(NAVY) NAVAIR 17-15-50.1
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(COAST GUARD) TO 33-1-37-1

15 November 2024

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 15 September 2014.

This manual is incomplete without NAVAIR-17-15-50.2, NAVAIR-17-15-50.3, NAVAIR-17-15-50.4 and NAVAIR-17-15-50.5.

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NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES/PAGES

List of Current Changes

Change #	*Date*		*Change #*	*Date*
Original 0	15 November 2024			

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 Dispose of the superseded issues of the technical manuals. Superseded classified technical information shall be destroyed in accordance with applicable regulations. This is a complete revision of Volume 1 of this manual. Due to the extensive revisions made to the text and the formatting throughout the volume changes are not indicated by change bars in the outer margin of the text.

Total number of pages in Volume 1 of this manual is 62.

Note: the HMWS WP for this manual is located in Volume 2

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NAVAL AIR SYSTEMS COMMAND TECHNICAL MANUAL PROGRAM

LIST OF TECHNICAL PUBLICATIONS DEFICIENCY REPORTS INCORPORATED

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

Activity	Report Control Number	Location
FRC East Cherry Point	N65923-15-2203	Cherry Point NC

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INTRODUCTION

Table of Contents

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 1 is to clarify the use of oil analysis as a diagnostic maintenance tool, to standardize JOAP operating policy and procedures, and to provide general guidance for JOAP managers and customers in accordance with the Tri-Service Regulation (AFI21-131(I)/AR700-132/OPNAVINST 4731.2). Specific JOAP Laboratory operating procedures and guidance are contained in Volume 2. 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 3 and 4 for aeronautical and non-aeronautical equipment, respectively. Volume 5 covers a collection of field deployable oil analysis test devices/systems designed to be operated at the organizational level. Volume 5 is a standalone manual and includes both the device/method operating procedures as well as the limits and evaluation guidance applicable for each specific component (engines, transmissions, etc.) for which its use is approved.

   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. AR700-132/OPNAVINST 4731.2A/AFI-21-131, Joint Oil Analysis Program (JOAP).

   b. Military Departments.

      (1) Army. AR 750-1, Army Material Maintenance Policy and Retail Maintenance Operations.

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

(3) Navy. OPNAVINST4730.10, Navy Oil Analysis Program

(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 Agreement 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: 645-9078/COMM 256-955-9078 MAILING: USASC DETACHMENT REDSTONE ARSENAL ARMY OIL ANALYSIS PROGRAM MANAGEMENT OFFICE AJAX RD, BLDG 3661 REDSTONE ARSENAL AL 35898
Navy Program Manager COMM: 301-997-8260 Email: NOAPSupport@us.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 3001 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.

NOTE

Participation in the JOAP Correlation Program is only required for laboratories using Atomic Emission Rotrode spectrometer(s).

(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. When a change is issued to a volume, the title page of the volume will be revised with the change number and date of issue. Also an updated version of the entire volume containing all of the changed pages will be posted by NATEC as well as the Army, Air Force and US Coast Guard technical document authorities.

(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 five volumes of the JOAP Manual are on-line at: https://mynatec.navair.navy.mil/ Registration is required to use the site, including entering a username 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/-5
US Navy	NAVAIR 17-15-50.1/.2/.3/.4/.5
US Air Force	T.O. 33-1-37-1/-2/-3/-4/-5
Coast Guard	CGTO 33-1-37-1/-2/-3/-4/-5

Navigation at the myNATEC site: Once logged in, click on "Technical Manuals Quick Search" link under the "myNATEC Links" section on the left of the screen. In the "Publication Number" blank enter the technical order number for your service, such as 33-1-37 for US Air Force, 17-15-50 for US Navy, or 38-301 for US Army. Do not use the "T.O.","NA" and "TM" prefixes or no match will be made. Regardless of which of the three number series are used, the same manual links will be displayed. By leaving off the "-1" or ".1", links to all four volumes and IRAC's will be seen. Click on the link for the particular volume desired. The manuals can be saved to your computer if desired. With the mouse pointer on the Adobe PDF icon, click on the right mouse button then select "Save Target As" from the list of options that appear. Just select where you want to save the document on your computer. All users of the JOAP Manuals are required to check the website at least every 30 days for possible changes. Once a volume is opened the search feature, accessible by clicking "Ctrl + F", is an extremely useful tool when looking for a particular item. Enter the search word and all matches will be displayed.

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. Detailed instructions for obtaining repair of spectrometers are contained in Volume 2.

