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30 August 2013

TECHNICAL MANUAL

JOINT OIL ANALYSIS PROGRAM MANUAL

VOLUME I

INTRODUCTION, THEORY, BENEFITS, CUSTOMER SAMPLING PROCEDURES, PROGRAMS AND REPORTS

This manual supersedes NAVAIR 17-15-50.1 dated 31 July 2012.

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List of Current Changes

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Only those work packages/pages assigned to the manual are listed in this index. Dispose of the superseded issues of the technical manuals. Superseded classified technical information shall be destroyed in accordance with applicable regulations. The portion of text affected in a changed or revised work package is indicated by change bars or the change symbol “R” in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands or change bars, as applicable.

Total number of pages in Volume I of this manual is 72.

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NAVAL AIR SYSTEMS COMMAND TECHNICAL MANUAL PROGRAM

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1. The TPDRs listed below have been incorporated in this issue.

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INTRODUCTION

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1. PURPOSE OF THIS MANUAL

   a. Source. This volume was prepared under the technical cognizance of the Navy Oil Analysis Program, Patuxent River MD. Comments and recommendations pertaining to this volume should be submitted in accordance with instructions in paragraph 5.

   b. Purpose. The Joint Oil Analysis Program (JOAP) was established by the Joint Army, Navy and Air Force regulation as a combined effort to establish and maintain a standard program that would consolidate and coordinate the three separate service oil analysis programs. The purpose of Volume I is to clarify the use of oil analysis as a diagnostic maintenance tool, to standardize JOAP operating procedures, and to provide general guidance for JOAP managers and customers in accordance with the Tri-Service Regulation (AFI21-131(I)/AR700-132/OPNAVINST 4731.1B). Specific JOAP Laboratory operating procedures and guidance are contained in Volume II. The JOAP equipment wear-metal criteria listings which contain trend tables and decision making guidance for laboratory use in evaluating oil sample analysis results and determining actions required are contained in Volumes III and IV for aeronautical and non-aeronautical equipment, respectively.

   c. Applicability. The provisions of this volume apply to all activities of the Departments of the Army, Navy, Air Force and the Coast Guard participating in the JOAP and to laboratories operating under contracts therewith. Laboratory services provided by JOAP laboratories to customer activities will be in accordance with instructions contained in this manual.

2. PROGRAM GUIDANCE. Guidance for the JOAP and Departments of the Army, Navy, and Air Force Oil Analysis Programs is provided by the following references:

   a. Joint Oil Analysis Program.

      (1) Tri-Service. AFI-21-131(I)/AR700-132/OPNAVINST 4731.1B, Joint Oil Analysis Program (JOAP).

   b. Military Departments.

      (1) Army. AR 750-1, Army Material Maintenance Policy and Retail Maintenance Operations. This publication is contained in the Maintenance Management UPDATE.

      (2) Navy. COMNAVAIRFOR 4790.2A, Naval Aviation Maintenance Program (NAMP).

      (3) NAVAIRINST 4731.1B, Navy Oil Analysis Program for Aeronautical Equipment.

(4) Air Force. AFI 21-124, Air Force Oil Analysis Program, and supplements thereto.

3. PROGRAM GOALS. The goals of the Joint Oil Analysis Program are to:

   a. Improve the operational readiness and economy of military equipment by the effective use of oil analysis.

   b. Collect and analyze technical data in order to:

      (1) Increase the effectiveness of oil analysis in diagnosing oil condition and potential equipment failures.

      (2) Accumulate engineering data for each phase of a weapon system's or equipment's life.

   c. Ensure all Army, Navy, and Air Force oil analysis plans and operations are integrated within the JOAP to provide:

      (1) Standardization of analytical techniques, procedures, data collection, calibration standards, and instrumentation/equipment.

      (2) Inter-service oil analysis support to all military departments.

      (3) The most cost-effective means of monitoring the condition of lubricating fluid and fluid lubricated mechanical systems.

4. JOINT OIL ANALYSIS PROGRAM RESPONSIBILITIES. Responsibilities for each service are delineated in the Joint Oil Analysis Program Tri-service Instruction and the Memorandum of Understanding for Support of the Joint Oil Analysis Program.

   a. JOAP Executive Committee (JOAP EC). A chartered committee established to provide joint service decisions on the Joint Oil Analysis Program (JOAP). The JOAP-EC is responsible for:

      (1) Approving policy and strategic planning for the JOAP.

      (2) Being the source of final resolution disagreements among services on oil analysis programmatic matters.

   b. JOAP Coordinating Group (JOAP CG). A chartered committee established to provide the resolution of routine problems in the JOAP and provide an interface among the services for planning and administering the JOAP. It is composed of all service Oil Analysis Program Managers. The Marine Corps, Coast Guard or other participating agencies may be invited as non-voting members of the JOAP-CG to advise the committee on their agency's unique requirements. The JOAP-CG coordinates inter-service planning and procedures for the execution of the JOAP. The JOAP-CG is responsible for:

      (1) Providing recommendations to the JOAP-EC on JOAP policy and strategic planning at the semi-annual meetings.

      (2) Assuring open communications between the services' Program Managers to ensure continuity and standardization of policies and procedures within and among the services.

      (3) Resolving routine problems occurring among the services.

      (4) Making recommendations to the JOAP-EC on joint service long range plans and inter-service issues.

      (5) Reviewing and recommending changes to the tri-service regulation.

TABLE 1 – JOAP Membership
Army Program Manager DSN: 645-0869/COMM 256-955-0869 FAX: 746-9344/COMM 256-876-9344 MAILING: ARMY OIL ANALYSIS PROGRAM MANAGEMENT OFFICE USAMC LOGISTICS SUPPORT ACTIVITY ATTN AMXLS-GO BUILDING 3661 REDSTONE ARSENAL AL 35898 7466
Navy Program Manager COMM: 301-997-8260 Email: NOAP@navy.mil MAILING: NAVY OIL ANALYSIS PROGRAM 22229 ELMER ROAD, BLDG 2360 PATUXENT RIVER MD 20670-1534
Air Force Program Manager Email: AFOAP@tinker.AF.mil MAILING: AFLCMC/LPS 4750 STAFF DRIVE TINKER AFB OK 73145-3033

c. JOAP Laboratories.

(1) Process and evaluate customer samples as soon as possible during normal work hours. Processing and evaluation priority is as follows:

(a) Special aeronautical

(b) Routine aeronautical

(c) Special non-aeronautical

(d) Routine non-aeronautical

(2) Provide recommendations to customer activities based upon analytical results of customer samples.

(3) Participate in the JOAP Correlation Program.

(4) Ensure entry of all laboratory analytical data into the laboratory database, regardless of home service or home base/station for that equipment. In other words, results for oil samples from transient equipment include samples from equipment from the sister services as well as equipment from other bases/stations for the same service as the laboratory.

d. JOAP Customers. Customer responsibilities are included in WP 003 00 of this volume.

5. TECHNICAL MANUAL MAINTENANCE

a. General Procedures. JOAP manual users desiring technical and or procedural changes shall provide feedback via their appropriate oil analysis Program Manager to ensure coordinated directive updating. The Program Manager will screen proposed changes for validity and forward recommended changes to the Navy JOAP Manual Manager for technical review and coordination with all service Program Managers and engine/equipment managers, as applicable. Procedural and technical changes are not authorized for program application until formally released.

b. Updates, Revisions, Supplements and Rapid Action Changes. The Navy is the lead service for publication of this manual; therefore, the following Navy publication change procedures apply:

(1). Revision. A revision is a complete document reissue with all change information incorporated. With the current Internet hosting of the JOAP manuals, the goal is to use complete revisions to avoid the workload of inserting page changes (in addition to RACs and IRACs).

(2). Routine Change. Technical manual changes are the official corrected pages to a portion of an existing document. They consist of replacement change pages for that area of the manual affected by the change action.

(3). Rapid Action Change. Rapid action changes are issued in order to provide the operating forces and maintenance personnel with accurate and timely information necessary for mission performance.

(a) Rapid action changes shall be prepared and issued when any of the following conditions exist:

1. Hazards to safety of personnel.
2. Impairment of safety of flight.
3. Aircraft grounding.
4. Mission capabilities adversely affected.
5. Potential equipment damage.

c. Rapid action changes may be issued as Interim Rapid Action Changes (IRAC) or as formal Rapid Action Changes (RAC). Interim Rapid Action Changes are issued as Naval messages to expedite the release of urgent and essential operational and maintenance change information. Army and Air Force Program Management offices are responsible for retransmission of IRAC's to appropriate service addresses.

d. Formal Rapid Action Changes are issued as insert change pages prepared in the same style and format of the technical manual being changed and as a replacement for an IRAC. A Formal RAC or routine change containing IRAC change material must be issued within one year of the release of an IRAC.

NOTE

All four volumes of the JOAP Manual are on-line at: https://mynatec.navair.navy.mil/ Registration is required to use the site, including entering a user name and obtaining a password for access. Be prepared to enter a Distribution Account Code (DODAC). Each installation has a unique code. Check with the local supply representative for the correct DODAC number to use. Some users, depending on the laboratory status (contractor, allied, etc.) may have to submit special paperwork to NATEC to obtain access. Generally, if your e-mail address ends with ".mil", registration should be quick and easy. Contact the trouble desk (see information below) to get help with registering on-line or inquire about any special registration requirements. Ensure

that Adobe Acrobat 9.0 or higher is used. If an upgrade is required, use the site link for downloading the latest Adobe Acrobat version. Without at least version 9.0, the manuals may not display correctly.

JOAP Manual Designations by Service:

US Army	TM 38-301-1/-2/-3/-4
US Navy	NA 17-15-50.1/.2/.3/.4
US Air Force	T.O. 33-1-37-1/-2/-3/-4
Coast Guard	TO 33-1-37-1/-2/-3/-4

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Points of Contact at NATEC:

NATEC Customer Service: 619-545-1888

Website Status Hotline: 619-545-1706

Email: nani_customerservice@navy.mil

6. PROCUREMENT, RELOCATION AND REPAIR OF OIL ANALYSIS EQUIPMENT. All requirements for procurement, relocation or repair of oil analysis spectrometers and ancillary equipment shall be submitted to the appropriate Service Program Managers in sufficient time to allow inter-service coordination of the action, if required. Detailed instructions for obtaining repair of spectrometers are contained in Volume II.

NOTE

During periods of shutdown such as shipyard repair or shop renovation, laboratory managers will ensure that JOAP laboratory personnel protect the spectrometer with a plastic covering. Seal off the spectrometer from possible contamination for dust and/or water by using tape to secure the plastic covering.

The AFOAP office advises labs request a waiver through owning MAJCOM to simulate movement of OAP assets during exercise/ORI. MAJCOMs will grant waivers on a case by case basis. Each MAJCOM will approve/disapprove simulations as they see fit with consideration given to number of units available for exercise, current wait time to repair, availability of funds if damage occurs, value-added training from movement of assets, current ops tempo, set-up/teardown experience, etc.

7. RELOCATION OF OIL ANALYSIS USING CUSTOMERS-TRANSFER OF SERVICES. Any time that an oil analysis customer relocates, either deployed or permanently, and oil analysis services are required at the new location, the transfer of workload and provision of services shall be handled through the normal chain of command in order to ensure orderly transfer of support. Unusual problems encountered should be referred to the appropriate service oil analysis Program Management office for resolution.

   a. When it is known that away from home base oil analysis support will be required on extended duration transit flights, transferring customers are responsible for obtaining complete oil analysis records for their equipment from the losing laboratory and for delivery of the records to the gaining laboratory at the new operating site. If sufficient time is not available to comply with these procedures prior to departure, the customer shall notify the losing laboratory concerning the relocation and the losing laboratory shall mail or electronically transfer all required oil analysis records to the gaining laboratory.

   b. Deployment/Permanent Relocation. The transferring activity (customer) is responsible for notifying the home base supporting oil analysis laboratory concerning transfer/deployment schedules in advance of departure. Advance notice is required in order to provide the laboratory sufficient time for orderly processing of records for transfer to the new supporting laboratory to avoid disruption in equipment oil analysis monitoring schedules. The losing laboratory will forward equipment oil analysis records directly to the receiving laboratory unless directed otherwise by competent authority. The losing laboratory shall ensure that each equipment record transferred is complete, accurate and legible. When the customer returns to home base, records of analysis done at intermediate locations must be delivered to the regular supporting laboratory. If the customer departs prior to receipt of the completed record, the intermediate laboratory will forward the completed record to the regular supporting laboratory.

8. REQUESTS FROM FOREIGN COUNTRIES. Requests from foreign agencies for JOAP technical information, assistance, equipment, spare parts, consumable supplies, etc. under Mutual Assistance Programs (MAP), Foreign Military Sales (FMS), Grant Aid Programs or other mutually beneficial programs should be addressed to the nearest United States Military Advisory Group for consideration and/or processing. Requests from foreign countries for participation in the JOAP Correlation Program are addressed in Work Package 004 00 of this volume.

OIL ANALYSIS THEORY AND BENEFITS

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1. Spectrometric Oil Analysis. Spectrometric oil analysis is a diagnostic maintenance tool used to determine the type and amount of wear metals in lubricating fluid samples. Engines, transmissions, gearboxes, and hydraulic systems are the types of equipment most frequently monitored. The presence of unusual concentrations of an element in the fluid sample can indicate abnormal wear of the equipment. Once abnormal wear is verified, the equipment may be repaired or removed from service before a major failure of a fluid wetted component occurs. Spectrometric oil analysis enhances personnel safety and material readiness at a minimum cost, and serves as a decisive, preventive maintenance tool.

2. Physical Property Testing. Lubricant physical property testing provides data on conditions that are standards of measurement for judgment of the quality of the oil. Physical property tests aid in determining degradation or contamination of the lubricant which occur from combustion blow by, oxidation from overheating, moisture from coolant leaks, additive depletion, etc. Physical properties testing of used lubricants is primarily utilized in ground and ship equipment applications but may also have some beneficial application to aeronautical equipment as an adjunct to spectrometer testing.

NOTE

Air Force Field Personnel are NOT trained or authorized to conduct any type of physical property testing. See Volume II WP 004 01 for U.S. Air Force Special Tests.

3. Benefits of Oil Analysis. Data from spectrometric and/or physical property testing may be used as guidelines to assist in identifying incipient mechanical failures or in determining the quality and useful life of the oil. Thus, potential equipment component wear or failure and premature lubricant failure may be detected prior to a major equipment failure or an expensive repair/rebuild. Oil analysis may also be used to identify inadequate or improper maintenance procedures and unsatisfactory equipment parts/components/assemblies.

4. Wear metals. Wear metals are generated by friction between moving metallic surfaces in mechanical systems. Despite lubrication, wear metal generation occurs in all oil wetted systems to some degree and the lubricant serves as a repository for the wear metals. Wear metals may also be generated from corrosive action resulting from moisture and electrolytic action within lubricated systems. Thus, information related directly to the condition of the assembly exists in the circulating lubricating fluid. This conclusion is developed as follows: first, the metal particles rubbed or gouged off the metal alloy surfaces will always have the same chemical compositions as the alloys from which they came; second, the normal level and rate of production of each kind of metal particle can be established for each type of equipment through oil analysis over a period of time. Thus, when an abnormal level and/or rate of production of wear metals is detected, the chemical identity of the abnormally produced particles will provide clues concerning the identity of the parts being worn. Some metallic elements will specifically identify an impending problem while others provide only general information that abnormal wear is occurring, For example, increased quantities of iron are quite common since iron is present in many component parts and the skill and knowledge of the evaluator is important in diagnosing equipment condition and the source of wear metal. On the other hand, increased quantities of an uncommon element such as silver may pinpoint the trouble area directly to a single part. For a normally operating piece of equipment, wear metals are produced at a constant rate. In some cases, the rate may be negligible, but this rate is similar for all normally operating equipment of the same model. The wear metal concentration will also increase at a constant rate for a normally operating, completely enclosed system with no fluid consumption. A theoretical plot of wear metal concentration in parts per million (PPM) vs. operating hours is represented in figure 1. Any condition which alters the normal relationship or increases the normal friction between moving parts will generally accelerate the rate of wear and increase the quantity of wear metal particles produced. An abnormal condition of this type will sharply increase the concentration and rate of buildup of wear metals in stable fluid systems. If the condition is not discovered and corrected, the deterioration will continue to accelerate, usually with major secondary damage to other parts of the assembly, resulting in the eventual failure of the entire

assembly. Newly overhauled assemblies may tend to produce wear metals in higher concentrations during the initial break in period.

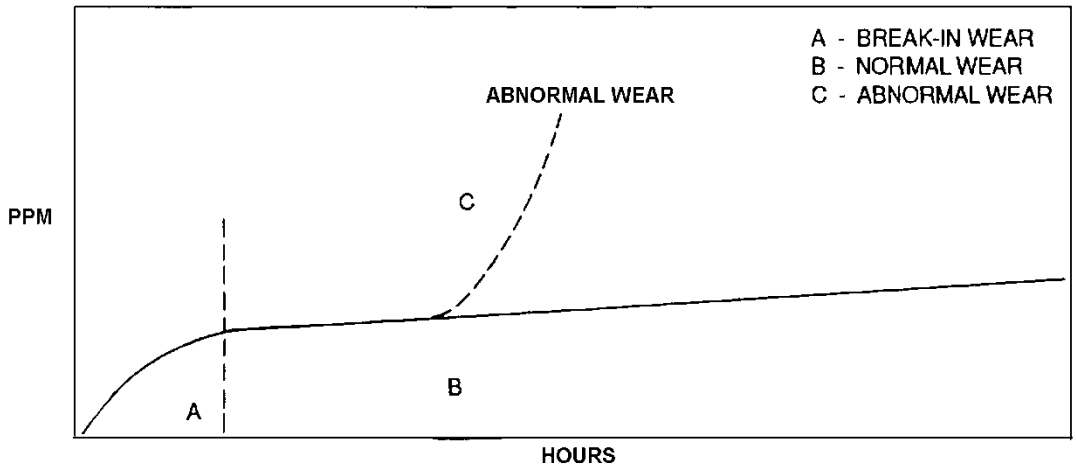

FIGURE 1. Wear Metal Concentration vs. Operating Hours

5. Identification and Measurement of Wear Metals. Wear metals produced in fluid lubricated mechanical assemblies can be measured in extremely low concentrations by spectrometric analysis of fluid samples taken from the assembly. The analytical instruments currently used for spectrometric oil analysis by the services are atomic emission rotrode instruments.

   a. Atomic Emission Spectrometer. An emission spectrometer is an optical instrument used to determine the concentration of wear metals in lubricating fluid. The analysis is accomplished by subjecting the sample to a high voltage spark or plasma which energizes the atomic structure of the metallic elements, causing the emission of light. There are two commonly used types of emission spectrometers, Atomic Emission Rotrode (AER), and Inductively Coupled Plasma (ICP). Laboratories certified under the Joint Oil Analysis Program utilize the AER spectrometer. The emitted light is subsequently focused into the optical path of the spectrometer and separated by wavelength, converted to electrical energy and measured. The intensity of the emitted light for any element is proportional to the concentration of wear metal suspended in the lubricating fluid.

   b.. Atomic Absorption Spectrophotometer. An atomic absorption spectrophotometer is an optical instrument used to determine the concentration of wear metals in the lubricating fluid. The sample is aspirated into a flame and vaporized. The molecular structure of the wear-metal compounds is reduced to ground state atoms by the high temperature. Light energy having the same characteristic wavelength of the element being analyzed is radiated through the flame. The resultant light which is not absorbed is converted to electrical energy and measured electronically. The amount of light absorbed by the elements in the flame is proportional to the concentration of wear metal suspended in the lubricating fluid.

