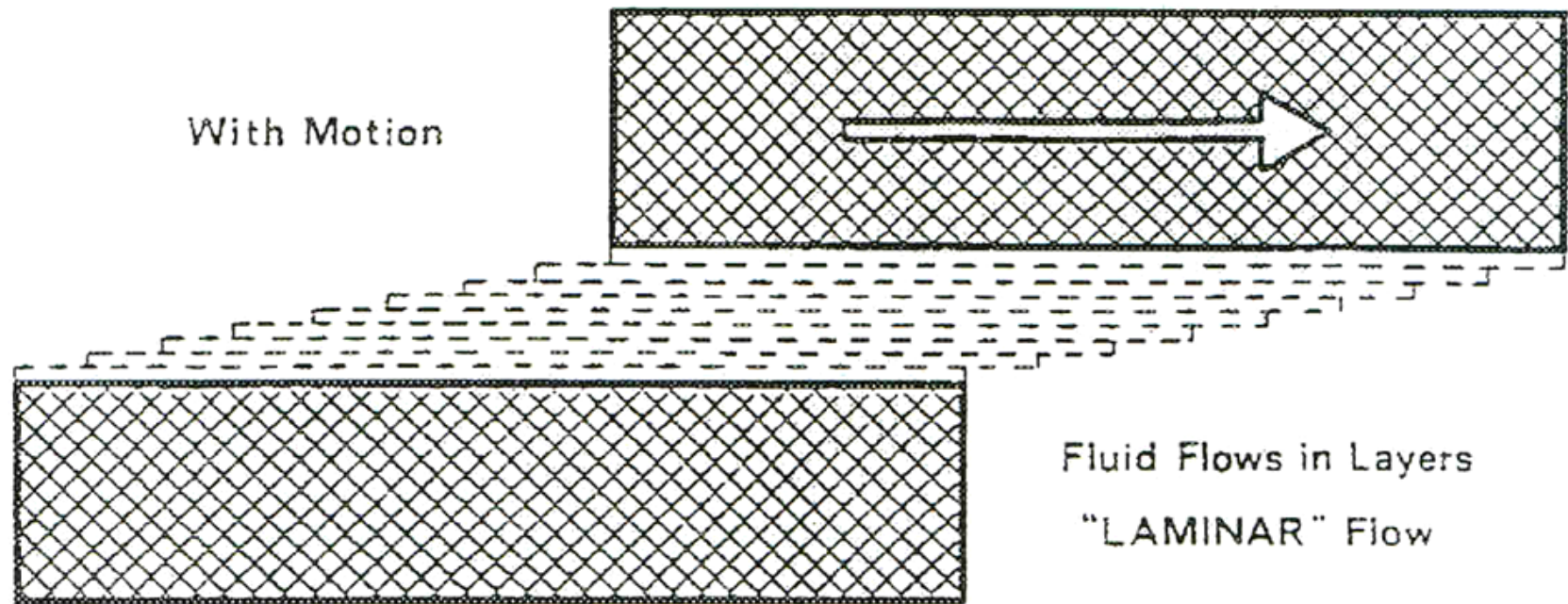
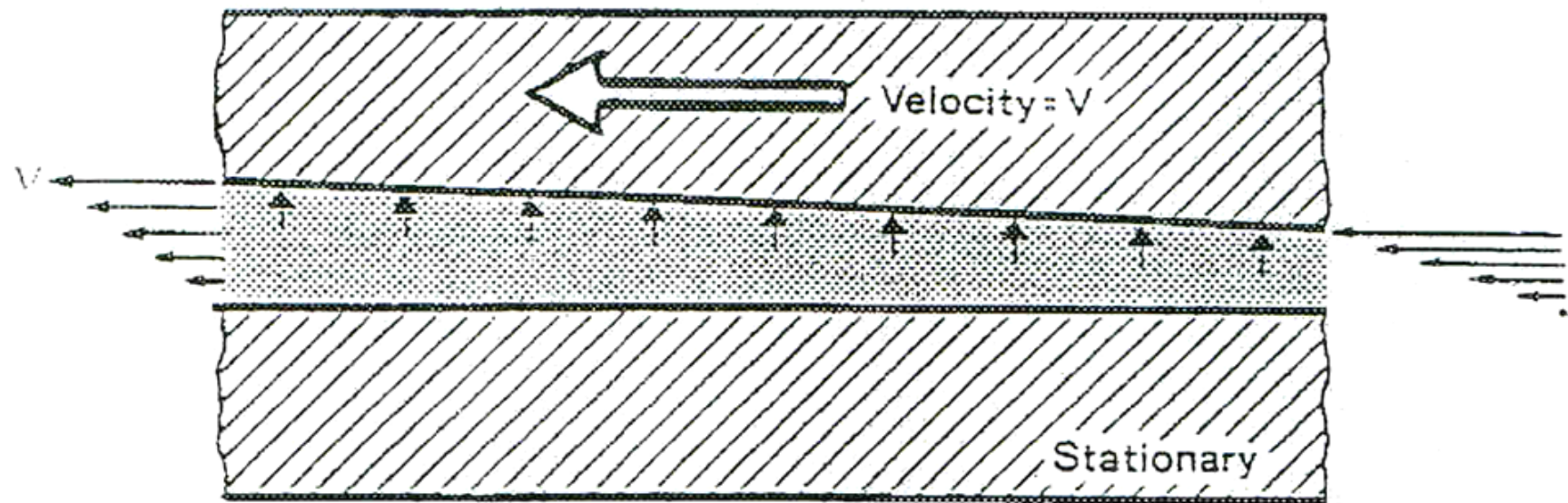


