

## STANDBY ENGINE ALTERNATORS

### SUMP OIL ANALYSIS

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1. GENERAL			KS-20526
1.01	This section covers sump oil analysis for standby engine alternators. Sump oil analysis is performed to determine the need for changing lubricating oil and filters. It may also indicate the need for various engine preventive maintenance procedures.		KS-20527
			KS-20542
			KS-21264

**NOTICE**

Not for use or disclosure outside the  
Bell System except under written agreement

KS-21501

KS-21879

- (b) Manufacture Discontinued Engine Alternators still in use:

KS-5565

KS-5574

KS-5602

KS-5636

KS-5664

KS-5665

KS-5666

KS-5667

KS-15521

KS-15622

KS-15717

KS-15884

KS-15899

KS-15954

KS-19896

KS-19989

74 This section covers general requirements without specifying a specific laboratory. Independent laboratories such as Faber Laboratories, 1115 Venice Blvd., Los Angeles, Calif., 90015; United States Testing Co., Inc., 1415 Park Ave., Hoboken, N. J., 07030; and E. W. Saybolt and Co., Inc., 400 Swenson Dr., Kenilworth, N. J. 07033, can perform these tests. The term "laboratory" in this section applies to the firm which is equipped to perform the following tests and relate the results to various engine malfunctions:

- (a) **Fuel Dilution**—the presence of unburned fuel

(b) **Fuel Soot**—suspended soft carbon from incomplete combustion

(c) **Total Insolubles**—products of combustion and oil and fuel deterioration

(d) **Viscosity**—resistance to flow

(e) **Water**—from cooling system leaks or condensation

(f) **Metal Particles**—any visible particles

(g) **Carbon**—hard carbon (coke)

(h) **Dirt and Sand**—Environmental contamination

(i) **Emission Spectrographic Analysis**—Quantitative elemental analysis for metals, but not to be used routinely as an analytical tool.

## 2. SAMPLING EQUIPMENT

2.01 The following equipment will be provided by the laboratory that is performing the oil analysis:

(1) **Sampling Syringe.** A syringe equipped with a flexible stem for obtaining a composite oil sump sample (a sample containing both settled and suspended contaminants) from engines that have an access port. (See Fig. 1).

(2) **Sample Mailing Container.** This includes a 2 oz. minimum sample bottle threaded to fit into the oil sample syringe, a screw-on cap, a pre-addressed return mailing label, and a mailing container for enclosing the sample bottle. One mailing container with label and bottle is required for each engine.

## 3. SAMPLING REQUIREMENTS

3.01 **Sample Administration.** The responsible supervisor will provide initially, and update every 6 months, an engine equipment list showing the make, size, identification number and mailing addresses for mailing sample bottles. He will also initiate action to correct mechanical defects when reported by the laboratory.

3.02 **Sample Review.** The testing laboratory will provide a report semiannually summarizing the sampling history to include:

- (a) Delinquent engine samples
- (b) Mechanical defects reported

3.03 **Subsequent Sampling.** Additionally, the testing laboratory will be required to provide subsequent sample mailing containers on an automatic basis upon receipt of samples. The laboratory will ship the sampling equipment directly to the supervisor responsible for engine maintenance per the engine equipment list. The laboratory will also replace any defective syringes.

#### 4. SAMPLING FREQUENCY

4.01 **New Engines.** For new engines, sample the oil from the sump within 30 minutes after the engine acceptance test has been completed. Have the testing laboratory perform an emission spectrographic analysis in addition to the routine tests in Tables A and B, to obtain the baseline signature of the oil. Subsequent tests will be as in paragraph 4.02.

4.02 **All Engines.** For all other engines, an oil sample shall be taken every 12 months or whenever a mechanical malfunction is suspected. An oil sample will also be taken immediately after any abnormalities are indicated in the oil analysis report to verify the first report. All samples should be taken within 30 minutes after a routine engine run has been finished. A follow up sample should be taken within 3 months to verify that the abnormality has been corrected.

#### 5. SAMPLING PROCEDURES

5.01 Using Fig. 1 as a typical sampling configuration; obtain sump oil sample using the following set of instructions.

- (1) Screw the sample bottle tightly into the syringe head.
- (2) With the syringe handle all the way in, push the syringe stem to the **bottom** of the oil sump through the dipstick hole.

(3) Holding the syringe stem to the bottom of the oil sump, **slowly** pull the syringe handle out until the bottle is three-quarters full.

(4) Raise the stem above the engine oil level and pump the syringe handle several times to discharge excess oil.

(5) Remove the syringe stem from the dipstick hole and replace the oil dipstick.