NOTE

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

Table of Contents

1. Oil Analysis Theory and Benefits. The lubricating oil circulating through an engine, gearbox or other system can be the source of valuable information about the health of the system. By measuring the metal contaminants in the oil, spectrometer analysis can provide information on the integrity of the components and whether any unusual wear is occurring. Changes in the lubricating oil itself can be measured by various physical and chemical tests.

   a. 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. Excessive 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, or assemblies.

   b. Oil analysis works best when it is combined with additional indicators to anticipate and/or confirm machinery health condition. Maintenance records, vibrations data (if available) are additional information that allow technicians and engineers to determine oil and machinery health condition. Each weapon system engineering group needs to regularly review their oil analysis data and revise their limits in order for oil analysis to provide predicative health maintenance benefits allowing for more operational availability of our Forces.

   c. Oil analysis is applied to weapon systems using a systems approach to detecting oil or machinery health condition. Joint Oil Analysis Program references the following material as guides to recommend approaches to successfully employ oil analysis for equipment Prognostic Health Management (PHM). The guides listed below are not comprehensive but serve to provide foundational information when used to collaborate with weapon systems engineers to gain an understanding on detection of specific issues.

      (1) ASTM D7874, Standard Guide for Applying Failure Mode and Effect Analysis (FEMA) to In-Service Lubricant Testing,

      (2) ASTM D7720, Standard Guide for Statistically Evaluating Measurand Alarm Limits when Using Oil Analysis to Monitor Equipment and Oil for Fitness and Contamination, and

      (3) ASTM D7769, Standard Guide for Practical Lubricant Condition Data Trend Analysis

2. Wear metals and debris. 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. Figure 1 depicts the relationship between the generation of wear metal debris in a component, the size of the generated debris and the health of that component/system. This chart is adapted from one found in “Mechanical wear debris feature, detection, and diagnosis: A review,” by Wei Hong et al,

ScienceDirect (https://www.sciencedirect.com/science/article/pii/S1000936117302637), used under CC BY 4.0 (https://creativecommons.org/licenses/by/4.0/) with images of JOAP tests superimposed on graph. On the left side of Figure 1 is a theoretical plot of wear metal / debris generation vs. running time / operating hours. 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 and size of the 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.