Figure 5-4 Laminar Action



Nonparallel Surfaces

Figure 5-5 Wedge Formation

SHAFT AND BEARING LUBRICATION

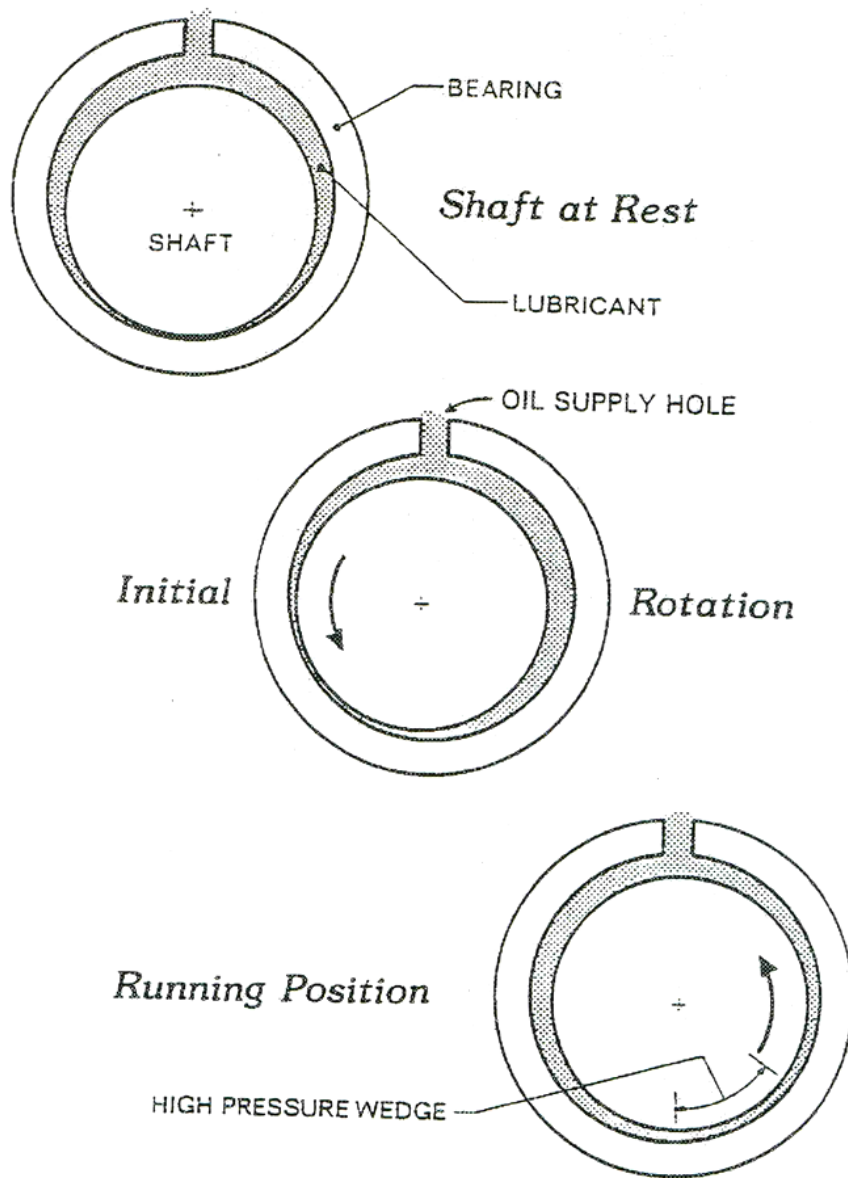


Figure 5-6

Shaft and Bearing

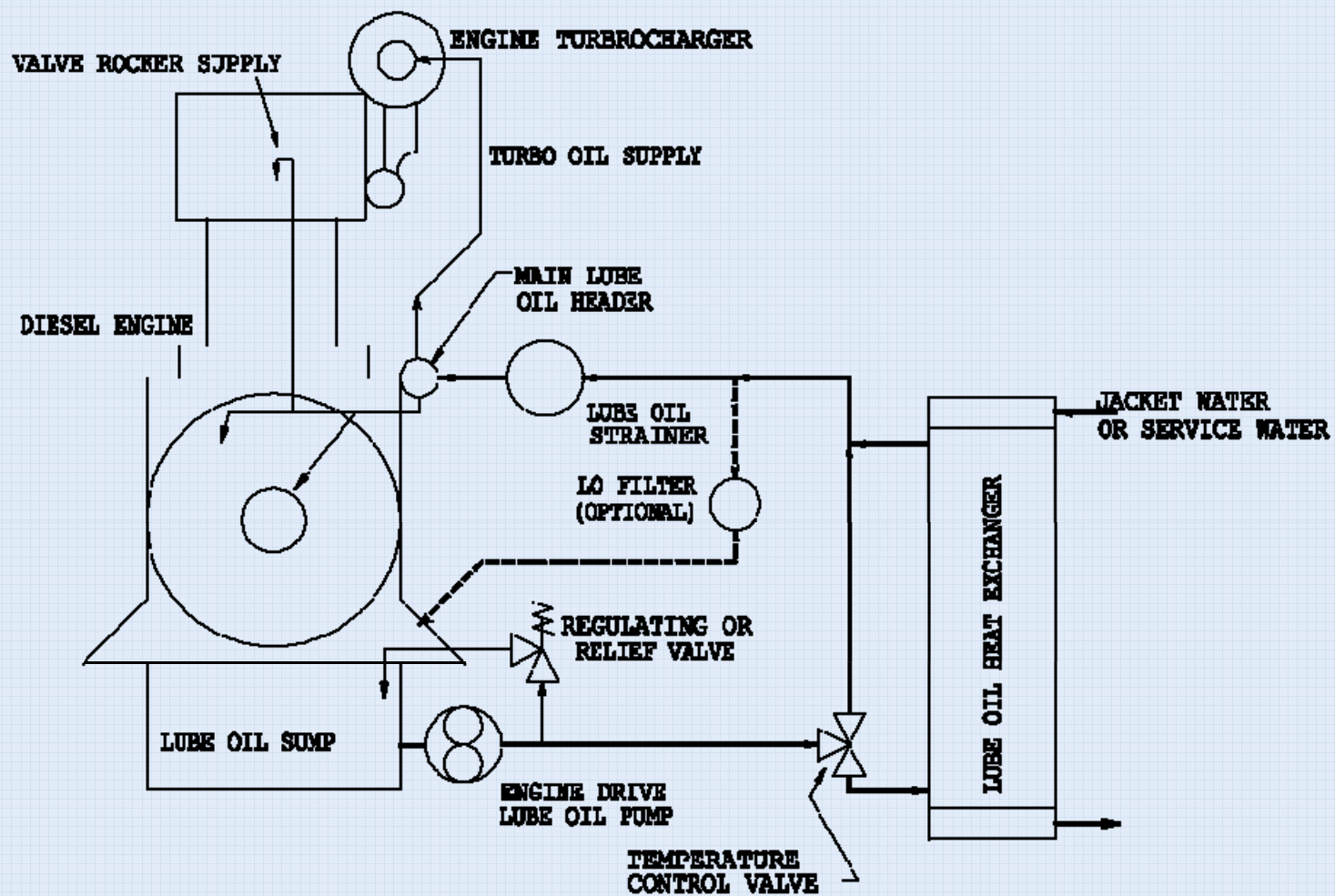
Lubrication Functions

- Maintain a film of lubrication between moving parts.
- Create a gas tight seal between the piston rings and cylinder wall.
- Remove and dissipate heat.
- Keep surfaces clean

Lubricants' properties must be as specified by the EDG manufacturer including:

- Viscosity
- Viscosity Index (no multi-viscosity oils)
- Pour Point
- Oxidation Resistance – TBN/TAN numbers
- Naphthenic versus Paraffinic Lubracants
- A Specific Manufacturer's Lubricant (in some cases)

A typical lube oil circulating and cooling system is shown in Figure 5-7. Details of some of their components are shown on Figures 5-8, 5-9, 5-10, and 5-12.