6. Spectrometric Limitations. The spectrometric/spectrophotometric fluid analysis methods detect only small particles and are effective in detecting those failures characterized by an abnormal increase in the wear metal content of the lubricating fluid. This is particularly true of failures that proceed at a rate slow enough to permit detection by the laboratory. Examples of both detectable and undetectable failures are listed below.

a. Detectable Failures.

(1). The following are good indicators of impending engine/component failure:

(a). A slow, progressive wear metal concentration buildup above established abnormal criteria.

(b). A series of rapid wear metal concentration increases occurring below established abnormal criteria.

(2). Typical sources of wear found in detectable failures.

(a). Jet/Turbine Engines. Worn bearings (balls, cages, races), bearing seals and retainers, bearing housings, constant speed drives, oil pump gears, and gearbox castings.

(b). Reciprocating/Internal Combustion Engines. Worn bearings, crankshafts, cylinder walls, oil pump gears, piston pin bushings, piston rings, push rods, rocker arms, valve guides, and valve springs.

b. Undetectable Failures.

(1). Catastrophic failures. Sudden failures not preceded by characteristic wear metal generation, such as fatigue failure, cannot be detected by spectrometric oil analysis techniques now in use.

(2). Failures with no wear metal indications. Equipment failure may occur when metal particles too large to be detected by spectrometric methods are generated without the accompanying normal wear metal generation pattern that oil analysis is designed to detect.

7. Practical Considerations.

a. Sample Integrity. The value of spectrometric analysis and the subsequent utilization of this analysis by the evaluator is based on the assumption that the oil sample is representative of the system from which it was taken. If the oil is not truly representative of the system, the analytical results are totally useless. Occasionally, samples from one component may be erroneously substituted for another, resulting in what may at first appear to be a developing wear condition for one of the components. Closer inspection of results will often reveal these discrepancies. Any sudden increase of wear metal in one component and decrease in another, within the same weapon system/end item, should be viewed as a problem related to mislabeling of samples, i.e., misidentifying a sample as an engine sample when it was actually a transmission, or reversing left and right engine samples.

b. Contamination. Contamination is the problem that most frequently affects sample integrity. Sharp increases in the concentration of wear metals, water, unusual color, and particulate matter may be indications of contamination, and additional samples may be required to establish the true wear metal baseline. In some cases, systems may have to be flushed one or more times to remove contaminating substances. The most common contamination found in lubricant systems is dirt and sand which is detected by an increase in silicon. Silicon contamination is a common problem in dry, sandy, or dusty operational areas. Once in the component, dirt and sand are abrasive, and may accelerate wear.

c. Type of Spectrometer. The type of instrument being used to analyze fluid samples has a direct effect on the analytical result and must be considered. The analytical results from an inductively coupled plasma or atomic absorption spectrophotometer will generally be lower than the value that would be given by an atomic emission rotrode instrument for used oil analysis.

d. Calibration Standards. Calibration standards which are used to standardize the spectrometer have an assigned shelf life. Standards which have exceeded the allowable shelf life may introduce errors into the analytical process that may not be readily detected, particularly if all standards on hand have degraded over the entire standard range of PPM. Calibration standards should be checked for signs of precipitation as an indication of degradation. Refer to Volume II for detailed information concerning calibration standards.

e. Additives. New lubricating fluids normally do not contain any metallic compounds or constituents that would interfere with spectrometric identification and measurement of the wear metals produced by operation of the major assembly. Occasionally, lubricant manufacturers will use a metallic compound as a fluid additive. Although such additive compounds may only contribute a small amount of metal/chemical to the lubricant, it is necessary for the laboratory to recognize this source of trace materials. An analysis of a sample of new fluid can be used to establish a baseline for determining actual concentration of wear metals.

f. Corrosion. Internal equipment corrosion may become a factor in oil analysis when water is allowed to contaminate equipment lubricating fluid. Helicopter gearboxes are particularly susceptible to water induced internal corrosion because of design features that frequently do not protect against water intrusion. Evaluators must be familiar with the corrosion mechanism because corrosion products may easily be mistaken for impending failure indications and the equipment may be unnecessarily removed from service.

g. Fuel Dilution. Engine oil lubricated systems using leaded gasoline sometimes become contaminated through oil system fuel dilution. Analytical results indicating a high concentration of lead are a good indication that the system is fuel contaminated.

h. New/Rebuilt Engines/Components. New or recently overhauled equipment tends to produce wear metals at an accelerated rate. During this break in period, evaluation may be difficult since wear metal production may be higher than normal. The break in period is about 20 hours for jet engines, gearboxes and constant speed drives (CSD's) and about 100-200 hours (depending on RPM) for reciprocating engines. Curves A and B in figure 2 show typical plots of operating hours versus wear metal concentration for most new/rebuilt equipment. After break in is complete, an oil change may be necessary to reduce wear metal concentration to normal levels so evaluation criteria can be effectively utilized.

i. Patterns of Wear. Note that in figure 1, the wear metal concentration level continued to increase gradually as the equipment continued in operation. In actual practice, this may not happen because of the effect of fluid consumption and the replenishment of lost fluid by new fluid. Fluid replenishment usually causes the wear metal concentration level in a normal engine to "level off" and remain steady. If fluid were replaced as it was lost (rather than at discrete intervals, as is the actual practice), the effect of this oil replenishment on the wear metal concentration level would be as shown in figure 2. In this hypothetical example, the wear metal concentration level reaches its steady state following the break in period and then remains fairly constant. This steady state point is a function of two variables: (1) the rate of fluid consumption and replenishment, and (2) the rate of wear metal production by internal friction within the equipment. Theoretically, a steady state condition is never reached but is only approached as a limiting condition. In practice, the steady state point varies due to changing rates of fluid consumption and wear metal production.

j. Effects of Fluid Loss/Addition/Change. The smooth curve of figure 2 shows the hypothetical result if fluid was replaced as it was lost. This, of course, is impossible for most items of equipment. Figure 3 shows the effect of periodic fluid addition and a fluid change. In components such as some reciprocating engines, where oil depletion is rapid and replenishment is frequent, concentrations of wear metals will change erratically. Under these conditions it is best for the oil sample to be taken for analysis just prior to the addition of new oil. An accurate record of time since last oil change or oil addition is a requisite for the evaluator, as he may be misled if this information is incorrectly reported. Eight parts per million iron at 50 hours since oil change may be normal for a turbine engine; however, eight parts per million at 2 hours since oil change may indicate impending failure.

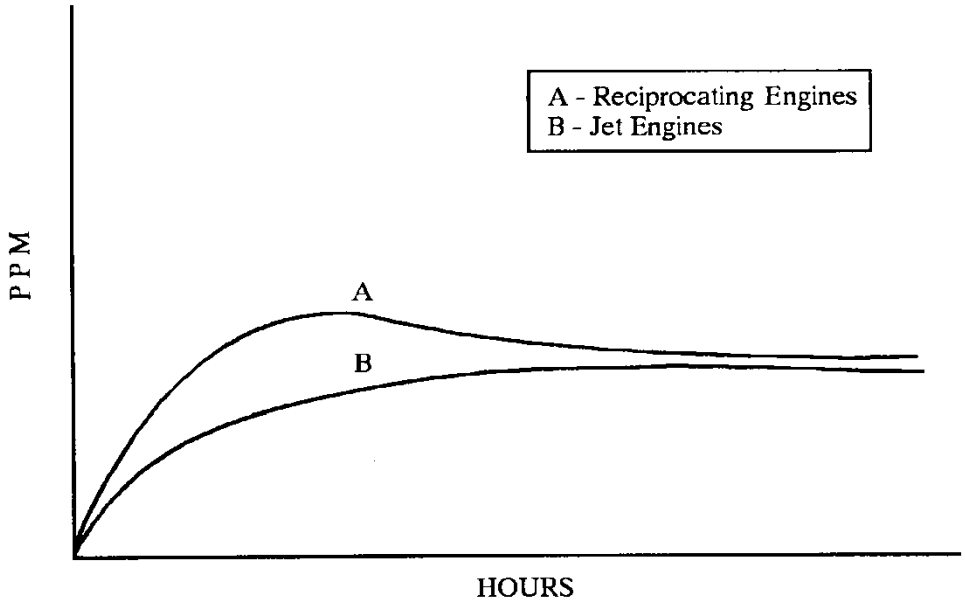

FIGURE 2. Wear-metal Concentration vs. Operating Hours

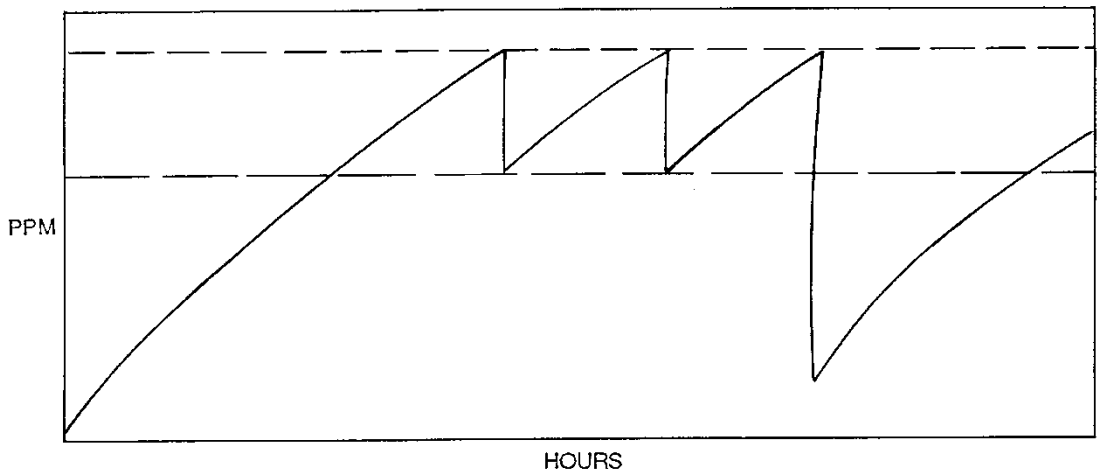

FIGURE 3. Effect of Periodic Fluid Addition and Fluid Change

k. Evaluation Information. Time since new or overhaul must be reported correctly, and the evaluator must remain alert to detect any inconsistencies in these data. When necessary, the customer must be contacted to check on the validity of any suspect values that affect the evaluation. The reporting of an incorrect time for the component may cause the evaluation to request a component removal rather than

an oil change or reducing the sampling interval. It is also important that information on component maintenance be reported and considered in the evaluation process.

l. Filter/Screen Checks. Information regarding the examination of filters or screens during routine equipment servicing can often augment spectrometric analysis. Large particles accumulated on filter screens may or may not be accompanied by high spectrometric wear metal indications. Normally, the wear metals detected and measured by spectrometric analysis are too small to be trapped on a filter screen. Therefore, visible particles on the screen and high wear metal content (spectrometric) may be detected independently. When large metal particles are detected in the oil system, either on filters or chip detectors, the source of the metal should be determined, if possible, or the equipment should be placed on shorter chip detector/filter inspection and/or oil sampling intervals.

m. Operating Conditions. The mission profile concerns the load factor and manner in which the equipment is operated. Generally speaking, equipment that operates at high percentages of maximum load at all times, will show a higher concentration of wear metals. Extreme operating load factors invite engine and power train problems. Under normal loads and less demanding conditions, most equipment operates at lower, more stable wear metal concentration levels. Equipment operated intermittently may exhibit symptoms associated with corrosion.

n. Feedback. Operating activity feedback containing maintenance or operating information that may affect the oil analysis results must be included in the evaluation process. For example, a sudden increase in wear metals may indicate a severe wear condition, but may also indicate that maintenance was performed on the component since the last sample was taken. Overboosts, overspeeds, overtemps, cylinder or rings replaced, overtorque, vibration, corrosion found, repair or adjustments on components, color of oil, mission profile information, compressor stalls, unusual noises from the component and filter/screen and chip detector inspections are all bits of information that will assist the evaluator in making a maintenance recommendation. Incorrect reporting or omission of even the most routine feedback information could adversely affect the evaluator's decision. Oil additions can distort developing wear trends and therefore affect evaluator decisions. The addition of oil between samples may result in abnormally low wear-metal results if the sample is taken immediately following an oil addition. This may be particularly misleading if it occurs when a sample has been requested to verify high results from a previous sample. Tank/sump draining actions done by the customer to reduce or eliminate wear metal levels will distort trends or mask actual conditions and are prohibited unless coordinated with the monitoring laboratory. All of the above information may affect oil analysis results and should be promptly reported to the laboratory. Details concerning oil analysis feedback requirements and procedures are contained in Section III of this volume.

8. Physical Properties Identification and Measurement. The physical properties of lubricating fluids are altered as lubricants degrade and/or become contaminated through service time and temperature, operational conditions and faulty maintenance practices. Important physical properties of lubricants are viscosity, moisture content, flash point, particulate level (solids), acidity/alkalinity and additive content. Physical property tests measure contaminants such as water, atmospheric dirt, fuel, combustion blow by products, and suspended particulate matter commonly found in used crankcase oils. A brief description of the physical test methods currently in use follows. The specific methods of analysis used to measure the various physical properties of used engine oils are included in Volume II. Physical properties tests on lubricants may be selectively applied to service equipment as determined by applicable service Program Managers.

   a. Viscosity. Lubricating fluids are affected by high temperatures and aeration during service which promote oxidation. This oxidation, if allowed to continue indefinitely, leads to increased viscosity, varnish and sludge. Viscosity decreases are usually attributed to fuel dilution. The viscosity of used lubricating fluids is determined by a viscometer which provides results/data that are converted to absolute viscosity and density readings in centipoise x g/cm3. These readings may be compared to new oil viscosity specifications and provide an indication of used oil condition.

b. Blotter Spot Test. This test is used to determine the presence of sludge in crankcase oils. One or two drops when placed on a piece of blotter paper and allowed to spread will provide information on the presence of sludge, the depletion of oil additives and/or moisture. The test is a rough estimate of sludge quantity but not of its identity.

c. Moisture Testing. Moisture or free water in oil causes sludge formation in the crankcase and prevents proper lubrication. Excess water causes flashing of metal surfaces under hot operating conditions and can cause engine failure. Moisture or free water in a transmission causes sludge formation or corrosion. Heat transfer fluids and dielectric fluids require careful treatment due to their sensitivity to moisture, particulate and ion contamination which can adversely affect equipment operation and degrade the fluid Insulating properties. Water or moisture may be determined by either of the following methods:

(1) Crackle Test. The crackle test is a qualitative test used for screening oil samples for the presence of water contamination. After vigorous shaking, one or two drops of the used oil sample are dropped onto the surface of a laboratory hot plate which has been heated to 150-177 degrees C (300-350 degrees F). A positive test is indicated by an audible crackling and spattering of the oil. Use of this test in conjunction with other tests can be used to identify probable sources of water contamination.

(2) Karl Fischer Method. The Karl Fischer method utilizes an automatic coulometric titrator that determines the quantitative amount of water in various fluids (transmission, heat transfer, dielectric, etc.). This is an electrochemical technique. A measured amount of sample is added to a cell containing a sensing electrode in a chemical medium. If water is present, the sensing electrode causes the cell to generate iodine. When the sensing electrode indicates no water is present, iodine production stops. The electrical charge used to generate the iodine is proportional to the concentration of water. The test functions automatically and provides a readout of the electrical charge used which is converted electronically into an indication of water content of the sample in PPM or in percent by volume/weight.

d. Fuel Dilution (Flash Point). Fuel dilution may be determined by flash point or by measuring fuel vapor in the sample headspace. The flash point is a means of determining if used lubricants are contaminated with diesel or gasoline fuel. The flash point method measures the reduction of flashpoint in the oil. The headspace analysis uses surface wave acoustic measurement to determine the percentage of fuel vapor in the headspace.

e. Insoluble Debris Characterization (Microscopic Analysis). Insoluble debris, collected by filtration on a membrane filter, are examined microscopically to determine their significance with respect to wear and contamination. Some contaminants such as metal chips or dirt may provide Indications of the source of the contaminants. This may be of particular value in the quality control of high performance fluids or in early detection of imminent failures.

f. Particulate Contamination. Measuring particulate contamination provides the quantity and size of particles present. Large particles are generally ingested dirt while smaller particles are usually generated from the system itself in the form of wear debris.

g. Fourier Infrared Transform Spectrometer (FT-IR). The FT-IR spectrometer system quantitatively measures water, fuel, coolant, soot, and by-products in synthetic and petroleum based lubricants. It also monitors component's lubricant additive depletion, lubrication degradation, and incorrect oil contamination for predicting a variety of fluid conditions that lead to component failures.

h. Debris/Wear Particle Analysis (Ferrographic Analysis). Ferrography is a means of microscopic examination of component wear particles suspended in fluids. The ferrographic analysis of wear particles begins with the magnetic separation of wear debris particles suspended from the lubrication fluids. The primary element evaluated is iron (Fe). There are two basic types of ferrographs to evaluate wear particles: the analytical ferrograph system and the Direct Read (DR) ferrograph. The analytical ferrograph

allows visual analysis for wear particles to be identified by type and characteristics of the wear. The DR ferrograph is used to obtain numerical baseline values for normal and abnormal wear.

i. Filter Debris Analysis. Filter Debris Analysis consists of backwashing an oil system filter with solvent, capturing the debris or portion thereof, and analyzing the debris by Energy Dispersive X-Ray Analysis.