(6) Remove the sample bottle from the syringe, screw the cap on tightly, and retighten after sample has cooled.

(7) Fill in the sump oil information label. (See Fig. 2)

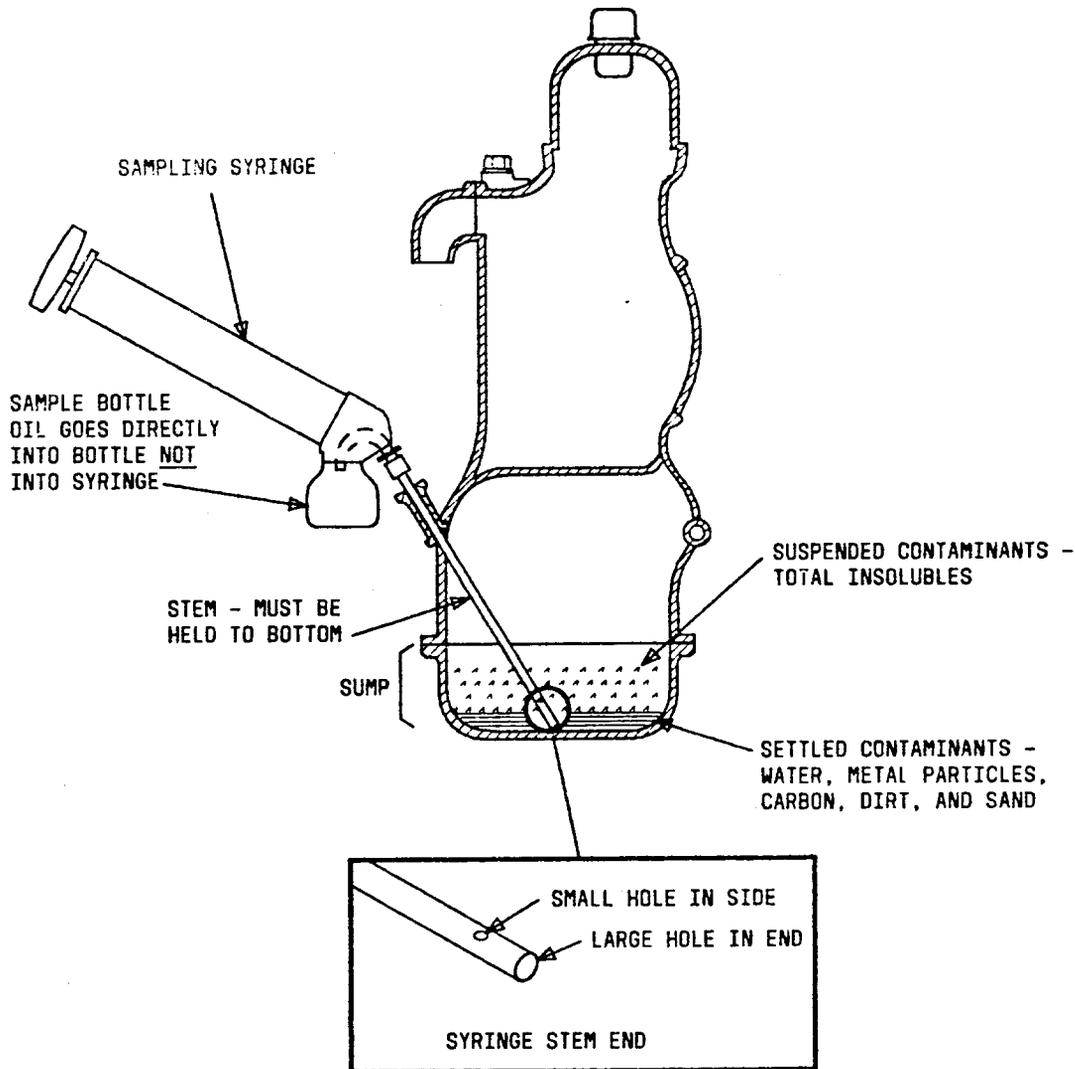
5.02 After sample has cooled, retighten the bottle cap. Place the sample bottle in the mailing container, seal container with the gummed return address label and mail it immediately to the testing laboratory.

5.03 When not in use, keep the bottle provided for syringe storage screwed into the syringe head. This protects the internal parts of the syringe from contamination by foreign matter. Store the syringe in a clean, dry place in a position that allows residual oil to drain from the syringe stem. **Do not clean the syringe with solvent or alter the stem design or holes in any manner.**

#### 6. ANALYSIS RESULTS

6.01 The test laboratory will provide two copies of the oil analysis report to a person designated by the operating company. One copy should be forwarded to the supervisor responsible for maintaining the engine. When emergency conditions are determined by the oil analysis, the laboratory shall immediately telephone the person designated to receive this information.