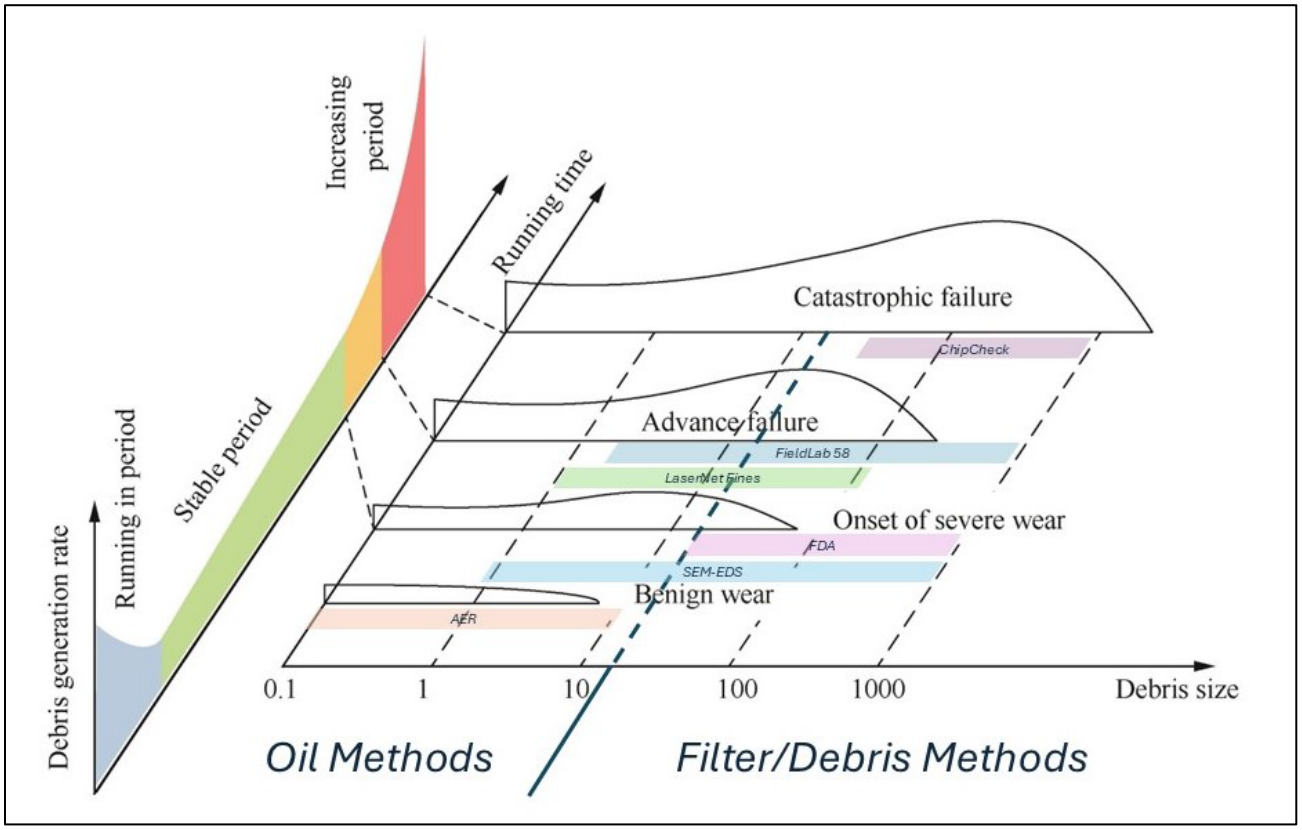

FIGURE 1. Wear Metal / Debris Generation versus Component Condition

3. Oil Analysis Techniques. Many methods/systems are available to evaluate oils and determine equipment as well as oil health. These can be organized into three general categories:

   a. 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.

b. Debris Analysis. Methods in this general category involve capturing the debris produced by wear within the equipment and then analyzing the debris often using a spectrometric method. Methods used to collect and concentrate the wear debris include magnetic chip collectors, component filters, filtration of large oil samples, etc. The LaserNet Fines system depicted in Figure 1 is a debris analysis system which evaluates the number, size and shape of particles found in a sample of lubricating oil.

c. Physical and Chemical Property Testing. Lubricant physical and chemical 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 of the physical property tests covered by work packages contained within Volume 2 See Volume 2 WP 004 01 for U.S. Air Force Special Tests.

4. Identification and Measurement of Wear Metals. Several spectrometric techniques are used to identify and measure the wear metals that accumulate in the lubricating fluid:

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. 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. The Joint Oil Analysis Program was originally established to coordinate and manage the efficient use of the limited spectrometer resources within the Department of Defense. A number of different types of spectrometers were originally deployed but over the years the DoD narrowed the focus to the use of Atomic Emission Rotrode (AER) spectrometers. This type of oil analysis method is depicted on the Figure 1 chart as AER. Laboratories certified under the Joint Oil Analysis Program utilize the AER spectrometer. Emission spectrometers are able to detect and measure wear metals in very small concentrations in the fluid but their accuracy rapidly declines as the size of the wear metal debris particles increase above 10µm.

b. X-Ray Fluorescence Spectroscopy. X-Ray Fluorescence uses a high energy X-ray from an X-ray tube or source. The high energy X-ray strikes the sample and displaces electrons from the sample. The displaced electrons change atomic orbit and give off a fluorescent X-ray. The energy of the fluorescent X-ray is then measured to determine the elements present in the sample. This spectrographic technique is the one employed by the FL58 Field Deployable OA Method described in Volume 5 of this manual and depicted as FieldLab 58 on Figure 1. It primarily identifies wear particles larger than ~4µ. This spectrographic technique is also employed by the GasTOPS Filter Debris Analyzer 400 test device that was retired in 2017. This technique is depicted on Figure 1 as FDA.

c. Laser Induced Breakdown Spectroscopy (LIBS). Laser induced breakdown spectroscopy uses a high-power laser pulse to create a small spot on the sample surface that forms a short duration plasma. This plasma gives off photons that are measured to produce a spectrum that can be used to characterize the sample material element. The laser must be able to target each individual particle in the sample to determine the element for that sample. The GasTOPS ChipCHECK 121, depicted on Figure 1 as ChipCheck, uses LIBS technology and is found in some USAF Oil Analysis labs and Navy Oil Analysis labs as of this publication.

d. Scanning Electron Microscope – Energy Dispersive Spectroscopy (SEM-EDS). This technique combines a scanning electron microscope with energy dispersive x-ray spectroscopy to analyze very small particles. This system can be used to evaluate particles found on chip collectors. The SEM-EDS method is part of the JetScan test device employed by the USAF. The debris size detection range is depicted in Figure 1 as SEM-EDS.

5. AER 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.

6. Practical Considerations.

   a. Sample Integrity. The value of AER 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. The difference in the wear metal particle size measured by X-Ray Fluorescence Spectroscopy means that results are not directly comparable to AER or ICP results.

d. Calibration Standards. Calibration standards which are used to standardize the AER spectrometers 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 2 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 2, 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.