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CUSTOMER RESPONSIBILITIES, REQUIREMENTS AND PROCEDURES

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1. IMPORTANCE OF OIL ANALYSIS AT CUSTOMER LEVEL. The stated purpose of the oil analysis program is to detect changes in the condition of used oil and other fluids, to detect unusual wear and to predict impending equipment failures. At the customer level this can be translated into improved equipment operational safety and reliability and increased maintenance effectiveness through performance of the right maintenance, at the right time at the lowest maintenance level consistent with good maintenance practices. An effective oil analysis program can also enhance maintenance workload planning by early identification of unscheduled maintenance requirements, improve the quality of maintenance and equipment operating practices, and result in improved maintenance procedures and equipment design as a result of oil analysis feedback information. Feedback is an extremely important element of the oil analysis program. Feedback is that information passed between all activities involved in the oil analysis program concerning conditions that may affect or influence either the oil analysis sample evaluation process and/or the resulting recommendation for maintenance action. Feedback may result in engineering change decisions that affect the safety, reliability or maintainability of operating equipment. Feedback from the oil analysis process also provides the basis for improved troubleshooting assistance from the supporting laboratory as data are compiled relating sample results to a particular component that may be generating abnormal wear metals. The refinement of this

process on some equipment has resulted in the ability to correct problems by component replacement at the organizational level rather than removal of the equipment for overhaul. Feedback concerning increasing contamination trends on a specific item of equipment has also assisted in improved operational planning, for example, restricting an aircraft from cross country flights to avoid the possibility of an engine change at a remote site, until the problem causing the increasing trend is identified and corrected. Feedback also creates a dynamic evolution of the criteria used to evaluate oil samples. This process ensures that the criteria applied to detected oil condition changes are more accurately related to actual equipment condition, thus reducing the possibility of premature, unwarranted equipment removals from service, while ensuring that criteria levels are low enough to ensure equipment operating safety. Probably the most important element of the feedback system to the customer is the laboratory recommendation for maintenance action following analysis of the customer's oil sample. Oil analysis laboratory recommendations are the result of careful trending and in-depth analysis of equipment history and should normally be followed. However, it is ultimately the customer's responsibility to decide what action to take in regard to any recommendation from the JOAP laboratory. A customer representative must work closely with the supporting oil analysis laboratory to ensure adequate maintenance procedures are implemented which will result in reduced maintenance costs and increased operational and personnel safety. See Appendix A for descriptions of all laboratory recommendation codes.

2. CUSTOMER RESPONSIBILITIES ARE AS FOLLOWS:

   a. Establish a system of internal accounting/record keeping to ensure that all samples for equipment entered in the oil analysis program are taken correctly and on time in accordance with applicable directives, to ensure that all samples are correctly identified, with accompanying paperwork correctly completed, and to ensure that all samples are expeditiously forwarded to the supporting oil analysis laboratory.

   b. Ensure that all personnel involved with the oil analysis program are properly trained in their duties and thoroughly aware of the importance of, and the benefits to be obtained by, an effective oil analysis program.

   c. Ensure that timely response is made to laboratory requests for samples or laboratory recommendations for maintenance actions and that prompt and complete feedback is provided to the laboratory concerning any condition or maintenance action that may affect the condition of the equipments' oil system. Customer feedback includes any internally generated maintenance action as well as those maintenance actions performed as a result of laboratory analysis reports or recommendations.

   d. Designate a unit point of contact to monitor activity compliance with oil analysis requirements and to establish close liaison with the supporting oil analysis laboratory for all matters relating to activity support and equipment condition.

   e. In accordance with COMNAVAIRFOR 4790.2A Series, U.S. Navy customers (aircraft reporting custodians) operating aircraft are additionally responsible for maintaining records of oil analysis results to highlight equipment trends. Although the laboratory operator/evaluators are responsible for evaluating analysis results and providing recommendations to the customers, the customer has the ultimate responsibility to determine what action, if any, is required in response to a laboratory recommendation. In order to fulfill this responsibility, certain equipment oil analysis and maintenance information must be available to the maintenance manager. The content and format of the oil analysis trend record may vary between activities, but the basic information to establish a trend record must be maintained by all aircraft reporting custodians. Figures 1 and 2 illustrate formats considered adequate for Oil Analysis Trend Forms and may be adapted for use by operating activities. Oil Analysis Trend Records are not available as standard forms and must be produced by individual user activities. Oil Analysis Trend Forms shall be maintained for each item of organizational equipment entered in the oil analysis program. Trend records shall remain on file until the equipment undergoes overhaul/first degree repair, at which time a new base line/trend will be established for the equipment.

3. LABORATORY SUPPORT OF CUSTOMERS. JOAP policy requires all JOAP laboratories to provide non-reimbursable routine support to all DOD and U.S. Coast Guard transient customers and permanent customers in each JOAP certified laboratory's assigned area of responsibility. The JOAP laboratory listed in Appendix B closest to an activity's area of operation that is capable of providing the most responsive support will normally support operational activities. Activities experiencing any problems with laboratory support or anticipating changing supporting laboratories due to change of operating site should request guidance via the normal chain of command. The Major/Type Command, the laboratory's parent command and the appropriate service oil analysis Program Management Office will coordinate assignment or transfers of customers between laboratories. Interservice laboratory support workload matters should be coordinated through the appropriate service chain of command directly to the service Program Management office. Customers desiring to obtain oil analysis support from an oil analysis laboratory not currently approved and qualified within the Joint Oil Analysis Program must submit a request through the chain of command to the appropriate service Program Manager:

   Laboratory name/location and affiliation

   Type spectrometer

   Type standards

   Laboratory operator qualifications

   Description of support work to be performed

   Details of proposed support agreement

   Service Program Managers may approve such laboratories if they qualify for entry in the JOAP Correlation Program in accordance with paragraph 4-3. Laboratories may be approved for interim operational support by the appropriate service Program Manager(s) following successful completion of analysis of three special sets (six pairs) of correlation samples as specified in paragraph 4-3.e. Laboratories shall then be entered in the JOAP Correlation Program and receive final Program Manager approval or disapproval based on Correlation Program performance results.

   All Navy laboratories, if equipped and capable to do so, shall process samples submitted to them by any DOD customer. Refusal to do so may be considered sufficient cause for laboratory to be decertified from the JOAP program.

4. SAMPLING

   a. Sampling Intervals. Sampling intervals have been established for specific equipment based upon engineering design, average wear rates, projected failure points, and the hazards related to potential system/equipment failures. Therefore, equipment sampling should be closely monitored for compliance with established intervals. The sampling interval should not vary more than ±10 percent of that specified for each Type/Model/Series of equipment except as modified by appropriate equipment managers.

NOTE

Samples may be taken earlier than the specified interval if adjustment to engine sampling time is required to permit simultaneous engine sampling on multi-engine aircraft. However, limits may not be exceeded to adjust sampling times.

Refer to the applicable scheduled maintenance or periodic inspection documents for the specific routine sampling interval and specific sampling instructions for each Type/Model/Series of equipment being sampled.

430086 EQUIP ID 127723 END ITEM ID

MO DAY	TSO TSOC	SAMPLE RANGE/ RESULT (1)	LAB (2) RECOMMENDATION	CUSTOMER ACTION (3)	OTHER OIL SYST MAINT AFFECTING OIL ANALYSIS (4)
2/15	/73	N (NORMAL)			
2/23	/105	M (MARGINAL) IRON OVER TH 7 PPM	DO NOT CHANGE OIL - RESAMPLE IN 5 HRS.	CW	
2/26	/110	H (HIGH) IRON EXCEEDS HIGH LIMITS 15 PPM	DO NOT FLY CHECK MAIN + ACCY OIL PUMPS + GB	CW	CHANGED MAIN OIL PUMP CHANGED OIL SUBMIT SAMPLE AFTER 1 HR GRD RUN
2/28	/01	N	SUBMIT 5 HR SAMPLE	CW	
3/2	/06	N	RESUME NORMAL SAMPLING		
3/17	/37	N			CHANGED OIL - ROUTINE 3-12 30HRS TSOC
4/7	/69	N ABNORMAL INC	SUBMIT 5 HR SAMPLE	CW	
4/9	/74	M IRON INCR OVER THRESHOLD 12 PPM	DO NOT FLY SAMPLE ASAP	CW	
4/10	/75	A ABNORMAL IRON LIMIT EXCEEDED 17 PPM	REPL ENGINE	CW	ENG REMOVED - SENT TO AIMD

NOTES:
(1) Enter PPM in sample results block for critical elements (as listed on applicable criteria sheet) that exceed the normal range.
(2) Enter message DTG in lab recommendation block for abnormal results reported (optional).
(3) Enter customer response to lab recommendation, e.g., CW-Complied With.
(4) List any other maintenance actions that may affect oil system analysis. Report significant maintenance to supporting lab using DD Form 2026.

FIGURE 1. Oil Analysis Trend Record (Sample Format)

EQUIP ID END ITEM ID

SAMPLE TSO/TSOC	FE	AL	AG	CU	MG	TI	NI	CR		LABORATORY RECOMMENDATION	MAINTENANCE DATA/ ACTION TAKEN

NOTES:
(1) Under lab analysis column – enter only critical elements from NAVAIR 17-15-50 for engine/equipment model being monitored.
(2) In maintenance data column – list action taken in response to lab recommendation and other miscellaneous remarks.

FIGURE 2. Oil Analysis Trend Record (Alternate Sample Format)

b. Sampling Procedures. The success and effectiveness of the oil analysis program is dependent upon reliable samples. A reliable sample is one which is truly representative of the circulating fluid in the equipment being evaluated.

(1). When to Take Samples. Samples should be taken as soon as possible but within 30 minutes (Air Force Only) of engine/equipment shutdown and before any fluid is added to the system. An exception to this requirement is non-aeronautical equipment oil samples. If fluid was not added following shutdown, these samples may be taken without warming a component to operating temperature if the equipment has been operated within the last 30 days. If not operated within the last 30 days, the equipment must be brought to operating temperature before sampling. (Army personnel sampling non-aeronautical equipment should refer to TM 43-0211 for additional oil analysis procedural information.) If a sample must be taken from a unit after new oil has been added, e.g., if oil level is too low to permit sampling or if laboratory requests a special sample following oil addition and prior to equipment operation, the old and new oils must be thoroughly mixed to obtain a homogeneous mixture by operating the unit to operating temperatures before taking the sample. In systems where system oil temperature is not an operating characteristic, a judgment of operating time required to obtain a homogeneous mixture must be made based upon system characteristics such as system capacity, pump volume output, reservoir capacity, etc. These procedures are necessary since any sample taken from a system in which the fluid is not a homogeneous mixture will not be representative of actual fluid condition and may distort the laboratory trend for the equipment and may result in a resample request from the laboratory.

(a) Routine Samples. Routine sampling intervals shall be as specified in appropriate service documentation governing operation and maintenance of each Type/Model/Series of equipment. Cognizant Weapon System/Model Engineering activities establish and maintain sample interval documentation to provide effective oil analysis coverage.

(b) Special Samples. Special samples from equipment monitored by the service oil analysis programs will be taken in accordance with the following guidelines:

1 Whenever requested by the laboratory.

2 Whenever directed by the unit maintenance activity to investigate suspected deficiencies.

3 Immediately following an operation in which any abnormal condition or incident occurred resulting from either malfunction of the oil lubricated system, or damage to the oil lubricated system from excessive loss of engine oil, or low/fluctuating or zero oil pressure.

4 Immediately prior to and after maintenance is performed affecting the oil lubricated system, including the removal and replacement of an oil lubricated system component. Systems, which are sampled after each flight, do not require samples taken prior to maintenance, provided an analysis was accomplished after the last flight. The "after replacement" sample should be taken after ground/functional run-up or check flight.

NOTE

Special sampling is not required for maintenance performed on oil pressure or quantity indicating systems where it is determined that only the instrument system components are faulty and where repair, replacement and/or failure of these components will not cause damage to oil wetted components or cause wear metal particles, foreign material and/or instrument system fluids to be introduced into the oil system.

5 After flight test following installation of new, overhauled, or repaired aircraft engines.

6 At completion of a test cell run. If unit is operated on oil previously used in the test cell system, a sample is required both prior to and at the completion of the test cell run.

7 Whenever excessive vibration or a chip light indication is experienced on an aircraft engine or component during flight, ground or test run.

8 Immediately following all aircraft incidents involving failure of internal enclosed lubricated parts or unplanned/unexpected shutdown affecting operation of internal enclosed lubricated parts.

9 Immediately following all aircraft accidents regardless of cause and resulting damage. These samples will be taken by any means possible to obtain a representative sample.

10 Prior to overseas deployment or redeployment of any equipment already being monitored by oil analysis. Samples should be taken far enough in advance to assure receipt of analysis prior to unit deployment or redeployment. A sample prior to departure is not required if:

a. The aircraft is on routine sampling.

b. Oil analysis records will accompany the aircraft.

c. The normal sampling interval can be maintained due to the availability of an oil analysis facility at the destination.

(c) Additional Special Samples. Special samples taken from equipment not enrolled in a service oil analysis program may be submitted to a JOAP laboratory. No advice is provided for samples that do not have limits provided to JOAP by the cognizant engineering activity.

(2). How to Take Samples. There are three basic techniques for taking a sample: dip tube, drain/valve, and pump. Detailed sampling procedures for specific equipment are established in applicable service documentation governing the use and operation of such equipment.

(a) Dip Tube Sampling.

1 Remove the filler cap/dip stick from the tank, and open the sample bottle.

2 Using a sampling tube of the correct length, grasp the tube at one end and lower it into the tank through the filler neck (see figure 3, Views A and B). For units using the new sampling kit with the plastic bottle, insert one end of the dip tube into the opening on the cap of the plastic bottle. Insert the other end into the oil reservoir. Squeeze and release the bottle. After the sample is obtained, remove the tube and close the lid.

WARNING

Do not use mouth suction to fill the sampling tube. Many fluids are highly toxic and may cause paralysis and/or death.

3 Allow the lower end of the tube to fill with fluid, then close the upper end with a thumb or finger. Withdraw the tube and drain the trapped fluid into the sample bottle (see figure 3, Views C and D). Repeat this operation until the bottle has been filled to approximately 1/2 inch from the top.

NOTE

The plastic sampling tubes may be received curved and difficult to straighten; but a tube straightener can be fabricated and used for taking samples from many

systems. An example of a tube straightener constructed with 3/32 inch diameter stainless steel rod is illustrated in figure 4.

4 Replace the filler cap on the tank, and dispose of the sampling tube in accordance with local base requirements.

CAUTION

If sampling materials are accidentally dropped into the system, do not operate the equipment until corrective action has been completed.

(b) Drain/Valve Sampling.

1 Check appropriate service documentation for location of drain/valve. Equipment may have to be in operation for valve sampling.

2 Open the sample bottle.

3 See figure 5 for a locally manufactured drain kit.

4 Hold the sample bottle under the drain/valve and fill to approximately 1/2 inch from the top as pictured in figure 5, views B and C. Close the drain/valve outlet.

5 Replace the bottle cap, and tighten it enough to prevent leakage from the bottle.

(c) Pump/Syringe Sampling.

1 Determine the best source for obtaining the sample such as the dipstick hole or filler neck.

2 Determine best length for sample tubing according to the equipment.

3 Open the sample bottle. (Pumps are designed to attach the sample bottles to the pump assembly.)

4 Use pump/syringe action to draw fluid from equipment.

5 Deposit fluid into sampling bottle. Repeat steps (d) and (e) as necessary to fill sample bottle to approximately 1/2 inch from the top.

6 Replace the filler cap or dipstick and discard the sampling tube. Replace the sample bottle cap and tighten enough to prevent leakage.

(d) Oil Servicing Cart Sampling.

1 Remove supply tank fill cap and visually inspect tank for contamination. If contamination is found, refer to applicable tech orders and conduct an investigation.

2 Ensure that the oil sample taken is representative of the oil in the cart reservoir and not the oil in the hose. Install the nozzle adapter onto the supply hose. Insert the nozzle end into the supply tank opening. Operate the pump handle a minimum of ten complete cycles circulating oil from the supply tank through the supply hose. Verify that there is a steady flow of fluid to ensure that the sample will be representative of the oil in the reservoir.

3 Carefully pump a sufficient amount of oil into the sample bottle, filling the bottle to within one-half inch from the top of the bottle.

(e) Oil Servicing Cart Sampling (Air Force Only).

1 Sampling of oil servicing carts is critical for maintaining the integrity of engine oils. Servicing carts are subject to contamination due to incorrect handling and storage, environmental

factors, and filling of servicing tanks with contaminated oils or incorrect fluids. The most common contamination is water or sand/dirt. When passed to aircraft engines, these contaminants can increase engine wear patterns or accelerate engine oil breakdown, reducing the service life of the oil and its ability to properly lubricate internal components. For these reasons, sampling of oil servicing carts must be completed as part of the oil analysis process and is integral to engine health/component monitoring. The policy of sampling of oil servicing carts and oil containers is applicable only for those locations with aircraft engines and/or components that are enrolled and monitored as part of the Air Force oil analysis program. Oil carts and containers that are used to service engines/components that are not routinely sampled and monitored under the air force oil analysis program are exempt from these requirements.

2 Each base/location that has engines and/or components enrolled and monitored and uses oil servicing carts as part of their engine maintenance and servicing schedules must establish a program to ensure the integrity of the oils within the servicing carts and containers. Each base/location that uses oil servicing carts as part of their engine maintenance and servicing schedules must establish a program to ensure the integrity of the oils within the servicing carts. Each base/location must develop procedures to ensure servicing carts are sampled on a routine basis. Oil servicing carts used to service aircraft engines must be sampled within the following guidelines:

a Must be sampled prior to the beginning of the routine flying week

b. Whenever contamination to the cart is suspected.

c. Upon completion of maintenance on the oil servicing cart.

d. Aircraft oils in bulk containers (55 gal drums or other) that are to be transferred to oil carts for the servicing of aircraft engines will be sampled at initial opening and results known prior to addition to the oil cart.

e. Whenever contamination is suspected in an aircraft engine sample.

3 Ensure that contaminated carts are handled according to local or MAJCOM policy. Refer to volume II, section IX for guidance on contamination from automotive oil.

4 Environmental conditions at some operating locations may drive a more frequent sampling interval to ensure the integrity of the oil. Desert, high moisture areas, exposure to salt, air, or extreme cold may all induce contamination into the oil reservoir and may require more stringent sampling intervals.

c. Special Precautions. The following precautions are provided to assist activities in ensuring reliable equipment fluid samples:

(1) Store unused sampling kits or materials in clean, closed containers, such as the packaging boxes in which received.