6.02 Table A contains guidelines for interpreting the sump oil analysis results for reciprocating engines. Table B contains similar guidelines pertaining to gas turbines.



**SAMPLING INSTRUCTIONS**

1. WITH HANDLE IN PUSH SYRINGE STEM THRU OIL DIP-STICK HOLE TO BOTTOM OF OIL SUMP.
2. PULL SYRINGE HANDLE OUT, HOLDING STEM TO OIL SUMP BOTTOM UNTIL BOTTLE IS 3/4 FULL.
3. RAISE STEM ABOVE OIL LEVEL AND PUMP HANDLE SEVERAL TIMES TO DISCHARGE EXCESS OIL.
4. SCREW BOTTLE CAP ON TIGHTLY AND RETIGHTEN AFTER SAMPLE HAS COOLED.

**ALTERNATE METHOD**

IF OIL DIPSTICK HOLE IS NOT ACCESSABLE, OIL SAMPLES CAN BE TAKEN BY FIRST WIPING THE OIL SUMP DRAIN PLUG CLEAN, AND THEN LOOSENING IT TO LET THE FIRST FEW OUNCES FLOW DIRECTLY INTO BOTTLE.

**NOTES:**

1. DO NOT POUR OIL FROM ONE SAMPLE BOTTLE TO ANOTHER.
2. DO NOT ALTER STEM DESIGN OR HOLES

Fig. 1—Typical Sump Oil Sampling Configuration

DATE OF SAMPLE _____	LOCATION CODE _____
ADDRESS OF ENGINE LOCATION _____	
CITY _____	STATE _____ ZIP CODE _____
ELAPSED TIME METER READING _____	ENGINE NO. _____
HOURS ON ENGINE SINCE LAST OIL CHANGE _____	S.A.E. NO. _____
GASOLINE _____	DIESEL _____ OTHER _____
AREA _____	DISTRICT _____
DIST. ADDRESS _____	ROOM NO. _____
CITY _____	STATE _____ ZIP CODE _____

Fig. 2—Typical Sump Oil Information Label

TABLE A

**GUIDELINES FOR INTERPRETING SUMP OIL ANALYSIS RESULTS FOR  
RECIPROCATING ENGINES\***

TEST	ALLOWABLE LIMIT	ACTION
Fuel Dilution	6.0% Max.	Check fuel injector dribbling, leaking gaskets or seals, cracked or loose fuel line connections, timing, overmetering, and compression. Change oil and oil filter.
Fuel Soot (Soft Carbon)	4.0% Max.	Check for inactive oil filter, restricted air intake or exhaust, low blower output, over-metering and compression. Change oil and oil filter.
Total Insolubles	11.0% Max.	Change oil and oil filter.
Viscosity	+ 25%, -10%	Change oil and oil filter.
Coolant Water	0.5% Max.	Check for leaking head gasket or sleeve seals, leaking oil cooler, cracked head or blocks.
Metal Particles	Positive Indication	Run emission spectrographic analysis.†
Hard Carbon	Positive Indication	Check cooling, over-metering, pump timing and overload.
Dirt and Sand	Positive Indication	Check breathers, handling of oil containers, or for debris entering valve chamber when cover is off.

\* No maintenance other than oil and oil filter changing will be performed on an engine without a second sample to confirm initial results.

† To be run only when visible metal is positive. Testing laboratory will make recommendation based upon results.

TABLE B

**GUIDELINES FOR INTERPRETING SUMP OIL ANALYSIS RESULTS FOR  
GAS TURBINE ENGINES\***

TEST		ALLOWABLE LIMIT	ACTION
Neutralization Number (mg KOH/g of Sample)	Total Base No.	Greater than 0.5	Change oil and oil filter.
	Total Acid No.	1.0 Max. Change over base oil	
Viscosity		+ 25%, -10%	Change oil and oil filter, and check viscosity of new oil for proper grade.
Water Content		0.2% Max.	Change oil and oil filter and determine source of water.
Metal Particles		Positive Indication	Run emission spectrographic analysis.†
Hard Carbon		Positive Indication	Change oil and oil filter.
Sand and Dirt		Positive Indication	Change oil and oil filter.

\* No maintenance other than oil and oil filter changing will be performed on an engine without a second sample to confirm initial results.

† To be run only when visible metal is positive. Testing laboratory will make recommendation based upon results.