LUBE OIL CIRCULATING AND COOLING SYSTEM

Figure 5-7 Lube Oil Circulating and Cooling System

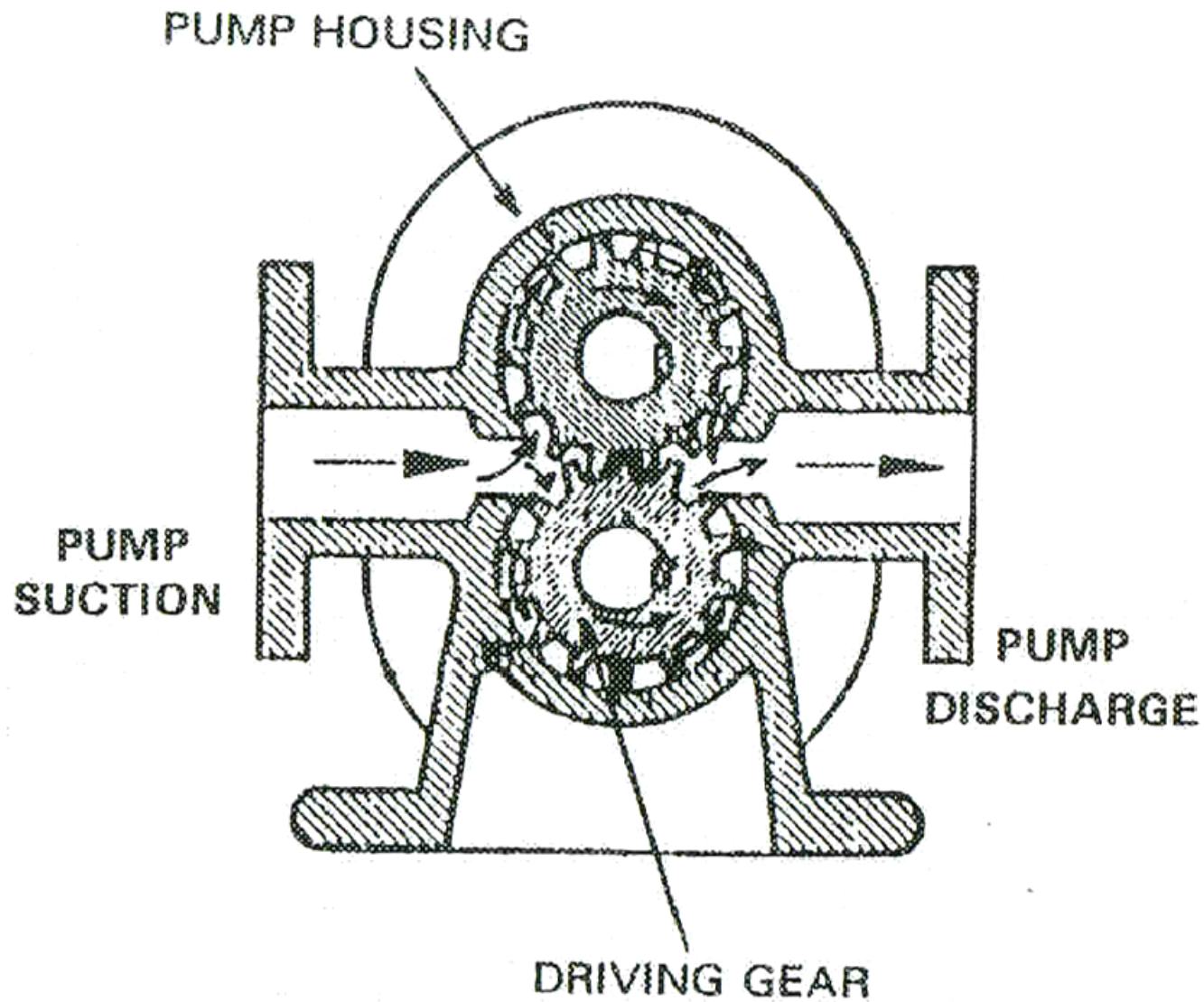


Figure 5-8

Lubricating Oil
Pump

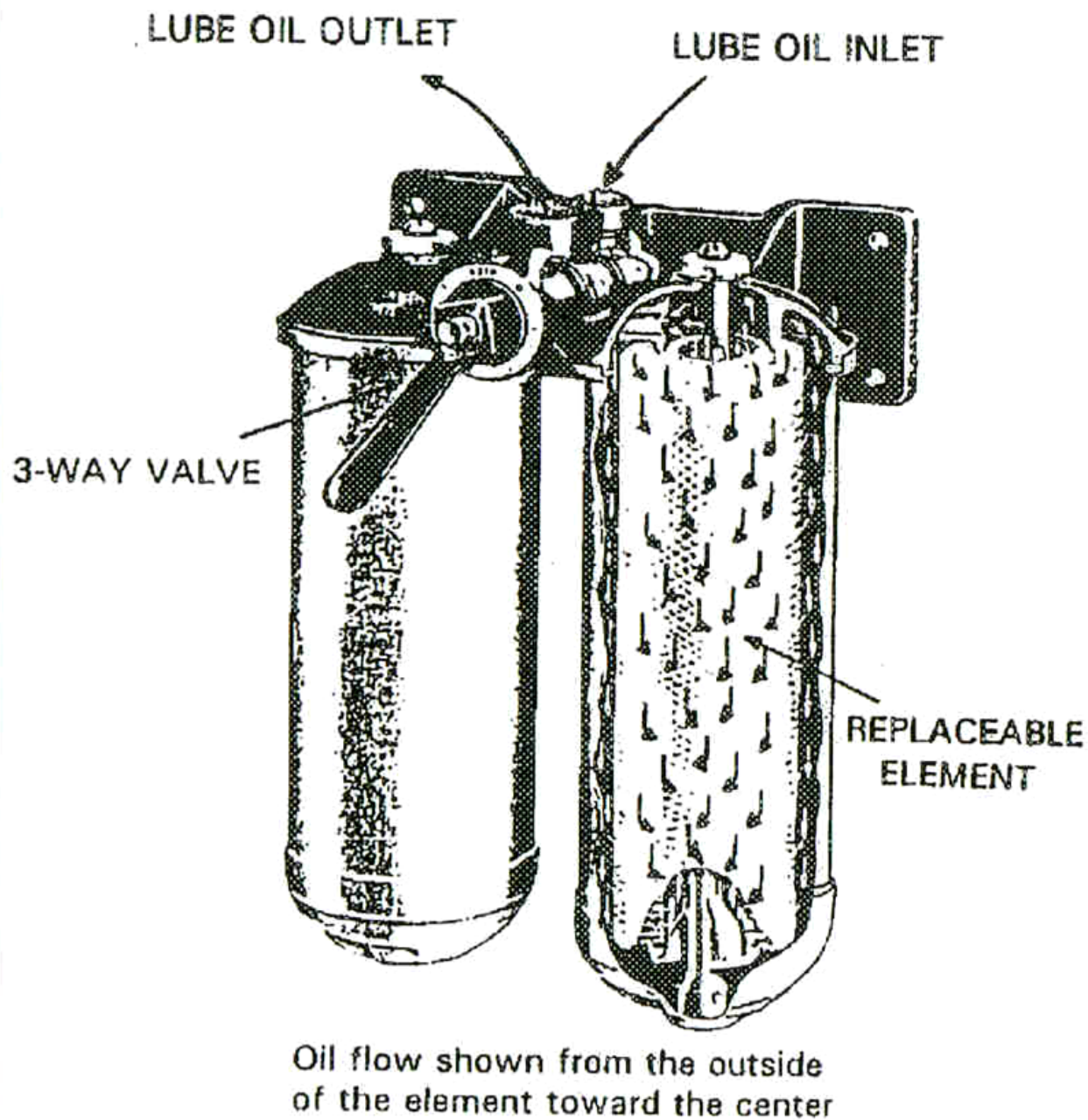


Figure 5-9

Lubricating Oil Filters