(2) Use the correct length of sampling tube for the particular equipment involved so that the tube cannot reach the bottom of the tank and pick up sludge contamination. In cases where the tubing must be cut to the proper length, the tubing should be cleanly cut at a 45 degree angle, exercising care not to leave rough edges that could introduce bits of plastic tubing into the system being sampled.

(3) Avoid contact of the sampling tube with the outside of equipment being sampled and all other surfaces which might contaminate it. Use a sampling tube to take one sample only and discard the tube after taking the sample.

(4) Open the sample bottle only when ready to take the sample and replace the bottle cap immediately after taking the sample.

(5) In cases where samples can be taken only by draining from a valve or the bottom of the tank, sump, or case, open the drain valve/outlet and allow enough fluid to flow through to wash out any accumulated sediment before filling the bottle. If it has been determined that a particular system does not normally have sediment at the point where the sample is drained, it is not necessary to perform the sediment removal procedure.

(6) Use lint-free wiping cloths to avoid introducing lint into the system.

CAUTION

If sampling materials are accidentally dropped into the system, do not operate the equipment until corrective action has been completed.

(7) Exercise caution to avoid dropping sample bottle caps or other material into the system during sampling.

WARNING

Do not use mouth suction to fill the sampling tube. Many fluids are highly toxic and may cause paralysis and/or death.

(8) Exercise care during the sampling process to avoid burns from hot fluid. Do not leave plastic tubing in hot fluid for extended periods since the tubing may melt and contaminate the system.

(9) To reduce the possibility of sample misidentification, all sample bottles/bottle containers should be marked with equipment/system identification as soon as possible after drawing the sample.

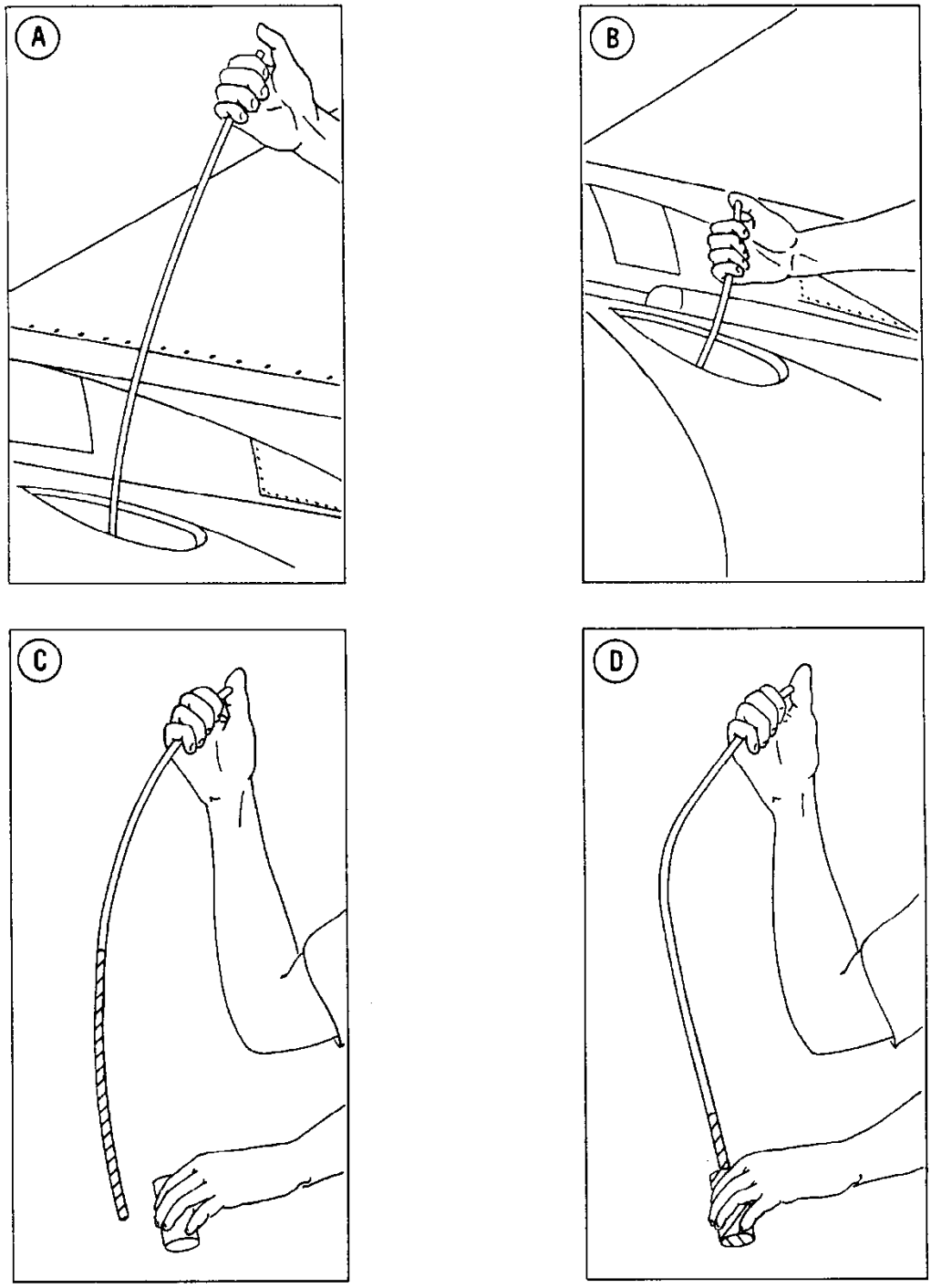

FIGURE 3. Dip Tube Sampling

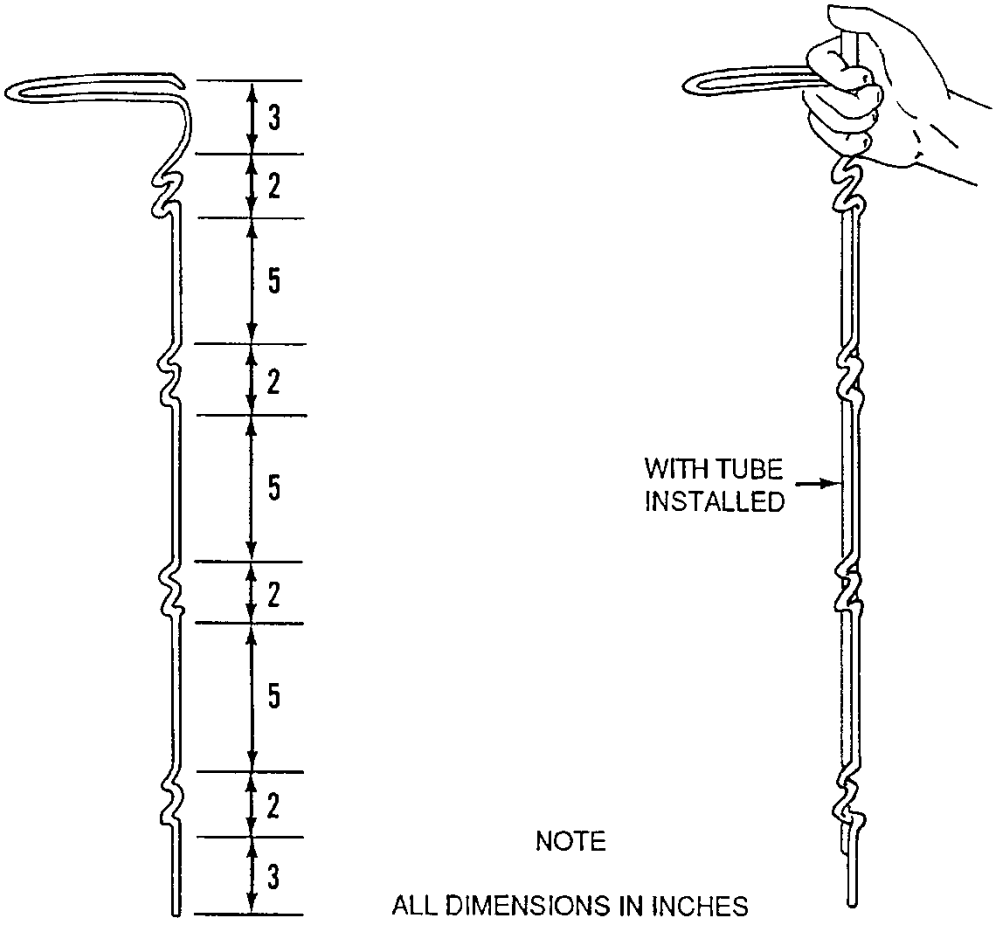

FIGURE 4. Sample Tube Straightener

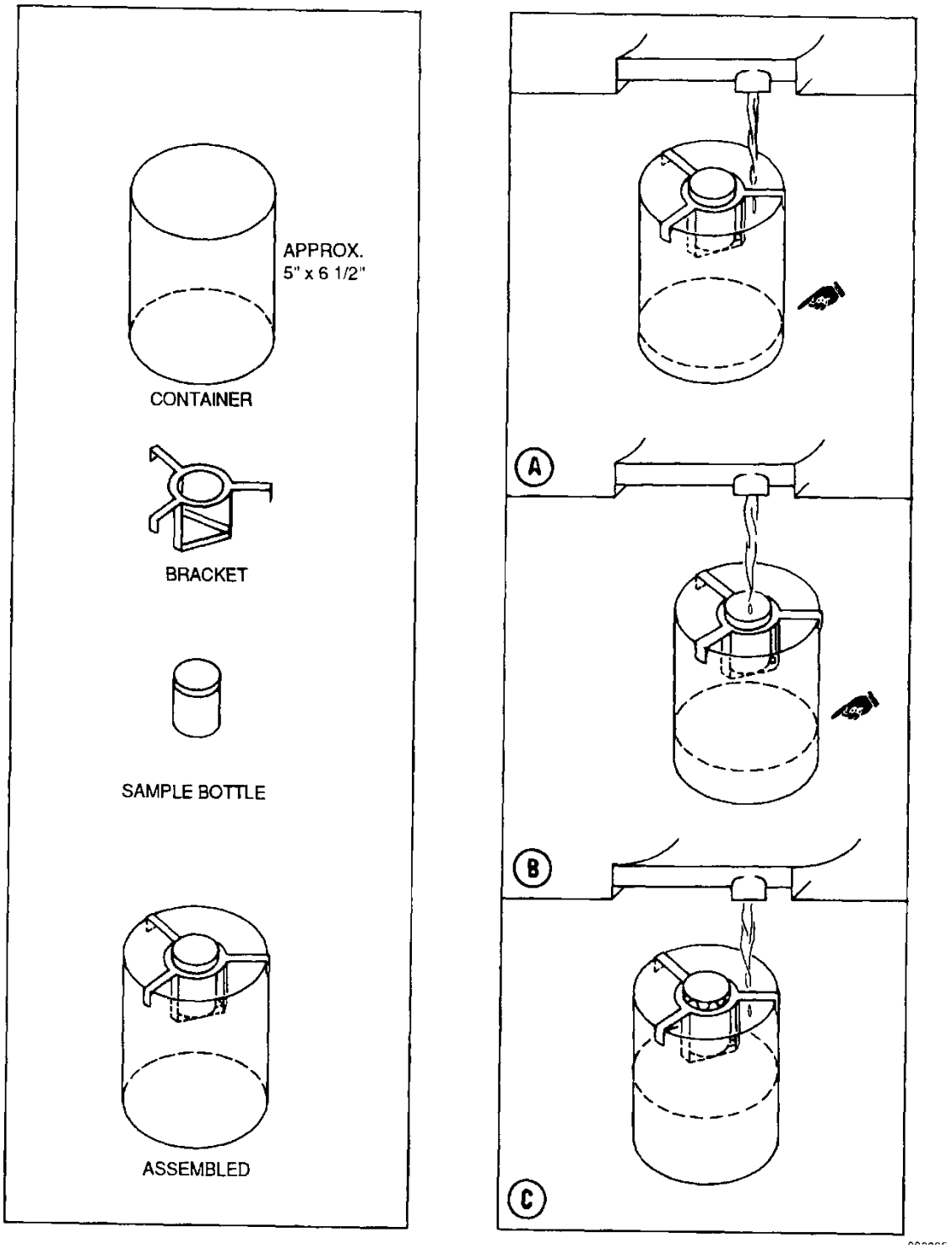

FIGURE 5. Locally Manufactured Drain Sample Kit

5. DD FORM 2026 and DA 5991-E (automated form for Army units), OIL ANALYSIS REQUEST

   a. The Oil Analysis Request Form, DD Form 2026, is used for:

      (1) Submission of routine or special oil samples.

      (2) Reporting Chip Detector Inspection Results.

      (3) Documenting / Report Analysis Results when automated reporting systems are not available.

   b. Filling out DD Form 2026. Proper completion of the Oil Analysis Request by the submitting activity is a vital step in the evaluation process upon which maintenance actions are based. When forms are incomplete or erroneously completed, all other efforts to produce a valid evaluation are degraded or impossible. Figures 6 and 7 are the DD2026 form as revised in 2013. Several changes have been made to the form to improve data collection and database maintenance. Examples of DD Form 2026 usage are provided by figures 8 through 10. Customers shall use only plain language, unless otherwise directed. If extra space is required, attach additional sheets.

      (1) Instructions for DD Form 2026 completion are as follows:

         (a) TO: Oil Analysis Laboratory. Enter the designated OAP laboratory, which will perform the sample analysis, e.g., Ft. Campbell, KY; Columbus AFB, MS; NADEP Jacksonville, FL; etc. Contact your respective Service Oil Analysis Program Management Office for a list of available laboratories. A list of Navy Oil Analysis Laboratories is also available in Vol II WP 003 02.

         (b) FROM.

            1. Major Command. Enter possessing Major Command, foreign government or contractors, e.g., TAC, FORSCOM, COMNAVSURFLANT, RAF UK, and General Dynamics.

            2. Operating Activity. Enter the designation of the operating activity submitting the sample, e.g., 432BW, 337 Med Co A., VA 165. Air Force, enter name of base;

            3. UIC. Enter the unit identification code.

            4. DMS Address (Navy): Navy activities are to enter their Defense Messaging System Plain Language Address, e.g. VAQRON ONE FOUR ZERO, VAQRON ONE FOUR TWO, etc.

            5. POC. Enter the name and rank of the person submitting the sample. AF personnel should include their employee number.

            6. POC. Enter the phone number, fax number and email address of the person submitting the sample.

            7. MMCO. Enter the name and email address of the Maintentance Control Officer.

         (c) Source of sample. Check the appropriate block for the source of the sample.

         (d) Equipment Model/Application. Enter type, model and series of engine being sampled, e.g., J57 21, J85 5, GTCP85 106, AVDS 1790, LM 2500. Accessory equipment being sampled will be identified by nomenclature such as CSD, main gearbox, fwd trans, hyd sys #1, etc. Navy activities enter a description of the shipboard component or piece of equipment.

(e) Equipment Serial No. Enter complete serial number of equipment being sampled. Since shipboard equipment rarely has a readily identifiable serial number, Navy activities submitting samples from shipboard equipment are requested to create a unique identification code for each piece of equipment by combining the ship's hull number with a number indicating position on the ship and an appropriate abbreviation. Details for creating these unique identification codes are contained in Table 1.

(f) End Item Model/Hull No. Enter mission, design and series (type, model, series) of end item which contains system being sampled, e.g., F100D, M32A 60, A4A, M 60, DD-963, CVN-68 etc.

(g) End Item Ser No/EIC. Enter the complete end item serial number (aircraft bureau number). For ship components leave blank.

(h) Machinery / Valve ID: Navy activities submitting samples from shipboard systems shall enter the machinery and/or valve ID if available.

(i) Date Sample Taken (Day, Mo, Yr). Enter the date in numeric—day, month, and year on which the sample was taken, e.g., 03/12/04 for 3 Dec 2004.

(j) Local Time Sample Taken. Enter local time sample was taken using 24-hour clock, e.g., 0700, 1600, 2200, etc.

(k) Hours/Miles Since Overhaul. Enter the total hours/miles since overhaul of system being sampled to the nearest whole hour/mile (round up if 0.5 or above). If the equipment has never been overhauled, the total operating hours/miles since new are used. Air Force personnel will normally enter total flying hours. However, on equipment such as the F-100 and F-110 series engines, operating hours will be entered. For Navy equipment leave blank.

(l) Hours/Miles Since Oil Change. Enter hours/miles since oil change on the system being sampled to the nearest whole hour/mile (round up if 0.5 or above). For Navy equipment enter hours if known, otherwise leave blank.

NOTE

Accurate data on hours/miles since overhaul and hours/miles since oil change are extremely important for correct evaluation of the analysis results. Every effort possible must be made to ensure that these data are correct.

(m) Current Odometer/hours Reading. Enter the odometer if available.

(n) Reason for Sample. Enter reason for taking sample. Place an "X" in applicable block; if "Other" block is marked, specify reason for sample, e.g., initial sample, warning light, etc.

NOTE

If the sample is a special sample, it must be prominently marked in red (such as red borders), both on the form and on the outside of the mailing container to alert the laboratory to the need for immediate processing.

(o) Oil Added Since Last Sample. Enter the quantity of oil added since the last sample to the nearest whole number and specify the measurement used. For Navy equipment enter hours if known, otherwise leave blank.

CAUTION

Oil consumption information is essential to the evaluation process for trend analysis and to determine if a system is using excessive amounts of oil. Report suspected excessive oil usage to both the local system manager(s) and the local oil analysis laboratory.

(p) How Taken. Leave blank unless specifically directed otherwise.

(q) Sample Temperature. Leave blank unless specifically directed otherwise.

(r) Type Oil. For Navy equipment enter the specification number, product designation or product name. Army and AF activities leave blank unless specifically directed otherwise.

(s) Remarks/Miscellaneous. Enter any pertinent sample information including a sample number if one is assigned by the submitting activity. On initial samples, note changes in equipment status, provide the JOAP laboratory and the following:

1. System oil capacity.
2. Sampling / Oil change interval.
3. Minor maintenance actions within the oil system.

(t) A/C Engine Position. Enter position number on aircraft when applicable.

(u) MCD Visual Insp. of Debris. If visual inspection of MCD is required, Air Force customers are to check the appropriate block for the debris observed on the chip collector. The person conducting the inspection must sign in the POC signature block (not OAP lab personnel).

(v) SEM/EDX LEVEL section. This form replaces CAF 22 for AF activities. AF OAP personnel are to complete this section when applicable by:.