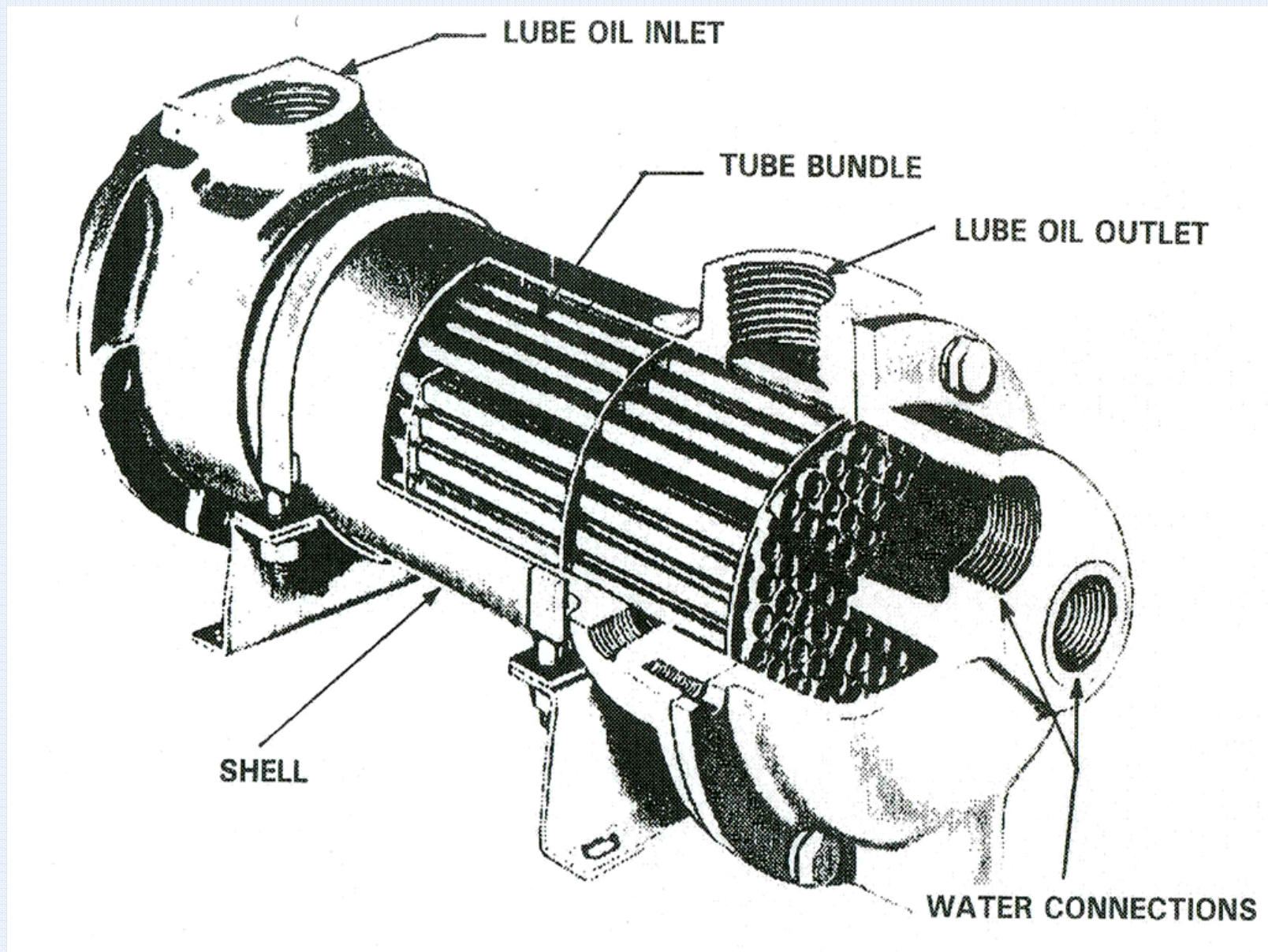


Figure 5-10 Lubricating Oil Cooler

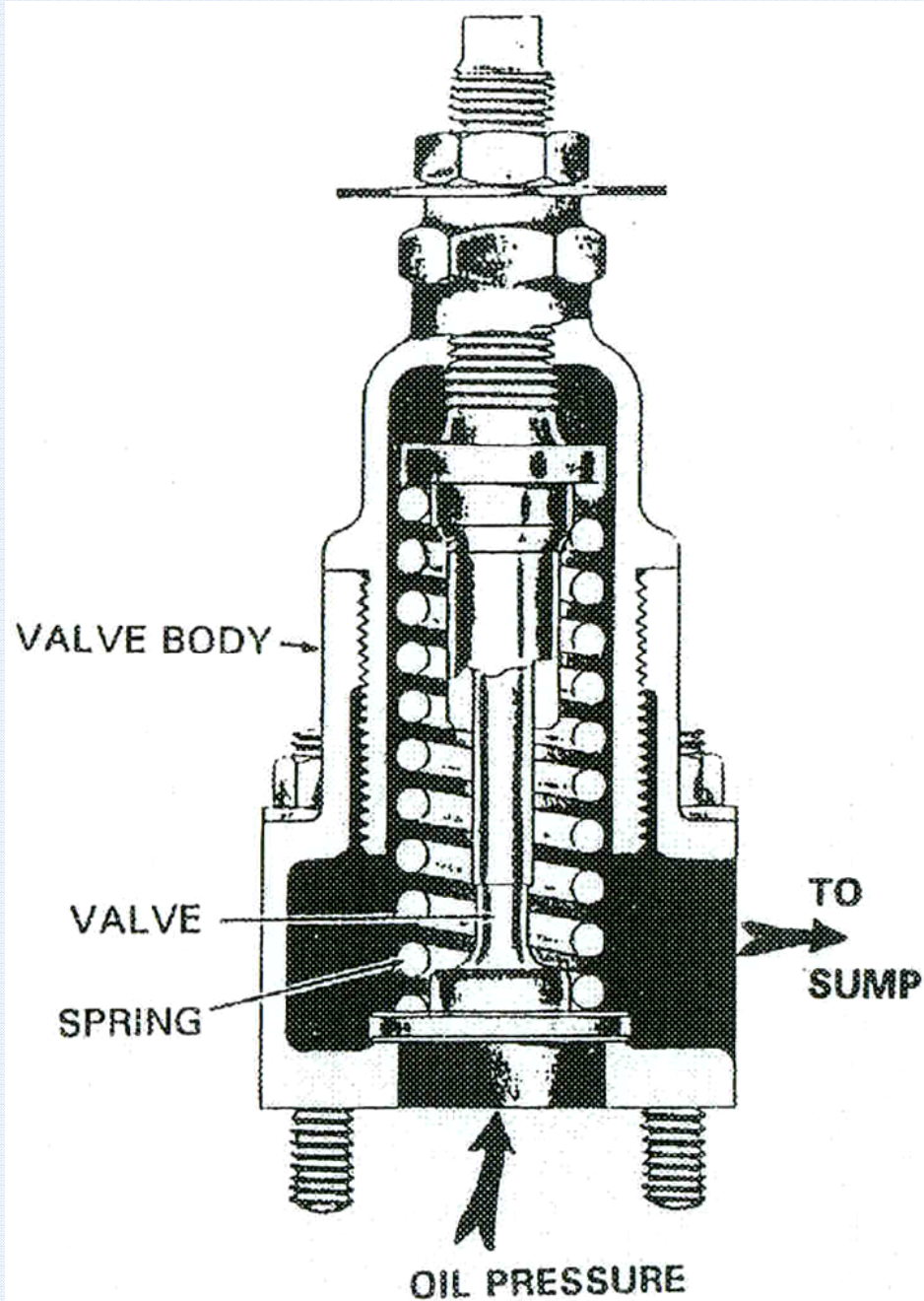


Figure 5-11

**Pressure Relief
Valve**

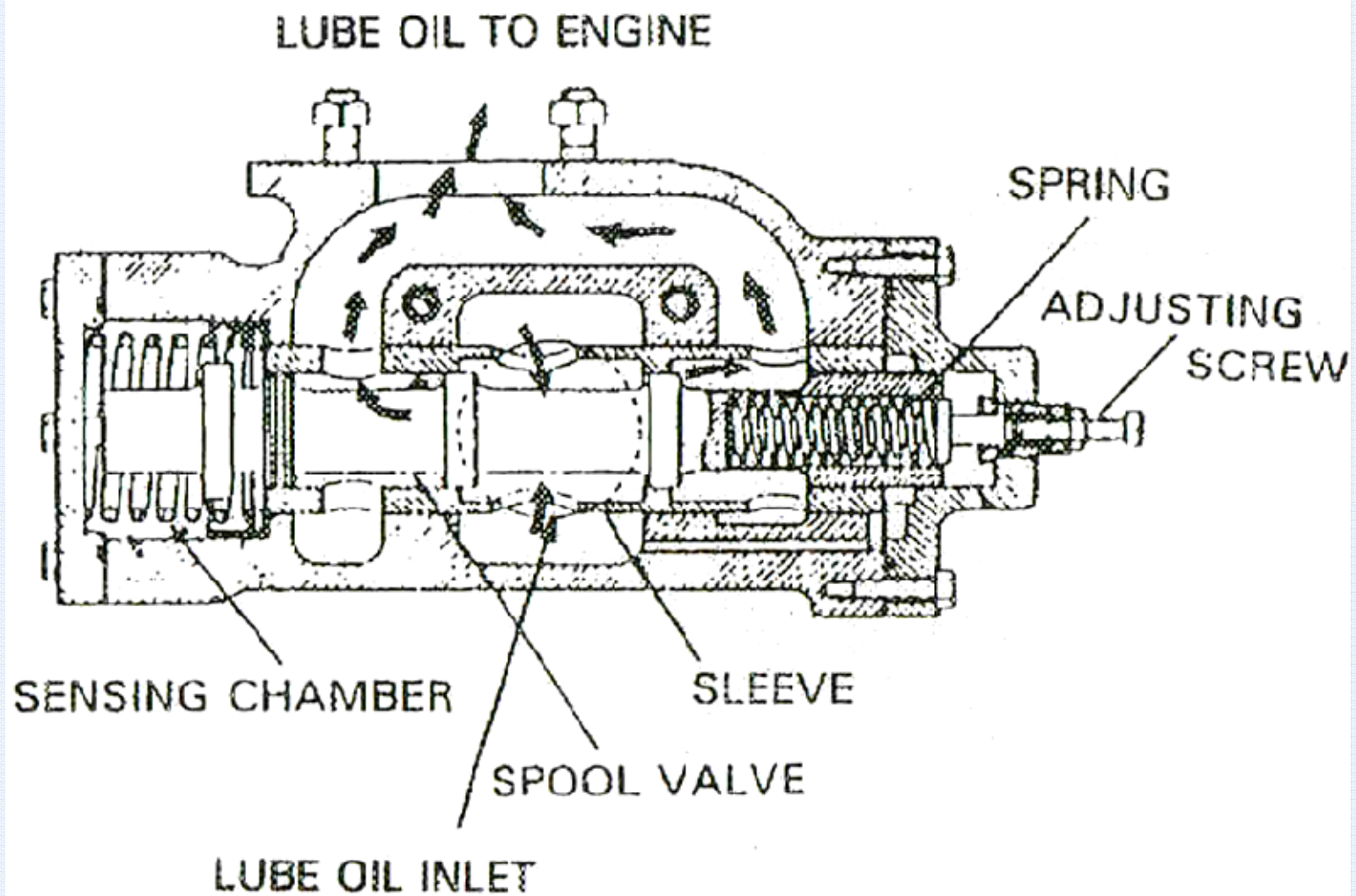


Figure 5-12 Pressure Regulating Valve

A typical lube oil system with keepwarm added is shown in Figure 5-13. Lubrication and cooling for the Pielstick engine bearings, pistons, cylinders, cylinder heads, and rocker arms are illustrated in Figures 5-14 and 5-15.

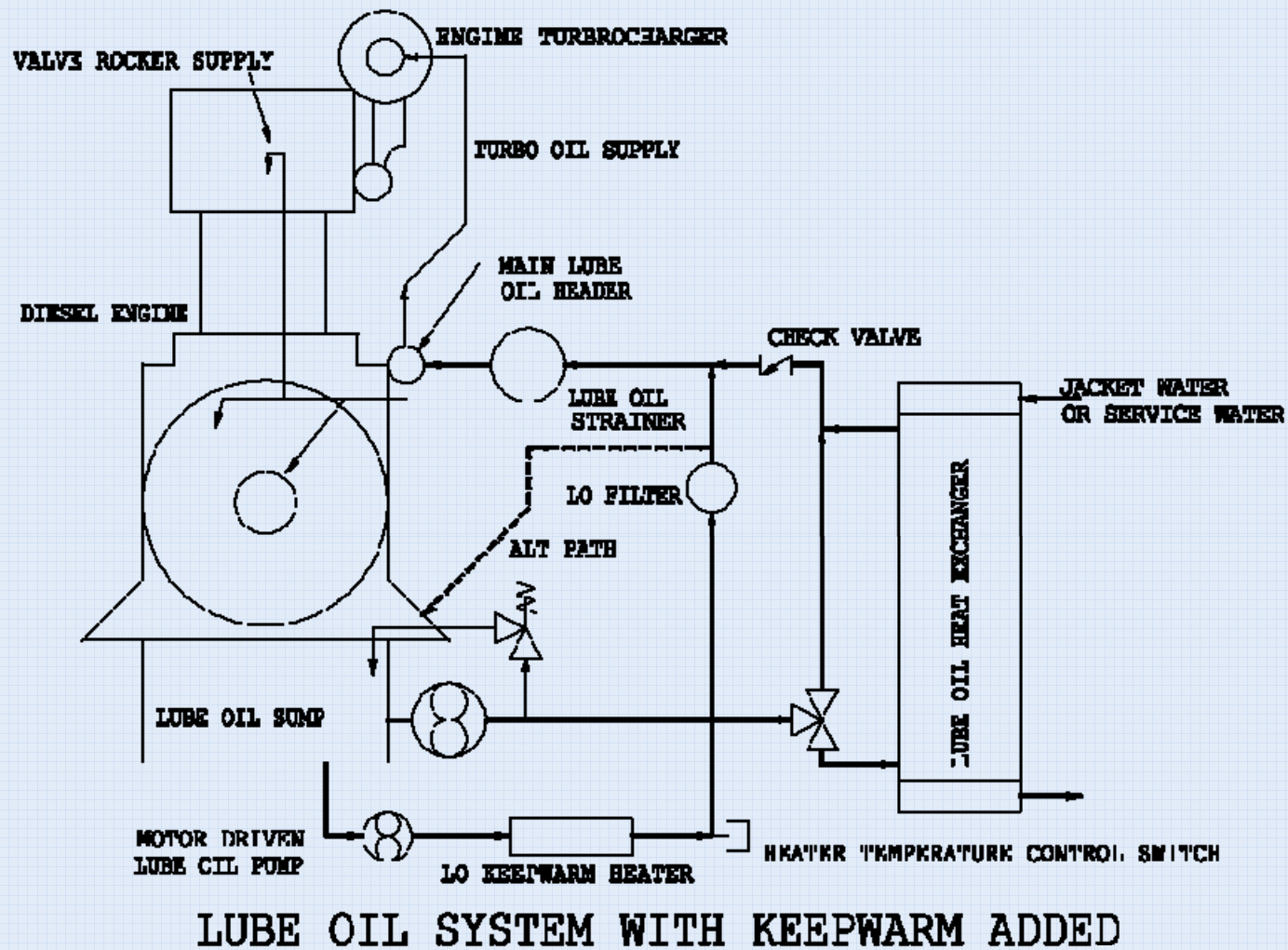


Figure 5-13 Lube Oil System with Keepwarm Added

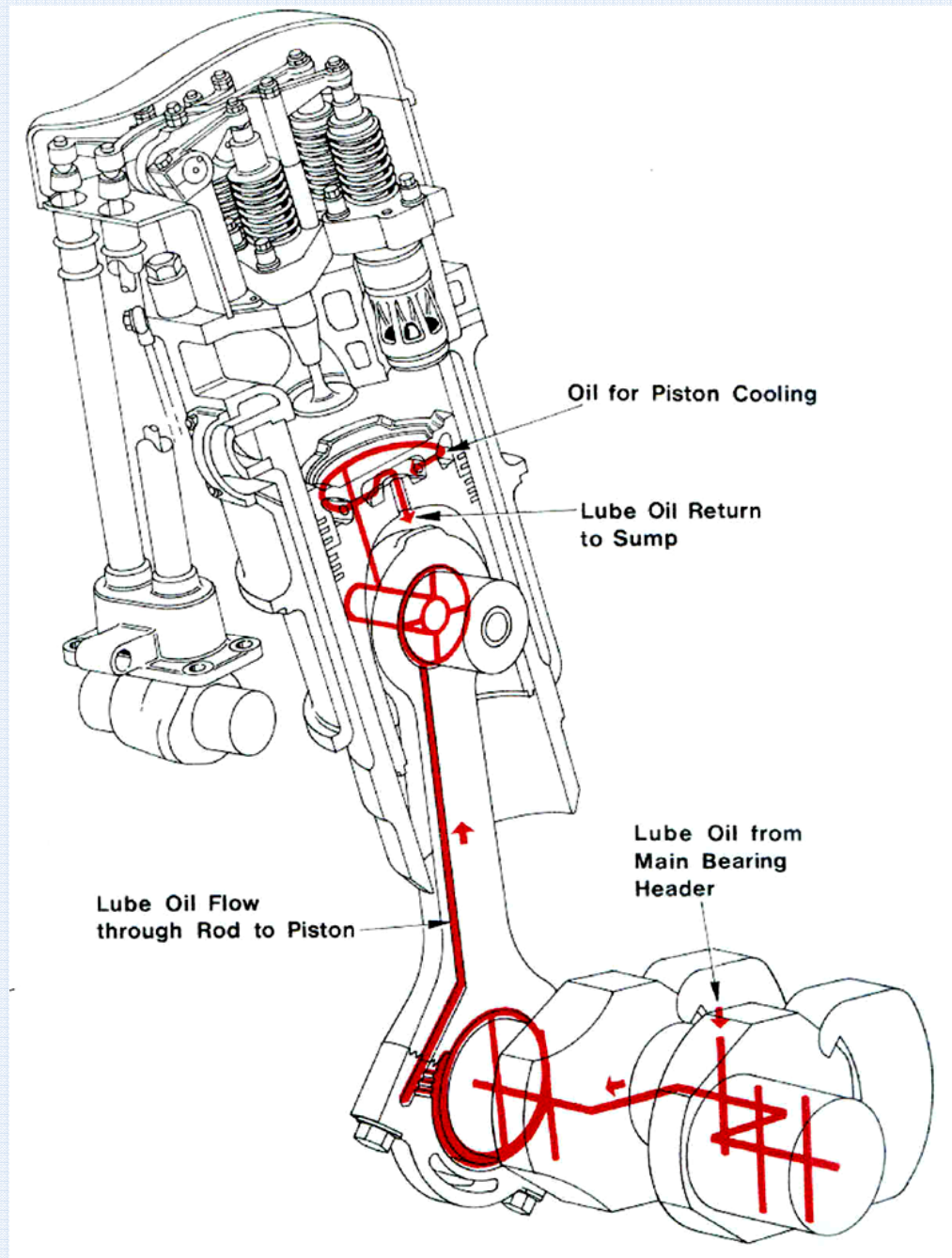


Figure 5-14
Pielstick Engine
Lube Oil Flow

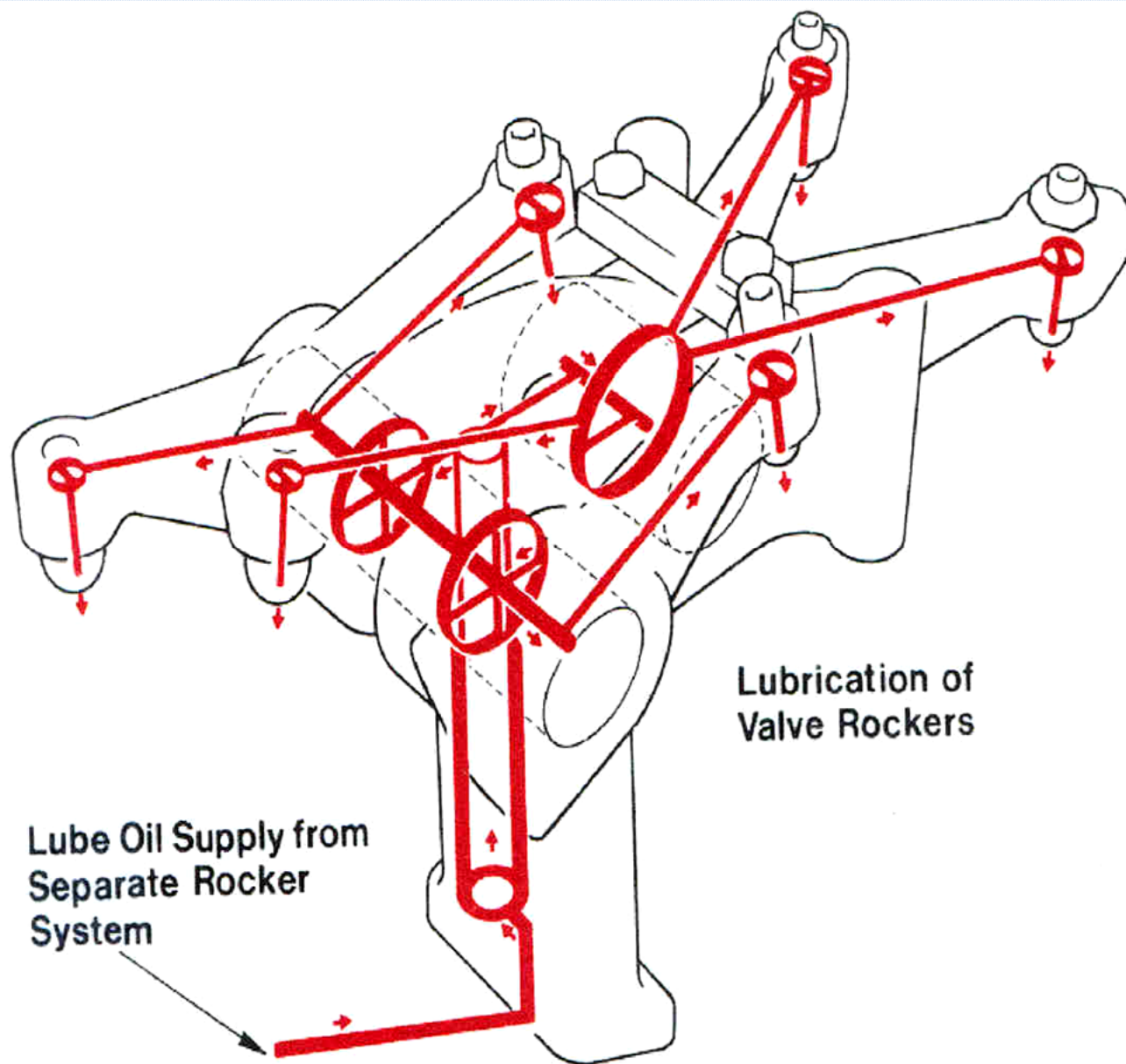


Figure 5-15

**Pielstick Valve
Rocker Flow**

Lube Oil System Monitoring

Typically, the pressures and temperatures of the fluids in the lubrication system will be monitored and displayed on the engine control panel. A few other items in the lube oil system may also be monitored, as follows:

- Crankcase pressure (vacuum). Because the oil is contained in the crankcase of the engine, monitoring that space may indicate a problem in the engine. A special sensor for doing so is shown in Figure 5-16.
- Main bearings may also be monitored for temperature. A sensor for that purpose is shown in Figure 5-17.