1. Annotate the MCD Level
2. Annotate Wear Metal Type
3. Attach MCD Tabs to back of 2026 in Remarks section

(w) Submitting Activity Sample Number. Submitting activities may use this space to assign a designation to the sample being submitted thus facilitating the submission of multiple samples and oil analysis requests in one shipping envelope or container. See Figure 10 for an example.

NOTE

The customer is responsible for completing all required information above "FOR LABORATORY USE ONLY". Sample numbers in the bottom left corner of the form are assigned by the laboratory to ensure that all of the samples taken were successfully processed.

THIS FORM MUST ACCOMPANY THE SAMPLE. DO NOT APPLY ADHESIVES OR TAPE TO THIS FORM.

OIL ANALYSIS REQUEST

TO	OIL ANALYSIS LABORATORY:
FROM	MAJOR COMMAND:
	OPERATING ACTIVITY NAME AND ADDRESS (Include Zip/APO)
	UIC: DMS Address (Navy):
	POC:NAME/RANK/EMP #
	POC: PHONE/FAX/EMAIL:
	MMCO: NAME / EMAIL:

Source of sample
☐ Aeronautical ☐ Ground ☐ Ship Equipment ☐ OTHER

EQUIPMENT MODEL/APPLICATION:
EQUIPMENT/COMPONENT SERIAL NUMBER:
END ITEM MODEL/SHIP NAME & HULL NUMBER (with Dash):
END ITEM SERIAL NUMBER:
MACHINERY / VALVE ID:
DATE SAMPLE TAKEN (DAY/MO/YR): LOCAL TIME SAMPLE TAKEN:
HOURS/MILES SINCE OVERHAUL:
HOURS/MILES SINCE OIL CHANGE:
CURRENT ODOMETER/HOURS READING:

REASON FOR SAMPLE
☐ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER (SPECIFY)

OIL ADDED SINCE LAST SAMPLE (OZ, PTS, QTS, GALS)

HOW TAKEN	SAMPLE TEMPERATURE	TYPE OIL
☐ DRAIN ☐ TUBE	☐ HOT ☐ COLD	

REMARKS A/C ENGINE POSITION

MCD Visual Insp of debris ☐ within limits ☐ exceeds limits ☐ unknown/NA

POC SIGNATURE:

SUBMITTING ACTIVITY SAMPLE NUMBER:

FOR LABORATORY USE ONLY

SAMPLE RESPONSE TIME:

WEAR METAL ANALYSIS

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si
Sn	Ti	B	Mo	Zn	Ba	V	Mn	Cd	

Water Content	Crackle	Acid Number	Viscosity @ 40C	Viscosity @ 100C	Fuel Dilution

PARTICLE COUNT

5 - 15 um	15 - 25 um	25 - 50 um	50 - 100 um	> 100 um	Overall NAS Class

SEM/EDX LEVEL

MCD LEVEL: WEAR METAL TYPE:

LABORATORY SAMPLE NUMBER(S)	OAP CODE	OPERATOR INITIALS

DD FORM 2026, SEPTEMBER 2013 PREVIOUS EDITIONS OBSOLETE.

Figure 6. DD2026 Oil Analysis Request Form (Front)

TRANSIENT AIRCRAFT OIL ANALYSIS RECORD

ASSIGNED OIL ANALYSIS LABORATORY	LABORATORY TELEPHONE NO. *(DSN):* *(Commercial):*	END ITEM MODEL AND SERIAL NO. / EQUIPMENT MODEL AND SERIAL NO.

LAB CODE	DATE	TOTAL TIME SINCE OVERHAUL	TOTAL TIME SINCE OIL CHG	FE	AG	AL	CR	CU	MG	NA	NI	PB	SI	SN	TI	B	MO	ZN	LAB REC

DATE DEPARTED *(Return this form with aircraft)*

REMARKS (Place MCD Tabs here)

DD FORM 2026 (BACK), SEPTEMBER 2013

Figure 7. DD2026 Oil Analysis Request Form (Back)

Table 1. Instructions for Creating Navy Ship Equipment Identifcation Codes

The ship component serial number (compsn) consists of the hull number (spelled out ex. LCAC), followed by "-", followed by a number indicating location on the ship (Table 1a), followed by "/", and the description (Table 1b and 1c) of item being sampled. Example* CVN68-1/EDG = *#1 emergency diesel engine on the ship CVN68.

Table 1a – Equipment Location Number

Number	Ship location
1	Starboard or forward
2	Port or aft
3	Center

Table 1b – Ship Equpment Name / Abbreviation

EQUIPMENT NAME	ABBREVIATION
AIR COMPRESSOR	ACOMP
AIR COMPRESSOR, DEBALLAST	DEBAL
AIR COMPRESSON, HIGH PRESSURE	HPAC
AIR COMPRESSOR, LOW PRESSURE	LPAC
AIR COMPRESSOR, MEDIUM PRESSURE	MPAC
AIR COMPRESSOR, RIX	RIX
AIR COMPRESSOR, SCBA	SCBPAC
AIR COMPRESSOR, SHIP SERVICE	SACOMP
AIR COMPRESSOR, STARTING	STRPAC
AIR CONDITIONER	AC
AIR SUPPLY SYSTEMS	ASSSUPPLY
ANCHOR WINDLASS GEAR	ANCHGE
ANCHOR WINDLASS GOVERNOR	GOVANCH
ANCHOR WINDLASS HYDRAULIC	ANCHHY
ANCHOR WINDLASS SPEED DECREASER	SPD
AUXILLARY POWER UNIT	APU
BALLAST HUDRAULIC SYSTEM	BALLHY
BEARING, LINE SHAFT	LSBEAR
BEARING, PEDESTAL	PEDBEAR
BEARING, THRUST	THBEAR
BOW THRUSTER GEAR	BOWGEAR
BOW THRUSTER HUDRAULIC	BOWTHR
CAPSTAND GEAR	CAPGE
CAPSTAND HYDRAULIC	CAPHY
CAPSTAN WARPING	WARANCH
CENTRAL HYDRAULC POWER UNIT	CHPU

EQUIPMENT NAME	ABBREVIATION
CONTROLLABLE PITCH PROPELLER	CPP
CRANE, FORWARD	FCRANE
CRANE, HOIST	HCRANE
CRANE, ROTATION	RCRANE
CRANE, SEA	SCRANE
CRANE, SLEW	SLCRANE
DAVIT GEAR	DAVITGE
DAVIT HYDRAULIC SYSTEM	DAVIT
DIESEL ENGINE ROCKER ARMS	ROCKARM
DIESEL ENGINE, ANCHOR	MADE
DIESEL ENGINE, AUXILIARY	AUXDE
DIESEL ENGINE, MAIN	MDE
DIESEL ENGINE, SMALL B0Y	SBDE
DIVING HYDRAULIC POWER UNIT	DHPU
DREDGER	DREDGE
ELEVATOR	ELEV
ELEVATOR, AIRCRAFT	ACELEV
ELEVATOR, CARGO WEAPONS	CWELEV
ELEVATOR, DECK EDGE	DEELEV
ELEVATOR, MEDICAL GEAR	MEDELEVGE
ELEVATOR, MEDICAL HYDRAULIC SYSTEM	MEDELEV
ELEVATOR, PERSONNEL	PERELEV
EXTERNAL DRIVE SYSTEM	DRICELEG
FIN STABILIZER	FINSTAB
FIRE FLUSHING PUMP	FFPUMP
GAS TURBINE ENGINE	GTE

Table 1b – Ship Equpment Name / Abbreviation(Contiued)

EQUIPMENT NAME	ABBREVIATION
GEAR, GOVERNOR	GOVGEAR
GENERATOR, AUXILIARY DIESEL	AUX
GENERATOR, EMERGENCY DIESEL	EDG
GENERATOR, EMERGENCY GAS TURBINE	EGTG
GENERATOR, GAS TURBINE	GTG
GENERATOR, MAIN DIESEL	MDG
GENERATOR, SHIP SERVICE DIESEL	SSG
GENERATOR, STEAM TURBINE	STEAMTG
GUIDED MISSILE	GDMIS
GUN MOUNT	GUNMT
GUN MOUNT, LOWER ACCUMULATOR	GUNLW
GUN MOUNT UPPER ACCUMULATOR	GUNUP
HYDRAULIC POWER UNIT, AUXILIARY	AUXHPU
HYDRAULIC POWER UNIT, HOSE	HOSHPU
HYDRAULIC POWER UNIT SORS	SORHPU
LAUNCHER HYDRAULIC SYSTEM	LAUNCH
LCAC SCAVENGER FAN	SCANFAN
MAIN MOTOR	MM
NITRO PLANT	NITRO
PRESS, HYDRAULIC	PRESS
PUMP, COOLANT CHARGING	CCPUMP
PUND, FUEL OIL	FOPUMP
PUMP, MAIN CIRCULATION	MCPUMP
PUMP, MAIN FEED	MFPUMP
PUMP, SHIP LUBE OIL	SLPUMP
PPUMP, TRANSFER	XPUMP
PURIFIER	PURI
REDUCTION GEAR, DIESEL SHIPS	DRG
REDUCTION GEAR GAS TURBINE	GRG
REDUCTION GEAR, MAIN	MRG
REDUCTION GEAR, STEAM SHIPS	SRG
REFRIGERATION SYSTEM	REFER
REFRIGERATION SYSTEM, CARGO	CGREF
REFRIGERATION SYSTEM, SHIPS SERVICE	SSREF
REFRIGERATION SYSTEM, THAW BOX	THWAC
STEERING DIVING HYDRAULIC POWER UNIT	DSTRHPU
STEERING GEAR	STRGEAR
STEERING GEAR, AUXILIARY	ASTRGEAR
STEERING GEAR, EMERGENCY	ESTRGEAR

EQUIPMENT NAME	ABBREVIATION
STERN RAMP HYDRAULIC SYSTEM	STERN
STRIKEDOWN SYSTEM	STRKDL
SUBMARINE HYD SYS, DAWG RETRUN	DRETHPU
SUBMARINE HYD SYS, DAWG SUPPLY	DSUPHPU
SUBMARINE HYD SYS, EXTERNAL RETURN	ERETHPU
SUBMARINE HYD SYS, EXTERNAL SUPPLY	ESUPHPU
SUBMARINE HYD SYS, PORT RETURN	PRETHPU
SUBMARINE HYS SYS, PORT SUPPLY	PSUPHPU
SUBMARINE HYS SYS, STARBOARD RETURN	SRETHPU
SUBMARINE HYD, SYS, STARBOARD SUPPLY	SSUPHPU
SUBMARINE HYD SYS, STEER/DIVING RETN	DSRHPU
SUBMARINE HYD SYS, STEER/DIVING SUPPLY	DSSHPU
SUBMARINE HYD SYS, VLS RETURN	VRETHPU
SUBMARINE HYD SYS, VLS SUPPLY	VSUPHPU
TANK, HEAD	HTANNK
TANK, STORAGE	STANK
TURBO CHARGER	TBCHARG
VERTICAL LAUNCH SYSTEM	VLS
VICKER VALVE STATION	VICKER
VLS CRAND	CRANVLS
VLS LAUNCHER POWER UNIT	LPUVLS
VLS MAGAZINE	MAGVLS
VLS TRAIN	TRAINVLS
WINCH, AMMO HOIST	AMWINCH
WINCH, AUXILIARY	AUXWINCH
WINCH, BOAT	BOWINCH
WINCH, BOW RAMP	BWWINCH
WINCH, BURTON	BWINCH
WINCH, GEAR,	WINGEAR
WINCH, GYPSY	GYPWINCH
WINCH, HAULING	HAWINCH
WINCH, HILINE	HIWINCH
WINCH, MAIN	MNWINCH
WINCH, MONORAIL	MONWINCH
WINCH, NIXIE	NIXWINCH
WINCH, RAM	RAMWINCH
WINCH, RAPID SECURING DEVICE	RSDWINCH
WINCH, RAST HUDRAULIC POWER UNIT	WHPU
WINCH, RAST ROPE	ROPWINCH

Table 1b – Ship Equpment Name / Abbreviation(Contiued)

EQUIPMENT NAME	ABBREVIATION
WINCH, RECEIVING	RECWINCH
WINCH, REPLENISHMENT AT SEA	RASWINCH
WINCH, SADDLE	SADWINCH
WINCH, SPAN WIRE	SPAWINCH
WINCH, STERN GATE	STRWINCH

EQUIPMENT NAME	ABBREVIATION
WINCH, TACTAS	TACWINCH
WINCH, TOPPING GEAR	TOPGEAR
WINCH, TOPPING HYDRAULIC	TOPWINCH
WINCH, VENHICLE RAMP	VEHWINCH

Table 1c – Abbreviation / Ship Equipment Name

ABBREVIATION	EQUIPMENT NAME
AC	AIR CONDITIONER
ACELEV	ELEVATOR, AIRCRAFT
ACOMP	AIR COMPRESSOR
AMWINCH	WINCH, AMMO HOIST
ANCHGE	ANCHOR WINDLASS GEAR
ANCHHY	ANCHOR WINDLASS HYDRAULIC
APU	AUXILLARY POWER UNIT
ASSSUPPLY	AIR SUPPLY SYSTEMS
ASTRGEAR	STEERING GEAR, AUXILIARY
AUX	GENERATOR, AUXILIARY DIESEL
AUXDE	DIESEL ENGINE, AUXILIARY
AUXHPU	HYDRAULIC POWER UNIT, AUXILIARY
AUXWINCH	WINCH, AUXILIARY
BALLHY	BALLAST HUDRAULIC SYSTEM
BOWGEAR	BOW THRUSTER GEAR
BOWINCH	WINCH, BOAT
BOWTHR	BOW THRUSTER HUDRAULIC
BWINCH	WINCH, BURTON
BWWINCH	WINCH, BOW RAMP
CAPGE	CAPSTAND GEAR
CAPHY	CAPSTAND HYDRAULIC
CCPUMP	PUMP, COOLANT CHARGING
CGREF	REFRIGERATION SYSTEM, CARGO
CHPU	CENTRAL HYDRAULC POWER UNIT
CPP	CONTROLLABLE PITCH PROPELLER
CRANVLS	VLS CRAND
CWELEV	ELEVATOR, CARGO WEAPONS
DAVIT	DAVIT HYDRAULIC SYSTEM
DAVITGE	DAVIT GEAR

ABBREVIATION	EQUIPMENT NAME
DEBAL	AIR COMPRESSOR, DEBALLAST
DEELEV	ELEVATOR, DECK EDGE
DHPU	DIVING HYDRAULIC POWER UNIT
DREDGE	DREDGER
DRETHPU	SUBMARINE HYD SYS, DAWG RETRUN
DRG	REDUCTION GEAR, DIESEL SHIPS
DRICELEG	EXTERNAL DRIVE SYSTEM
DSRHPU	SUBMARINE HYD SYS, STEER/DIVING RETN
DSSHPU	SUBMARINE HYD SYS, STEER/DIVING SUPPLY
DSTRHPU	STEERING DIVING HYDRAULIC POWER UNIT
DSUPHPU	SUBMARINE HYD SYS, DAWG SUPPLY
EDG	GENERATOR, EMERGENCY DIESEL
EGTG	GENERATOR, EMERGENCY GAS TURBINE
ELEV	ELEVATOR
ERETHPU	SUBMARINE HYD SYS, EXTERNAL RETURN
ESTRGEAR	STEERING GEAR, EMERGENCY
ESUPHPU	SUBMARINE HYD SYS, EXTERNAL SUPPLY
FCRANE	CRANE, FORWARD
FFPUMP	FIRE FLUSHING PUMP
FINSTAB	FIN STABILIZER
FOPUMP	PUND, FUEL OIL
GDMIS	GUIDED MISSILE
GOVANCH	ANCHOR WINDLASS GOVERNOR
GOVGEAR	GEAR, GOVERNOR
GRG	REDUCTION GEAR GAS TURBINE
GTE	GAS TURBINE ENGINE
GTG	GENERATOR, GAS TURBINE
GUNLW	GUN MOUNT, LOWER ACCUMULATOR
GUNMT	GUN MOUNT

Table 1c – Abbreviation / Ship Equipment Name (Contiued)

ABBREVIATION	EQUIPMENT NAME
GUNUP	GUN MOUNT UPPER ACCUMULATOR
GYPWINCH	WINCH, GYPSY
HAWINCH	WINCH, HAULING
HCRANE	CRANE, HOIST
HIWINCH	WINCH, HILINE
HOSHPU	HYDRAULIC POWER UNIT, HOSE
HPAC	AIR COMPRESSON, HIGH PRESSURE
HTANNK	TANK, HEAD
LAUNCH	LAUNCHER HYDRAULIC SYSTEM
LPAC	AIR COMPRESSOR, LOW PRESSURE
LPUVLS	VLS LAUNCHER POWER UNIT
LSBEAR	BEARING, LINE SHAFT
MADE	DIESEL ENGINE, ANCHOR
MAGVLS	VLS MAGAZINE
MCPUMP	PUMP, MAIN CIRCULATION
MDE	DIESEL ENGINE, MAIN
MDG	GENERATOR, MAIN DIESEL
MEDELEV	ELEVATOR, MEDICAL HYDRAULIC SYSTEM
MEDELEVGE	ELEVATOR, MEDICAL GEAR
MFPUMP	PUMP, MAIN FEED
MM	MAIN MOTOR
MNWINCH	WINCH, MAIN
MONWINCH	WINCH, MONORAIL
MPAC	AIR COMPRESSOR, MEDIUM PRESSURE
MRG	REDUCTION GEAR, MAIN
NITRO	NITRO PLANT
NIXWINCH	WINCH, NIXIE
PEDBEAR	BEARING, PEDESTAL
PERELEV	ELEVATOR, PERSONNEL
PRESS	PRESS, HYDRAULIC
PRETHPU	SUBMARINE HYD SYS, PORT RETURN
PSUPHPU	SUBMARINE HYS SYS, PORT SUPPLY
PURI	PURIFIER
RAMWINCH	WINCH, RAM
RASWINCH	WINCH, REPLENISHMENT AT SEA
RCRANE	CRANE, ROTATION
RECWINCH	WINCH, RECEIVING

ABBREVIATION	EQUIPMENT NAME
REFER	REFRIGERATION SYSTEM
RIX	AIR COMPRESSOR, RIX
ROCKARM	DIESEL ENGINE ROCKER ARMS
ROPWINCH	WINCH, RAST ROPE
RSDWINCH	WINCH, RAPID SECURING DEVICE
SACOMP	AIR COMPRESSOR, SHIP SERVICE
SADWINCH	WINCH, SADDLE
SBDE	DIESEL ENGINE, SMALL B0Y
SCANFAN	LCAC SCAVENGER FAN
SCBPAC	AIR COMPRESSOR, SCBA
SCRANE	CRANE, SEA
SLCRANE	CRANE, SLEW
SLPUMP	PUMP, SHIP LUBE OIL
SORHPU	HYDRAULIC POWER UNIT SORS
SPAWINCH	WINCH, SPAN WIRE
SPD	ANCHOR WINDLASS SPEED DECREASER
SRETHPU	SUBMARINE HYS SYS, STARBOARD RETURN
SRG	REDUCTION GEAR, STEAM SHIPS
SSG	GENERATOR, SHIP SERVICE DIESEL
SSREF	REFRIGERATION SYSTEM, SHIPS SERVICE
SSUPHPU	SUBMARINE HYD, SYS, STARBOARD SUPPLY
STANK	TANK, STORAGE
STEAMTG	GENERATOR, STEAM TURBINE
STERN	STERN RAMP HYDRAULIC SYSTEM
STRGEAR	STEERING GEAR
STRKDL	STRIKEDOWN SYSTEM
STRPAC	AIR COMPRESSOR, STARTING
STRWINCH	WINCH, STERN GATE
TACWINCH	WINCH, TACTAS
TBCHARG	TURBO CHARGER
THBEAR	BEARING, THRUST
THWAC	REFRIGERATION SYSTEM, THAW BOX
TOPGEAR	WINCH, TOPPING GEAR
TOPWINCH	WINCH, TOPPING HYDRAULIC
TRAINVLS	VLS TRAIN
VEHWINCH	WINCH, VENHICLE RAMP
VICKER	VICKER VALVE STATION

Table 1c – Abbreviation / Ship Equipment Name (Contiued)

ABBREVIATION	EQUIPMENT NAME
VLS	VERTICAL LAUNCH SYSTEM
VRETHPU	SUBMARINE HYD SYS, VLS RETURN
VSUPHPU	SUBMARINE HYD SYS, VLS SUPPLY
WARANCH	CAPSTAN WARPING

ABBREVIATION	EQUIPMENT NAME
WHPU	WINCH, RAST HUDRAULIC POWER UNIT
WINGEAR	WINCH, GEAR,
XPUMP	PPUMP, TRANSFER

THIS FORM MUST ACCOMPANY THE SAMPLE. DO NOT APPLY ADHESIVES OR TAPE TO THIS FORM.

OIL ANALYSIS REQUEST

TO	OIL ANALYSIS LABORATORY: NAS Pensacola NOAP Lab	
FROM	MAJOR COMMAND: Chief of Naval Air Training	
	OPERATING ACTIVITY NAME AND ADDRESS (Include Zip/APO): Training Air Wing 6, 390 San Carlos Rd / STE C, NAS Penascola FL 32508-5509	
	UIC: 52814	DMS Address (Navy): COMTRAWING SIX PENSACOLA FL
	POC:NAME/RANK/EMP #: John Doe / AD2 / S-0231	
	POC: PHONE/FAX/EMAIL: 850-452-XXXX / 850-452-XXXX / john.doe@navy.mil	
	MMCO: NAME / EMAIL: James Smith / James.Smith@navy.mil	

Source of sample: ☑ Aeronautical ☐ Ground ☐ Ship Equipment ☐ OTHER

EQUIPMENT MODEL/APPLICATION: PT6A-6B

EQUIPMENT/COMPONENT SERIAL NUMBER: RA0037

END ITEM MODEL/SHIP NAME & HULL NUMBER (with Dash): T-6A

END ITEM SERIAL NUMBER: 165986

MACHINERY / VALVE ID:

DATE SAMPLE TAKEN (DAY/MO/YR): 09/08/2013 | LOCAL TIME SAMPLE TAKEN: 13:00

HOURS/MILES SINCE OVERHAUL: 4375

HOURS/MILES SINCE OIL CHANGE: 879

CURRENT ODOMETER/HOURS READING:

REASON FOR SAMPLE: ☑ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER (SPECIFY)

OIL ADDED SINCE LAST SAMPLE (OZ, PTS, QTS, GALS)

HOW TAKEN	SAMPLE TEMPERATURE	TYPE OIL
☐ DRAIN ☐ TUBE	☑ HOT ☐ COLD	MIL-PRF-23699

REMARKS | A/C ENGINE POSITION

MCD Visual Insp of debris ☐ within limits ☐ exceeds limits ☐ unknown/NA

POC SIGNATURE: _____

SUBMITTING ACTIVITY SAMPLE NUMBER: 2-234

FOR LABORATORY USE ONLY

SAMPLE RESPONSE TIME:

WEAR METAL ANALYSIS

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si
Sn	Ti	B	Mo	Zn	Ba	V	Mn	Cd	

Water Content	Crackle	Acid Number	Viscosity @ 40C	Fuel Dilution

PARTICLE COUNT

5 - 15 um	15 - 25 um	25 - 50 um	50 - 100 um	> 100 um	Overall NAS Class

SEM/EDX LEVEL

MCD LEVEL: | WEAR METAL TYPE:

LABORATORY SAMPLE NUMBER(S)	OAP CODE	OPERATOR INITIALS

DD FORM 2026, SEPTEMBER 2013 — PREVIOUS EDITIONS OBSOLETE.

FIGURE 8. Oil Analysis Request, DD Form 2026 Routine Aeronautical Sample (from Naval Aviation Activity)

THIS FORM MUST ACCOMPANY THE SAMPLE. DO NOT APPLY ADHESIVES OR TAPE TO THIS FORM.

OIL ANALYSIS REQUEST

TO — OIL ANALYSIS LABORATORY:

FROM
- MAJOR COMMAND: MARCC JOAP Lab Norfolk
- OPERATING ACTIVITY NAME AND ADDRESS (Include Zip/APO): USS LEYTE GULF (CG 55) FPO AE 9570-1175
- UIC: N21388 — DMS Address (Navy): USS LEYTE GULF
- POC:NAME/RANK/EMP #: John Doe / MMC / S-0231
- POC: PHONE/FAX/EMAIL: john.doe@CG55.navy.mil
- MMCO: NAME / EMAIL: James Smith / James.Smith@CG55.navy.mil

Source of sample: ☐ Aeronautical ☐ Ground ☑ Ship Equipment ☐ OTHER

EQUIPMENT MODEL/APPLICATION: Anchor hydraulic Starboard Reservoir
EQUIPMENT/COMPONENT SERIAL NUMBER: CG55-1/ANCHHY
END ITEM MODEL/SHIP NAME & HULL NUMBER (with Dash): CG-55
END ITEM SERIAL NUMBER:
MACHINERY / VALVE ID:
DATE SAMPLE TAKEN (DAY/MO/YR): 19/06/2012 — LOCAL TIME SAMPLE TAKEN: 13:00
HOURS/MILES SINCE OVERHAUL:
HOURS/MILES SINCE OIL CHANGE:
CURRENT ODOMETER/HOURS READING:

REASON FOR SAMPLE: ☐ ROUTINE ☑ LAB REQUEST ☐ TEST CELL ☐ OTHER (SPECIFY)

OIL ADDED SINCE LAST SAMPLE (OZ, PTS, QTS, GALS)

HOW TAKEN	SAMPLE TEMPERATURE	TYPE OIL
☐ DRAIN ☐ TUBE	☑ HOT ☐ COLD	MIL-H-17672

REMARKS — A/C ENGINE POSITION

MCD Visual Insp of debris ☐ within limits ☐ exceeds limits ☐ unknown/NA

POC SIGNATURE:

SUBMITTING ACTIVITY SAMPLE NUMBER: 23456

FOR LABORATORY USE ONLY

SAMPLE RESPONSE TIME:

WEAR METAL ANALYSIS

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si
Sn	Ti	B	Mo	Zn	Ba	V	Mn	Cd	

Water Content	Crackle	Acid Number	Viscosity @ 40C	Fuel Dilution

PARTICLE COUNT

5 - 15 um	15 - 25 um	25 - 50 um	50 - 100 um	> 100 um	Overall NAS Class

SEM/EDX LEVEL

MCD LEVEL: — WEAR METAL TYPE:

LABORATORY SAMPLE NUMBER(S) — OAP CODE — OPERATOR INITIALS

DD FORM 2026, SEPTEMBER 2013 — PREVIOUS EDITIONS OBSOLETE.

FIGURE 9. Oil Analysis Request, DD Form 2026 – Lab Request Sample (Submitted by Navy Ship Activity)

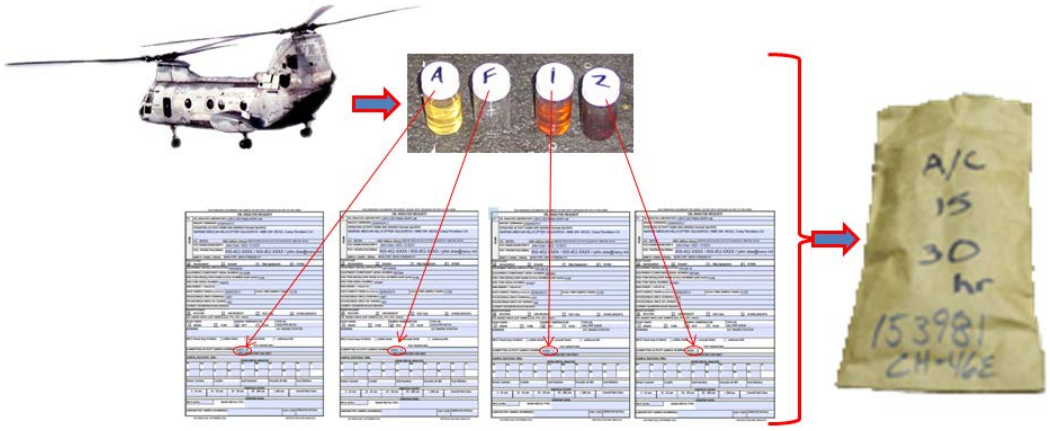

FIGURE 10. Submitting Multiple Samples and Linking to Applicable Oil Analysis Request Forms via the Activity Sample Number

(2) An example of a transit aircraft oil analysis record (Side 2 of DD Form 2026), is provided by figure 12.

(a) When equipment is scheduled for a mission away from the home installation/base, and oil samples will be due during the mission, the customer is responsible for coordinating oil analysis support at the mission site or at intermediate site(s) if applicable (refer to Appendix B for a complete listing of laboratories). The laboratory that usually supports the equipment will provide historical analytical data upon request. It is the customers' responsibility to provide the laboratory that supports the equipment at the mission or intermediate site(s) with the historical data so they have a record of previous oil analysis results for the equipment prior to the samples they receive. Complete Side 2 of the DD Form 2026 as described in paragraphs 6.b.(1)(a) through (r), adding the word "transit" after the name of the home base if the sample is to be processed at any lab other than the home base laboratory. Aircraft on rotational assignment will reflect the name of rotational base and will not be considered transient. Prior to aircraft departure from home installation/base, the servicing laboratory shall prepare a DD Form 2027 or provide an equivalent printed record of OAP results. The DD 2027 or equivalent historical record shall be included in the maintenance or service records that accompany the aircraft. The DD 2027 shall be supplied to and used by all laboratories visited en route to provide effective oil analysis while the aircraft is in transit. Steps 1-7 are to be completed by the home laboratory with step 8 completed by each en route laboratory. The record must contain at least the following information:

1. Complete message and mailing address of assigned support OAP laboratory.
2. Home installation/base laboratory telephone number (DSN and commercial where applicable).
3. End item model and serial number.
4. Equipment model and serial number.
5. Contain the OAP results for at least the last 10 samples and all samples analyzed during at least the last 10 hours of operation.
6. Any pertinent remarks about the aircraft or results.
7. Date aircraft departed on transit mission.

THIS FORM MUST ACCOMPANY THE SAMPLE. DO NOT APPLY ADHESIVES OR TAPE TO THIS FORM.

OIL ANALYSIS REQUEST

TO — OIL ANALYSIS LABORATORY: NELLIS AFB

FROM
- MAJOR COMMAND: ACC
- OPERATING ACTIVITY NAME AND ADDRESS (Include Zip/APO): 575 AMXS/NELLIS AFB, NV 89191
- UIC: DMS Address (Navy):
- POC:NAME/RANK/EMP #: JOHN SMITH, SSgt, 01062
- POC: PHONE/FAX/EMAIL: 123-4567
- MMCO: NAME / EMAIL:

Source of sample: ☑ Aeronautical ☐ Ground ☐ Ship Equipment ☐ OTHER

EQUIPMENT MODEL/APPLICATION: F110-GE-129
EQUIPMENT/COMPONENT SERIAL NUMBER: 538443
END ITEM MODEL/SHIP NAME & HULL NUMBER (with Dash): F-16
END ITEM SERIAL NUMBER: 81-1062-1
MACHINERY / VALVE ID:
DATE SAMPLE TAKEN (DAY/MO/YR): 01/08/13 — LOCAL TIME SAMPLE TAKEN: 0700
HOURS/MILES SINCE OVERHAUL: 1233.5
HOURS/MILES SINCE OIL CHANGE: 15.5
CURRENT ODOMETER/HOURS READING:

REASON FOR SAMPLE: ☑ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER (SPECIFY)

OIL ADDED SINCE LAST SAMPLE (OZ, PTS, QTS, GALS): 0.5 PTS

HOW TAKEN: ☐ DRAIN ☑ TUBE — SAMPLE TEMPERATURE: ☑ HOT ☐ COLD — TYPE OIL: 7808

REMARKS — A/C ENGINE POSITION: 1

MCD Visual Insp of debris: ■ within limits ☐ exceeds limits ☐ unknown/NA — Customer Signature

POC SIGNATURE:

SUBMITTING ACTIVITY SAMPLE NUMBER:

FOR LABORATORY USE ONLY

SAMPLE RESPONSE TIME:

WEAR METAL ANALYSIS

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si
0	0	1	2	1	0	5	1	2	2

Sn	Ti	B	Mo	Zn	Ba	V	Mn	Cd	
2	1	1	0	0					

Water Content	Crackle	Acid Number	Viscosity @ 40C	Fuel Dilution

PARTICLE COUNT

5 - 15 um	15 - 25 um	25 - 50 um	50 - 100 um	> 100 um	Overall NAS Class

SEM/EDX LEVEL

MCD LEVEL: 2 — WEAR METAL TYPE:

LABORATORY SAMPLE NUMBER(S): 08022 — OAP CODE: A — OPERATOR INITIALS: JVM

DD FORM 2026, SEPTEMBER 2013 — PREVIOUS EDITIONS OBSOLETE.

FIGURE 11. Oil Analysis Request, DD Form 2026 – Lab Request Sample (Submitted by an Air Force)

8. The en route laboratory will complete the remainder of the transit record. Transient sample results may be documented either on the back of the DD Form 2026, by continuation on the DD Form 2027, or by providing a printed record of all results of any oil analysis performed. Regardless of what other forms the data are provided in, all data obtained by or in an en route laboratory must be entered into the en route laboratory's electronic database—even if the aircraft and en route laboratory belong to different services.

(b) When the customer returns to home base, records of analysis done at intermediate locations must be delivered to the regular supporting laboratory. If the customer departs prior to receipt of the completed transit record, the intermediate laboratory will forward the completed transit record to the regular supporting laboratory.

6. PREPARING SAMPLES FOR LABORATORY DELIVERY.

a. Insert the sample bottle in the shipping bag and attach the completed DD Form 2026 to the outside of the bag. If multiple samples are to be shipped together in a bag or box, identify each sample bottle with a unique sample number and insert the sample number in the "Submitting Activity Sample Number" blank on the applicable DD Form 2026. See Figure 10.

NOTE

If the sample is a special sample, it must be prominently marked in red (such as red borders), both on the form and on the outside of the mailing container to alert the laboratory to the need for immediate processing.

b. Forward the sample package to the supporting laboratory by established channels using the most expeditious means. Criticality of the sample should govern the delivery method, i.e., mail, hand delivery, etc. It should be noted that 4 ounce samples require additional packaging, either individually or in groups, to be forwarded by mail.

7. SAMPLING SUPPLIES

a. Kit, Spectrometric Oil Analysis (NSN 6695-01-045-9820). This is a general purpose sampling kit required by operating activities taking and submitting samples for spectrometric testing. This spectrometric oil analysis kit should only be used on equipment that requires the siphoning method for obtaining an oil sample. See paragraph 8.d. for individual supplies for equipment that requires the drain method of sampling. This kit consists of a 30-inch long, 5/16-inch OD plastic tube, a 5-dram glass bottle with plastic screw cap, a shipping bag and one DD Form 2026 (Oil Analysis Request). Nomenclature is Sampling Kit, Spectrometric. Unit of issue: box, containing 144 kits.

b. Kit, Spectrometric and Physical Test (NSN 4920-01-003-0804). This sampling kit is required by Navy operating activities taking and submitting samples for physical tests only or spectrometric tests combined with physical tests. Each kit contains a 4-ounce polyethylene bottle, a shipping bag, a plastic bag, a NOAP sample label and a DD Form 2026. Nomenclature is Sampling Kit, Oil. Unit of issue: each, material for 72 kits.

c. Kit, Mailer (NSN 8125-01-193-3440). For AOAP use, this kit is required by operating activities taking and submitting samples for physical tests only or spectrometric and physical tests. Each kit contains 24 each of 3-ounce plastic bottles, plastic bags and shipping sacks.

d. Individual Supplies.

(1) Bottle, Spectrometric (NSN 8125-01-378-9518). This bottle with cap can be individually ordered for equipment that uses the drain sampling method. This bottle and cap are the same as contained in the Spectrometric Oil Analysis Kit in paragraph 8.a. above. This sample bottle is a 5-dram (5/8-

ounce), clear, glass bottle. Nomenclature is Bottle, Screw Cap. Unit of issue: gross (144 each). Air Force authorizes the use of a smaller bottle if cleanliness standards set for approved JOAP bottles are met and the bottle size permits at least two sample analyses.

(2) Bottle, Spectrometric and Physical Test (NSN 8125-01-082-9697). For AOAP use, this sample bottle is a 3-ounce plastic bottle. Nomenclature is Bottle, Oil Sample. Unit of issue: box (120 each).

(3) Shipping Bag Spectrometric (NSN 8105-00-498-6619). This bag measures 4 inches by 8 inches. Nomenclature is Shipping Bag, Spectrometric. Unit of issue: bundle (500 each).