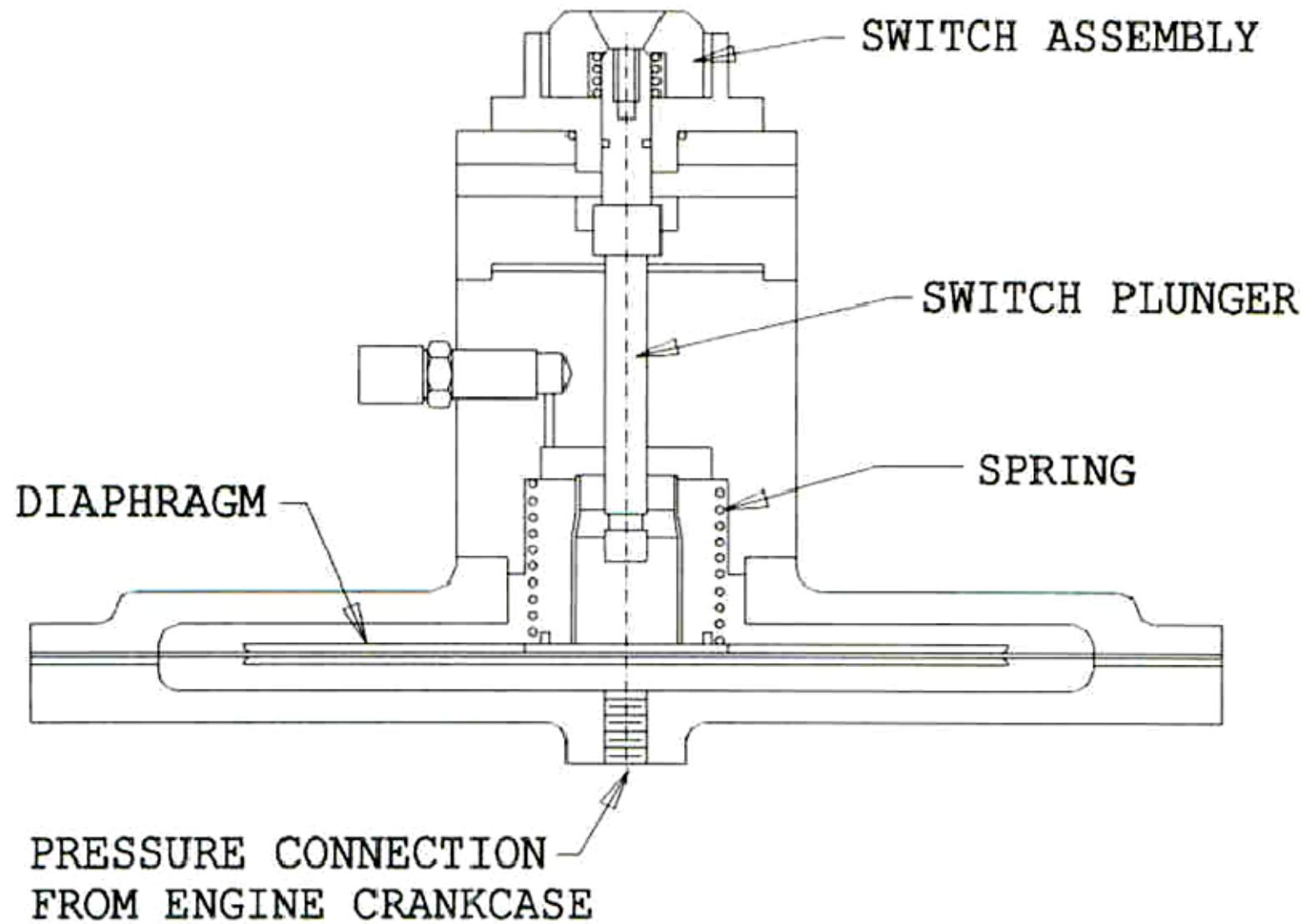


Figure 5-16 Diaphragm-Type Crankcase Pressure Monitoring Switch

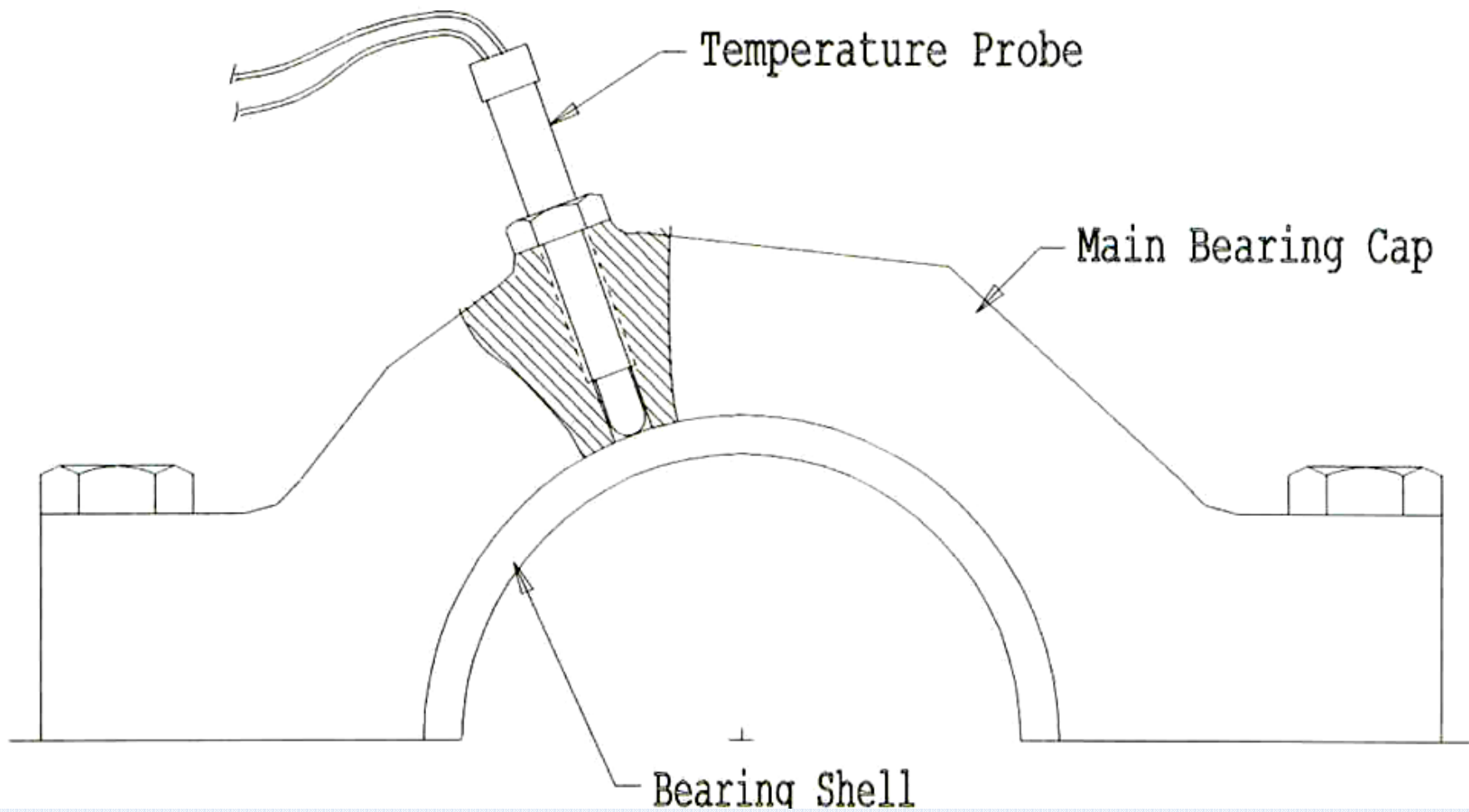


Figure 5-17 Bearing Temperature Probe

END OF CHAPTER 5