(4) Shipping Bag, Spectrometric and Physical Test (NSN 8105-00-290-0340). This bag measures 6 inches by 10 inches. Nomenclature is Sack, Shipping. Unit of issue: box (250 each).

(5) Plastic Tubing. Various diameters and lengths of plastic tubing are available. Nomenclature is Tubing, Nonmetallic except for NSN 4710-01-087-1629 which is Tubing, Plastic.

Plastic Sample Tubing	NSN	Unit of Issue
15" long by 3/8" OD	4710-00-933-4415	Bag (100 each)
30" long by 3/8" OD	4710-01-087-1629	Bag (100 each)
20" long by 1/4" OD	4710-00-933-4417	Bag (100 each)
1000 long by 1/4" OD	4720-00-964-1433	Roll (1000 feet)
5/16" OD	4710-01-040-4175	Feet

Nomenclature is Tubing, Nonmetallic except for NSN 4710-01-087-1629 which is Tubing, Plastic

(6) Oil Sampling Pump (NSN 4930-01-119-4030). This pump is used to extract fluid from non-aeronautical equipment and is used with bottle, NSN 8125-01-082-9697. Nomenclature is Pump, Oil Sampling. Unit of issue: each.

(7) DD Form 2026. Obtain locally through publication distribution channels.

8. AIR FORCE SPECTROMETER DEPLOYMENT/TDY PROCEDURES

a. Prior to aircraft leaving home station.

(1) Send a request for deployment kits for pre and post deployment to AF Correlation Team afoap@tinker.af.mil

(2) Print out DD Form 2027 trend history to accompany aircraft(s) to deploy or TDY location.

(3) Inform AF OAP manager of deployed spectrometer include serial number, mailing address, and POC email and phone contact information (afoap@tinker.af.mil).

(4) Pack and inventory all equipment, spare parts, tools and consumables. Ensure adequate supplies are on-hand for entire deployment/TDY.

(5) Ensure spectrometer is operating properly and is certified in the correlation program.

b. During aircraft deployment/TDY.

(1) Input DD Form 2027 trend history data into deployed/TDY database since aircraft left home station.

(2) Identify lab point of contact, message address, mail address and any particulars about sample transfer, etc.

(3) Send email to AF Correlation Team to put spectrometer on deployed status oapcorr@tinker.af.mil. Include serial number, mailing address, and POC email and phone contact.

TRANSIENT AIRCRAFT OIL ANALYSIS RECORD

ASSIGNED OIL ANALYSIS LABORATORY	LABORATORY TELEPHONE NO.	END ITEM MODEL AND SERIAL NO.
NAS Pensacola NOAP Lab	(DSN): 922-3191	A-4 158725
	(Commercial): 850-452-3191	EQUIPMENT MODEL AND SERIAL NO. J52-P6 650116

LAB CODE	DATE	TOTAL TIME SINCE OVERHAUL	TOTAL TIME SINCE OIL CHG	FE	AG	AL	CR	CU	MG	NA	NI	PB	SI	SN	TI	B	MO	ZN	LAB REC
ANH	12-02-99	460	102	14	0	1	0	3	2		0		3						A
ANH	17-02-99	471	113	13	0	1	0	2	1		0		3						A
ANH	25-02-99	480	122	15	0	1	0	2	1		0		2						A

DATE DEPARTED *(Return this form with aircraft)*
26 Feb 1999

REMARKS (Place MCD Tabs here)

DD FORM 2026 (BACK), SEPTEMBER 2013

FIGURE 12. Transit Aircraft Oil Analysis Record, DD Form 2026 (Side 2)

(4) Analyze deployment kit and complete test. Email test to AF OAP Correlation Team (oapcorr@tinker.af.mil).

(5) Analyze monthly correlation samples that are due while instrument is in deployed/TDY location.

c. Post aircraft deployment/TDY.

(1) Input DD Form 2027 trend history data which has not previously been entered into home station AETC OAP database since aircraft left deployed TDY location and file 2027 hard copy for 1 year.

(2) Analyze post deployment kit and complete test. Email test to AF Correlation Team ((afoap@tinker.af.mil).

(3) Unpack and inventory all equipment, spare parts, tools and consumables.

JOAP PROGRAMS AND REPORTS

Table of Contents

1. General. This section provides general information concerning JOAP programs and reports.

2. Background. The JOAP certification and correlation programs are primary elements of the JOAP quality assurance effort to ensure standardization of operations and quality of oil analysis by the laboratories enrolled in these programs. Participation in these programs by both organic and contracted laboratories is mandatory for all laboratories equipped with atomic emission rotrode spectrometers. A directory of laboratories participating in the JOAP certification and correlation program is available on AF Oil Analysis Program website: https://cews.tinker.af.mil/gkg/OilAnalysisProgram/default.htm

3. JOAP Certification Program.

   a. Purpose. To ensure that all participating laboratories meet specified criteria in order to maintain quality and uniformity of spectrometric oil analysis between laboratories.

   b. Policy.

      (1) All DoD oil analysis laboratories (organic or under contract to a DoD agency or US military service for the purpose of analyzing samples from US government equipment or supplies) will participate in the JOAP Correlation Program. Laboratories with approved types of atomic emission rotrode

spectrometers are certified by the AF Correlation Team. Only certified laboratories may perform inter-service oil analysis functions. Uncertified laboratories may perform intra-service or intra-agency analysis functions only with the service Program Manager's written authorization.

(2) The JOAP Certification Program is currently standardized on the atomic emission rotrode spectrometer. Atomic absorption (AA) spectrophotometers and Inductively Coupled Plasma (ICP) spectrometers do not meet the certification criteria, and therefore will not be certified for inter-service oil analysis. AA or ICP laboratories may be approved for independent operations by Program Managers for individual service oil analysis.

c. Certification Procedures. The Air Force OAP Correlation Team certifies laboratories upon their initial establishment and relocation based on the Service Program Manager's attestation (see figure 4-1 AND 4-1A) that the laboratory/spectrometer meets specified criteria and the laboratory/spectrometer's satisfactory participation in the JOAP Correlation Program. The certification checklist enables the Air Force OAP Correlation Team to ensure that laboratories meet minimum criteria required for an operating laboratory. An electronic Certification-Verification Checklist is available from the Air Force Program Management Office at afoap@tinker.af.mil. Air Force laboratory personnel must maintain on hand the current Certification-Verification Checklist with signatures including attestation by Program Manager.

NOTE

An officer, senior non-commissioned officer*, or senior civilian manager who is responsible for laboratory operations must sign the certification checklist. For contractor-operated laboratories, an Officer-in-charge is considered to be the lowest level of government supervision within the laboratory's chain of command authorized to sign correspondence leaving the installation. *Not applicable to AOAP laboratories.

d. Levels of Participation. Based upon qualifications and performance, the Air Force OAP Correlation Team places eligible laboratories/spectrometers in the following categories:

(1) Certified (Applies to ALL DoD Labs). Monthly correlation score of 80 percent or above and all certification checklist requirements satisfied. Annual certification checklist is required and the completed certification checklist must be sent to oapcorr@tinker.af.mil and the appropriate service program manager’s office. The completed annual certification checklist must be submitted as part of the correlation program requirements by 1 March each year to the respective Service Program Manager.

(2) Uncertified (Applies to ALL DoD Labs). Monthly correlation score below 80 percent and/or certification checklist requirement(s) not satisfied.

(3) Enrolled. (Applies to all Foreign Military and DoD Contractors).

(4) When a laboratory or spectrometer certification is withdrawn because of a one month score below 80 percent, the applicable Service Program Manager may approve a onetime repeat of correlation samples analysis and submission of results. The new results must be submitted to oapcorr@tinker.af.mil and scored within five days of service program manager approval. If a score of 80% or above is received on the re-submittal, certification is reinstated. If the score of 80% or above is not received on the re-submittal, the laboratory certification is withdrawn and unit must begin trouble shooting procedures immediately. Laboratories will only be approved for one re-submittal in a three month timeframe. If a 2nd failure is received within a three month timeframe the laboratory will be decertified and will be required to undergo recertification of the spectrometer. A certification kit will only be sent upon approval from the applicable Service Program Manager.

NOTE

Under special conditions the Service Program Manager may waive certain checklist elements in order to avoid interruption of essential laboratory operations.

An officer*, senior non-commissioned officer* or senior civilian manager who is responsible for laboratory operations must be copied with the data re-submittal email which is sent to oapcorr@tinker.af.mil for scoring.

e. Laboratory/Spectrometer Certification Procedure. A laboratory must complete the following steps to become certified:

(1) Complete three special certification sample sets (six pairs) with an average of 80 percent or above. The new JOAP, commercial, contract or previously stored instrument schedule is completed over three weeks as follows:

First Monday	A1/2
First Friday	A3/4
Second Monday	B1/2
Second Friday	B3/4
Third Monday	C1/2
Third Friday	C3/4

The JOAP de-certified instrument schedule is completed in six workdays as follows:

First workday	A1/2
Second workday	A3/4
Third workday	B1/2
Fourth workday	B3/4
Fifth workday	C1/2
Sixth workday	C3/4

If approved by the applicable Service Program Manager, an accelerated three day schedule may be performed for JOAP instruments when a spectrometer must be used for critical JOAP support (i.e. as the only spectrometer available and is needed for deployment):

First workday AM	A1/2
First workday PM	A3/4
Second workday AM	B1/2
Second workday PM	B3/4
Third workday AM	C1/2
Third workday PM	C3/4

Deviations may occur due to the time samples are received or actual days worked. Regardless, the analysis schedule for each set of two samples must be completed following a new and complete standardization followed by a successful series of standards checks. Refer to the spectrometer manual for other possible requirements such as optical alignment or electrode offset procedures when changing rod or disk electrode lots. . Standards checks and standardizations must be performed only using aluminum boats. Certification/Correlation samples are analyzed using white caps (NSN 6640-01-042-6583), not the caps supplied with the correlation samples. AF labs must use AETC OAP software, Screen C to send correlations unless waived by the AF PMO. Send completed sample pair results by email using the normal correlation report form to OAPCORR@TINKER.AF.MIL. The overall average of scores must be 80 percent or above.

(2) Forward the completed/signed Certification Verification Checklist to the Service Program Manager; who will forward to the Air Force OAP Correlation Team.

AIR FORCE OIL ANALYSIS PROGRAM CERTIFICATION CHECKLIST			
Parent Command		Official Mailing Address:	
Lab Activity			
Group/Squadron:			
Com Tel No.	DSN No.	FAX No.	Backup Lab:
Lab Supervisor:		Email:	

Assigned Aircraft and Engines			
A/C 1:	Eng 1:	A/C 2:	Eng 2:
A/C 3:	Eng 3:	A/C 4:	Eng 4:
A/C 5:	Eng 5:	A/C 6:	Eng 6:
A/C 7:	Eng 7:	A/C 8:	Eng 8:
A/C 9:	Eng 9:	A/C 10:	Eng 10:

SPECTROMETRIC OIL ANALYSIS INSTRUMENTS			
Use Dropdown Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service
Model Nr.	Serial Nr.	Lab Code:	Date Placed in Service

SEM/EDX INSTRUMENTS		
Use Dropdown Manufacturer	Serial Nr.	Date Placed in Service
Manufacturer	Serial Nr.	Date Placed in Service
Manufacturer	Serial Nr.	Date Placed in Service
Manufacturer	Serial Nr.	Date Placed in Service

LABORATORY STAFFING AND MANHOURS			
NAME (Last, First MI)	Grade/AFSC	Use Dropdown Training	Use Dropdown Years of Lab Experience

FIGURE 1. Certification Verification Checklist or Program Manager's Attestation

Engine Abnormal Oil Analysis Maintenance Action Report			
Base	**Unit**	**Date**	**Code (H, R, or T)**
A/C Type	**Tail Number**	**Engine Serial Number**	**Engine Operating Hours**
QDR Number			**Date QDR Submitted to PIM**
Explanation of OAP Lab Recommendation			
Printed Name/Grade of OAP Personnel:		**OAP Personnel Signature:**	
Maintenance Performed/Action Taken (Provide complete details)			
If engine is removed from aircraft, it is currently located at:		☐	Flight line
		☐	Engine Shop
		☐	Shipped to Depot
Printed Name/Grade (verifying above action taken/location):		**Signature/Date (verifying above action taken/location):**	

Figure 2. Air Force OAP Feedback Form

f. Existing Laboratory Procedure.

(1) Certified. Laboratory/spectrometer certification does not expire unless it is uncertified by an action listed in paragraph 3f.(2) below.

(2) Uncertified. Reasons for reduction to uncertified are as follows:

(a) One month score falls below 80 percent.

(b) Failure to submit monthly correlation results prior to the next month's due date.

NOTE

Units with spectrometers in Reported Maintenance (RM) status will comply with procedures in paragraph 4. Units with deployed spectrometers will comply with procedures in paragraph 5.

(c) Failure to submit an annual approved verification checklist.

(d) Failure to meet full operating requirements (dependent upon nature of deficiency).

(e) Laboratory/spectrometer is physically relocated.

NOTE

Spectrometers that are geographically relocated (other than spectrometers that are relocated within the same operating base or vessel) shall be decertified and required to undergo the complete certification procedure as listed for new laboratories. Spectrometers that are physically relocated within the same operating base or vessel will be required to submit a new certification verification checklist and to perform a complete spectrometer standardization prior to commencing normal operational support. Any spectrometer, which has to be disassembled in any manner in order for it to be relocated, must undergo the complete certification procedure. Mobile emission spectrometers (Spectroil M's, etc.) will use the deployment kit available from the Air Force OAP Correlation Team to ensure proper operation after movement of the spectrometer.

(f) Laboratory is deactivated.

(g) Upon direction of the Service Program Manager.

g. Reinstatement To Certified. A laboratory/spectrometer that has been placed in the uncertified category must complete the certification requirements as outlined in paragraph 3e.

4. Laboratories with Equipment in Reported Maintenance "RM" Status.

   a. Laboratories reporting RM status for a spectrometer will receive no calculated correlation score for that spectrometer if the RM period extends past the correlation sample analysis due date. During RM periods, spectrometers will be placed in an RM status and will not be authorized to perform any operational oil analysis support functions.

   b. Correlation score will be frozen at pre-RM period recorded averages for the duration of the RM period.

   c. Spectrometers in RM status for one or more element channels but not reporting total equipment failure will not be subject to the criteria listed above. Due to inherent differences in operating requirements, different weights placed on different elements, and the type of equipment being monitored, spectrometers will be placed in a status as determined by the appropriate Program Manager.

      (1) RM status for one to two months. When the spectrometer has been repaired, up to two months of correlation samples that were on hold may be analyzed. If only one set of samples are overdue, analyze the correlation samples on hand immediately after repair. If two sets of samples are overdue, analyze one set on the first workday after repair, and the second set on the second workday after repair. This procedure is to ensure that a different standardization is accomplished for each set.

         (a) Example 1: One Month RM. The lab reports that their spectrometer is R/M on 17 October. On 4 November, it is repaired. Then October samples are submitted to OAPCORR@TINKER.AF.MIL. The November sample results are due in by 21 November.

         (b) Example 2: Two Months RM. The lab reports that their spectrometer is R/M on 17 October. On 5 December, it is repaired. Then October samples are submitted to OAPCORR@TINKER.AF.MIL After the October score is obtained, the November samples are analyzed on the next workday and submitted to OAPCORR@TINKER.AF.MIL. After obtaining the November score, the December sample results are due in by 21 December.

      (2) RM Status for Three Months. Spectrometers will be decertified when the third correlation due date is missed. When the laboratory reports the spectrometer repaired, the laboratory will complete the certification procedures as outlined in paragraph 3e.

5. Deployed Spectrometers.

   a. Deployable laboratory spectrometers must be approved for deployed operation through a special test procedure. Procedures outlined below must be performed when an organization deploys with a portable atomic emission rotrode instrument prior to supporting actual deployed operations. The test procedure is designed to quickly determine if the spectrometer has survived the transportation to the new site/original site, has adjusted to the environment, and is ready to provide accurate support for the sampling requirements.

NOTE

If the spectrometer is deployed during an exercise and transported from the regular lab location, but will not be used for actual oil analysis support, the special test procedure is not required.

b. After the spectrometer has returned from the deployment, laboratory personnel must ensure that the spectrometer is again fully operational. If the spectrometer will be immediately re-deployed, or immediately used to support local oil analysis requirements, another kit must be successfully analyzed. However, if time permits prior to re-deployment or use within the laboratory, standardization, standardization checks, and participation in the JOAP Correlation Program will ensure that the spectrometer is fully operational.

c. Deployment kits are supplied to all laboratories by the Air Force OAP Correlation Team upon request for projected deployments. Each kit includes complete instructions, two synthetic oil correlation samples, results forms including pass / fail criteria, an envelope for mailing. Send requests to OAPCORR@TINKER.AF.MIL.

d. Two tests are required. Test 1 is the analysis of two JOAP Correlation Program synthetic oil samples. Each sample is analyzed three times and averaged. The average value obtained for each of the required fifteen elements is compared to upper and lower limit values that are supplied with the kit. Test 2 involves ten analyses of D12-100 and D3-100 JOAP Calibration Standards that are not supplied with the kit, but are required for standardization of the instrument and must accompany the spectrometer when it is deployed/re-deployed. The test monitor must be an officer, senior NCO, or senior civilian manager with overall responsibility for laboratory management. The monitor must attest that the spectrometer passes or fails the overall testing based on criteria supplied with each kit. An overall average of 80 percent is required.

e. Test results must be reported by email to OAPCORR@Tinker.af.mil, applicable command, and the Service Program Office. No approval from any outside agency is required if the results meet the criteria that is supplied with each kit. The spectrometer is approved for deployed site use immediately after the successful completion of the kit. Regular monthly JOAP Correlation samples must still be processed at the deployed location. If the correlation samples must be mailed to the deployed location, contact OAPCORR with new address information. If the deployed spectrometer fails the overall test requirements, contact the applicable Service Program Management office for further instructions.

6. Other Laboratories Requiring Recertification.

a. For laboratories requiring recertification, the officer-in-charge/senior civilian manager must verify in writing, using checklist shown in figure 1A, that the laboratory meets all operating requirements listed below. The appropriate Service Program Manager, depending upon the nature and severity of the operating deficiency, may grant an operating waiver for certain operating requirements.

b. Operating requirements are as follows:

(1) Space requirement (as determined by Program Manager).

(2) Environmental control of equipment spaces.

(3) Staffing adequate for projected workload (as determined by Program Manager).

(4) Necessary operating supplies available.

(5) Required instrument and support equipment available.

(6) Full time qualified operator/evaluator assigned and present (Army evaluators must be certified, see Volume II, WP 002 01).

7. Qualifications Required for Operators and Evaluators.

a. Qualifications required for Operators and Evaluators for each branch of service are as follows:

(1) Air Force.

(a) Complete either Block 9 of the Air Force Non-Destructive Inspection Course (J3ABP2A732-000) training school, or complete the DoD Operator/Evaluator Training Course (J3AZP2A752-000), and

(b) Perform 30 days on-the-job training in a JOAP-certified laboratory, and

(c) Achieve five (5) additional months of operator/evaluator experience, totaling 6 months continuous OJT in lab.

(2) Navy. Training requirements for Navy personnel are listed in Volume II WP 003 01

(3) Army. Meet all of the requirements of Volume II, WP 002 01.

b. In the case of some operators and evaluators, it may not be possible or appropriate to satisfy all of the above requirements. The responsible Service Program Manager may waive these requirements on an individual basis with the exception of Army and Air Force laboratories. Specific instructions require the adherence of Army laboratories to the requirements outlined in Volume II WP 002 01

c. The qualified operator and evaluator must be assigned to the laboratory to qualify the laboratory for JOAP certification and must be present for duty in the laboratory during all hours of laboratory operation. A supervisor, present on an intermittent basis, does not satisfy the operator/evaluator requirements.

8. JOAP Correlation Program.

a. Purpose. To ensure uniform and continuous high quality oil analysis results throughout the Joint Oil Analysis Program. The Correlation Program quickly identifies laboratories experiencing instrument and/or operator problems and provides managers and laboratory personnel a means to compare their performance with other laboratories having the same type of spectrometer.

b. Policy. AII DoD oil analysis laboratories, (organic or under contract to a DoD agency or US military service for the purpose of analyzing samples from US government equipment or supplies) will participate in the JOAP Correlation Program. The applicable Program Manager may grant a participation waiver for extenuating circumstances. The JOAP Correlation Program is also extended to the following categories of laboratories:

(1) Privately owned laboratories with oil analysis contracts with elements of the DoD.

(a) If the contract does not specify that the DoD will provide participation free of charge in the JOAP Correlation Program, the privately owned laboratory must pay an annual fee to participate in the program.

(b) Contact the Air Force OAP Correlation Team for current fees and processing instructions. Cash or negotiable instruments cannot be accepted. Payment must be made through the local contracting office or the major command approving the contract. The Air Force OAP Correlation Team address is AFLCMC/LPSB , 4750 Staff Dr., Tinker AFB, OK 73145-3033.

(2) Federal Government owned laboratories other than DoD laboratories.

(3) Laboratories of an allied nation providing support to the military forces of that nation or to US military forces.

NOTE

Foreign or private laboratories under contract to provide oil analysis services to US military forces and desiring entry into the JOAP Correlation Program should submit letter requests to the appropriate JOAP Management Office via the service contracting office administering the contract.

Laboratories of an allied nation providing oil analysis support to the military forces of that nation and desiring entry in the JOAP Correlation Program should apply through the appropriate FMS case, or in the absence of an FMS case, submit letter requests to the nearest United States Military Advisory Group for consideration and/or processing.

c. Correlation Procedures. The Correlation Program for spectrometers is conducted monthly by the Air Force OAP Correlation Team. Two sample pairs are mailed from the Air Force OAP Correlation Team to each participating JOAP laboratory scheduled to arrive not later than the 5th working day of the month. Allow sufficient time for postal delivery, if not received by the 15th of each month notify oapcorr@tinker.af.mil. If FEDEX is required send valid physical address (No APO/FPO's) and commercial phone number (No DSN). Correlations are to be analyzed within 5 duty days of receipt. The spectrometer is standardized and the same qualified operator analyzes the sample pairs. Results are submitted to the Air Force OAP Correlation Team to arrive not later than the 21st of each month. Results may be submitted by e-mail, to OAPCORR@TINKER.AF.MIL On the 25th of each month or the first workday immediately following the 25th, the Air Force OAP Correlation Team computes the mean of all spectrometer results for each sample for all required elements for the two categories of spectrometers (JOAP Rotrode and other). Using standard statistical techniques, acceptable reproducibility 1 and reproducibility 2 criteria are calculated. These acceptable criteria are compared to each laboratory's results and points are assigned. From these points, an overall score is assigned for each spectrometer. These scores are used, in addition to facility and personnel requirements, to classify laboratories as JOAP certified or as uncertified. Laboratories with spectrometers in R/M status will report this status to the Air Force OAP Correlation Team prior to 21st of the month. Correlation samples will be retained and analyzed when the spectrometer is repaired. Contact the Air Force OAP Correlation Team for special instructions when the R/M period exceeds two correlation-reporting periods. An e-mail request for maintenance help to the Air Force OAP Correlation Team or some other agency with info copy to the Air Force OAP Correlation Team does not constitute requesting R/M status unless a specific request for R/M status is included. Either call the Air Force OAP Correlation Team or send an e-mail specifically requesting R/M status and try to provide the Air Force OAP Correlation Team with a "get well" date.

NOTE

Correlation printouts, including all standardization data, and all left over correlation oil samples shall be retained for three months. The service program managers may also request printouts as a quality assurance check.

9. JOAP Training.

a. Training Courses Available.

(1) Spectrometer operator/evaluator training courses available at NAS Pensacola, FL:

Website: http://www.netc.navy.mil/Development.aspx

Student Registration number 850-452-7200 ext 4184

Title	Course No.
Defense Joint Oil Analysis Program (Physical Properties Testing)	A-491-0017A

NOTE

The Air Force Non-Destructive Inspection (NDI) course, J3ABP2A732-000 (or equivalent), includes evaluator training and operation/maintenance of the Spectro,Inc. Model M or M/N spectrometer, which is equivalent to training provided in course J3AZP2A752-000.

(2) Spectro, Inc. offers a spectrometer maintenance course. For additional information call 1-888-486-0123.

b. Training Requests.

(1) Army/Air Force: submit training requirement(s) in accordance with established service procedures.

(2) US Navy, US Marine, and US Coast Guard personnel will contact the following offices:

US Navy/US Marine personnel:	Defense Joint Oil Analysis Program Student Registration Naval Personnel Development command DSN 459-7200 ext 4184 COMM 850-452-7200 ext 4184
US Coast Guard:	AETCM Dukes Training Quota Management Center Chesapeake VA COMM 757-366-6582

10. JOAP Data Processing and Warehousing.

    a. The US Army data is processed and warehoused by the US Army Program Management office at Redstone Arsenal, Huntsville, AL. The US Navy data is processed and warehoused by the US Navy Program Management office at Pensacola NAS, Pensacola, FL. The US Air Force data is processed and warehoused by the AF OAP PMO at Tinker AFB, Oklahoma City, OK.

    b. Laboratories shall submit data to their respective service data base as directed by the Service Program Manager or as contained in this publication.

    c. Each Service Program Manager is responsible for routine data transfer to the other services. See Volume II Work Packages 002 through 004 for information about each Services oil analysis database.

    d. Data Reports. Routine reports are produced from laboratories and from the service data bases. Examples of some of the reports available are included in Volume II Work Packages 002 through 004.

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JOAP REPORT CODES

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Table 1 - STANDARD LABORATORY RECOMMENDATION CODES--AERONAUTICAL FOR SPECTROMETRIC ANALYSES (FOR AIR FORCE AND NAVY USE ONLY)

CODE	GENERAL LAB RECOMMENDATIONS
A	Sample results normal; continue routine sampling.
X	Analysis results supplied to customer; no recommendation required.
Z	Previous recommendation still applies.
CODE	**INSPECTION RECOMMENDATIONS (Requires Feedback)**
D	(Applicable to all customers utilizing Air Force OAP labs) Documentation error to include incorrect/missing engine serial number, incorrect/missing aircraft tail number, incorrect/missing engine time, incorrect/missing oil time, incorrect/missing oil added. Do not fly or operate until discrepancy is corrected on DD Form 2026 or other approved automated forms.
H**	Inspect unit and advise lab of finding. Abnormal wear indicated by *** PPM (element).
R**	Do not fly or operate; inspect filters, screens, chip detector and sumps; advise laboratory of results.
T**	Do not fly or operate. Examine for discrepancy and advise laboratory of results and disposition. If discrepancy found and corrected, continue operation and submit resample after *** hours of operation. If discrepancy is not found, recommend remove component from service and send to maintenance.
CODE	**OIL CHANGE RECOMMENDATIONS (Requires Resample)**
J	Contamination **** confirmed. Change oil, sample after *** minute run-up and after *** operating hours.
W	Contamination**** suspected. Change oil; run for *** additional hours, take samples hourly. (This code is for Air Force ALC Depot use only).
CODE	**LAB REQUESTED RESAMPLES (Requires Resample)**
B*	Resample as soon as possible; do not change oil.
C*	Resample after *** hours; do not change oil.
E*	Do not change oil. Restrict operations to local flights or reduced load operation, maintain close surveillance and submit check samples after each flight or *** operating hours until further notice.
F*	Do not change oil. Submit resample after ground or test run. Do not operate until after receipt of laboratory result or advice.
G*	Contamination**** suspected. Do not change oil, resample unit and submit sample from new oil servicing this unit.
P*	Do not fly or operate; do not change oil; resubmit resample as soon as possible.
Q*	Normal PPM reading was obtained from test cell run after complete P.E. where oil lubricated parts were changed/removed/replaced. Monitor engine closely after installation to ensure a normal trend before release to routine sampling.

NOTES:
* Resample (red cap) required.
** Maintenance feedback required; advise laboratory of findings.
*** Laboratory will specify time limit.
**** Contamination is defined as water, coolant, silicon, etc. and not wear metals. Use the appropriate recommendation codes for increasing trends or elevated wear metal conditions.

Table 2 - STANDARD LAB RECOMMENDATION CODES NON-AERONAUTICAL FOR SPECTROMETRIC ANALYSES (FOR NAVY USE ONLY)

CODE	GENERAL LAB RECOMMENDATIONS
A	Sample results normal; continue routine sampling.
X	Analysis results supplied to customer; no recommendation required.
Z	Previous recommendation still applies.
CODE	**INSPECTION RECOMMENDATIONS (Requires Feedback)**
H**	Inspect unit and advise lab of finding. Abnormal wear indicated by (element) (PPM). Resample after (maintenance/***hours/etc.).
K**	Impending failure, critical wear indicated by (element). Inspect unit and advise lab of findings. Resample after (maintenance/***hours/etc.).
L**	Inspect brake and clutch plate adjustments, change oil service filters, resample after *** hours of operation.
M**	Perform engine coast-down check. If engine fails test, examine for discrepancy and advise lab of results, else resample after *** hours of operation.
U**	Cooling system leak indicated by (Mg/Cr/Na/B). Inspect unit and advise lab of findings. Resample after (maintenance/***hours/etc.).
CODE	**OIL CHANGE RECOMMENDATIONS (Requires Resample)**
D	Change oil and service filters. Resample after *** hours of operation.
CODE	**LAB REQUESTED RESAMPLES (Requires Resample)**
B*	Resample as soon as possible; do NOT change oil.
C*	Resample after *** hours.
F*	Do not change oil; submit special sample after test run. Do not operate until after receipt of laboratory results or advice.
G*	Contamination suspected; resample unit and submit sample from new oil servicing this unit.
N*	Unit 'wear-in' indicated; resample in accordance with break-in schedule or after *** hours.
I*	Stop purification; resample each engine after 4 hours of operation.
P*	Do not operate; do not change oil; submit resample as soon as possible.

NOTES:
* Resample (red cap) required.
** Maintenance feedback required; advise laboratory of findings.
*** Laboratory will specify time limit.

Table 3 - STANDARD LAB RECOMMENDATION CODES PHYSICAL TEST RECOMMENDATIONS (FOR NAVY USE ONLY)

CODE	RECOMMENDATION
AA	Oil condition normal; continue routine sampling.
DN	Do not operate.
ER	Evaluate and repair component.
TS	Check oil type and source.
ZZ	Previous recommendation still applies.
XX	Analysis results supplied to customer; no recommendation required.
CODE	**OIL CONDITION STATEMENTS**
FD	Fuel dilution.
NN	Neutralization or acid number.
PC	Particle count excessive.
PN	Precipitation number.
SA	Solid or abrasive material.
VS	Viscosity (high/low/change).
WA	Water.
CODE	**OIL CHANGE RECOMMENDATIONS**
CS	Change oil and service filter.
CP	Purify, renovate or change oil and service filters.
CODE	**LAB REQUESTED RESAMPLES (Requires Resample)**
RB*	Resample as soon as possible.
CC*	Resample after *** hours.
RH*	Submit hot sample.
RI*	Resample; insufficient amount of sample received.
RS*	Submit sample of new oil servicing this unit.
CODE	**INSPECTION RECOMMENDATIONS (Requires Feedback)**
IA**	Inspect and repair air induction system.
IC**	Inspect and repair cooling system.
IF**	Inspect repair fuel system; change/service filters oil.
IW**	Inspect for source of water.

NOTES:
* Resample (red cap) required.
** Maintenance feedback required; advise laboratory of findings.
*** Laboratory will specify time limit.

Table 4 – Data Index Codes

CODE	FILE MAINTENANCE ACTION
(Blank)	Detail Input
R	Sample Detail Revision
N	Sample Detail Deletion
T	Maintenance Feedback Revision
J	Maintenance Feedback Deletion
F	Maintenance Feedback

Table 5 – Reason for Sample Codes

CODE	REASON SAMPLE SUBMITTED
A	Accident/Incident
C	Customer Requested
J	Equipment Failure
F	Functional Check Flight
L	Lab Request
H	Metal in Sump/Screen/Filter
P	Physical Test (Not for Air Force use)
M	Post Maintenance Check
I	Pre-Shop Inspection (Not for Air Force use)
K	Prior to Maintenance - Removal
R	Routine
D	Sample Prior to Deployment
T	Test Cell
E	Test Cell - Reconditioned (Not for Air Force use)
U	Test Track (for Army depot use)
G	Test Track - Reconditioned (Not for Air Force use)
V	Vibration
W	Warning Light or Abnormal Gage Indication

Table 6 – Action Taken Codes

CODE	DESCRIPTIONS
D	Removed and Returned to Depot
E	Complied with Oil Lab Recommendation
G	Repair/Replace Minor Parts
H	Equipment Checked - No Repair Required
R	Removed and Replaced
S	Removed

Table 7 – Discrepant Item Codes

NOTE

The Discrepant Item Codes shown are general in nature and are designed to be applicable to all equipment entered in the oil analysis program. Due to the general nature of these codes, descriptions may not always be precise. Select the description that most closely fits for the discrepant item being reported. These codes are intended for use on oil analysis documentation only. Report errors or omissions on this listing to the NOAP@navy.ml.

CODE	DISCREPANT ITEM
AA	A-Sump Scavenge Pump Rotor Vanes and liners
AB	Accessory Gearbox Bearing Housing
AC	Adapter Cover
AD	Air Filter
AE	Bands
AF	Basic Engine (no other item applies)
AG	Bearings (no other bearings apply)
AH	Block
AI	Brake Plates
AJ	Bushings
AK	Camshaft
AL	Camshaft Bearing
AM	Case/Main Housing
AN	Center and Counter Shafts
AO	Clutch Plates
AP	Connecting Rod
AQ	Connecting Rod Bearings
AR	Constant Speed Drive
AS	Core Engine Module
AT	Core Engine Module Number 2 Bearing
AU	Core Engine Module Number 3 Bearing
AV	Core engine Module Number 4 Bearing
AW	Crankshaft
AX	Crankshaft Bearing
AY	Cylinder
AZ	Cylinder Head
BA	Cylinder Liners
BB	Ducting/Hoses
BC	Fan Drive Turbine Module
BD	Fan Drive Turbine Module Number 5 Bearing
BE	Fittings

Table 7 – Discrepant Item Codes

CODE	DISCREPANT ITEM
BF	Fuel Connectors
BG	Fuel Injectors
BH	Fuel/Injector Pump
BI	Fuel Lines
BJ	Gasket
BK	Gears
BL	Inlet Fan Module
BM	Inlet Fan Module Number 1 Bearing
BN	Lifter
BO	Number 0 Bearing and Housing
BP	Number 1 Bearing and Housing
BQ	Number 2 Bearing and Housing
BR	Number 3 Bearing and Housing
BS	Number 4 Bearing and Housing
BT	Number 5 Bearing and Housing
BU	Number 6 Bearing and Housing
BV	Number 7 Bearing and Housing
BW	"O" Ring
BX	Oil Cooler/Heat Exchanger
BY	Oil Filter
BZ	Oil Pump
CA	Piston
CB	Piston Rings
CC	Planetary Gears
CD	Power Take-Off
CE	Pump
CF	Reservoir
CG	Rocker Arm
CH	Rocker Arm Bushing
CI	Seals
CJ	Servo
CK	Starter Retainer
CL	Support Bushing
CM	Thrust Washer
CN	Timing Gear
CO	Torque Converter
CP	Turbo Charger/Blower
CQ	Valve
CR	Wrist Pin
CS	Wrist Pin Bushing

Table 8 – How Malfunctioned Codes

CODE	HOW MALFUNCTIONED
A	Accident
B	Adjustment of Alignment Improper
C	Backlash Excessive
D	Bearing Failure or Faulty
E	Bent, Buckled, Collapsed, Dented, Distorted or Twisted
F	Binding, Stuck or Jammed
G	Broken
H	Broken, Faulty or Missing Safety Wire or Key
J	Bushing Worn or Damaged
K	Chipped
L	Corroded - Mild to Moderate
M	Corroded - Severe
N	Cracked
P	Defects Unknown
Q	Defects Unknown - Unit shipped to SRA - Depot
R	Dirty, Contaminated or Saturated by Foreign Material
S	Improper or Faulty Maintenance
T	Keyway or Spline Damage or Worn
U	Loose
V	Loose or Damaged Bolts, Nuts, Screws, Rivets, Fasteners or Clamps
W	Missing Bolts, Nuts, Screws, Rivets, Fasteners, Clamps, other Hardware
X	Nicked
Y	No Defects
Z	Pitted
3	Removal Not Associated with OAP
4	Scored or Scratched
5	Sheared
6	Worn Beyond Limits
7	Leaking, Internal or External
8	Low Compression

Table 9 – How Found Codes

CODE	HOW FOUND
A	Air or Ground Crew Unscheduled Maintenance
G	Air/Ground Crew Scheduled Maintenance
S	Impending/Incipient Failure Indicated by OAP