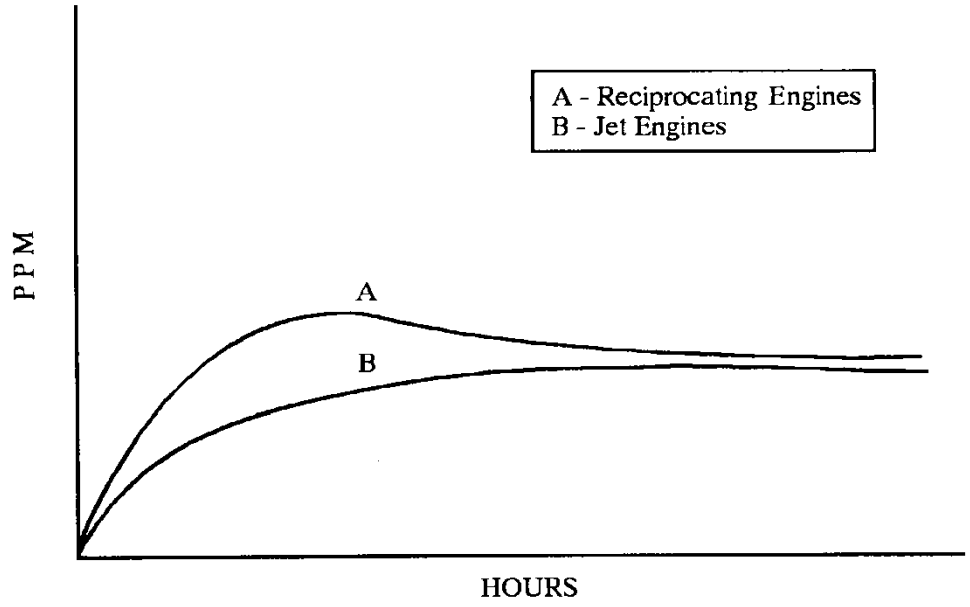

FIGURE 2. Wear-metal Concentration vs. Operating Hours

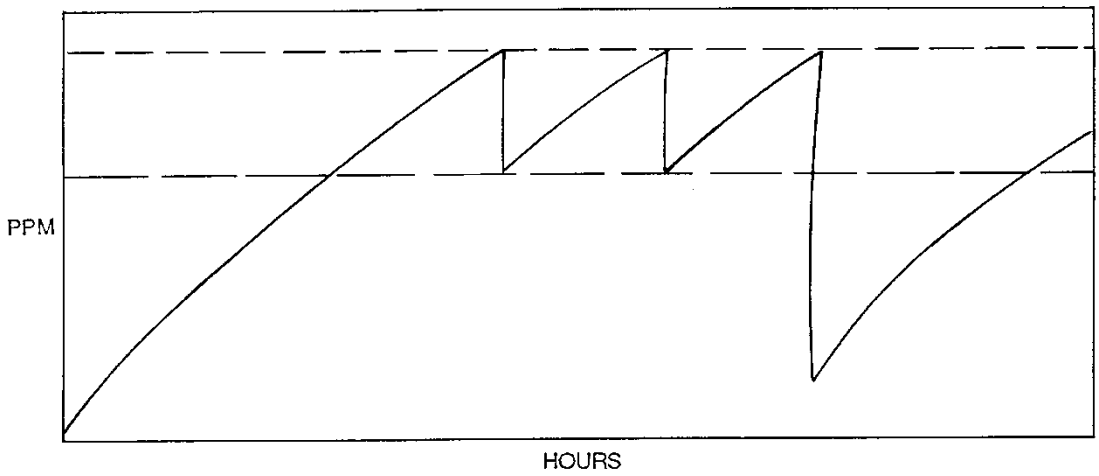

FIGURE 3. Effect of Periodic Fluid Addition and Fluid Change

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 Work Package 003 of this volume.

7. 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 2. 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. Fourier Infrared Transform Spectrometer (FT-IR). The FT-IR spectrometer system quantitatively estimates 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.

g. 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.

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.

j. LaserNet Fines. This device combines particle counts with an evaluation of the size and shape of the particles.

k. ChipCHECK. A portable device which uses a proprietary laser spectroscopy technology to analyze chips collected via a magnetic plug or other in-line system.

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 Volume 1 WP 005 00 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 equipment’s' 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 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 WP 004 00 of this Volume. Laboratories may be approved for interim operational support by the appropriate service Program Manager(s) following successful completion of analysis of one special set (one pair) of correlation samples as specified in paragraph 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.

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)

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.

b. Sampling Procedures. The success and effectiveness of the oil analysis program is dependent upon reliable samples.

(1). When to Take Samples. 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. A reliable sample is one which is truly representative of the circulating fluid in the equipment being evaluated. Below are general guidelines when to take a sample:

Aeronautical. Samples should be taken as soon as possible after the engine/equipment is shutdown. Every effort shall be made to take samples within 30-minutes shutdown. Samples shall be taken before any fluid is added to the system. If more than 30-minutes has passed, engines should be run at engine idle/motored for minimum of five minutes and resampled. All aircraft oil samples will be taken and delivered as soon as possible after engine shutdown, not to exceed 75 minutes.

NOTE

Air Force Personnel are required to meet the 30-minute sampling window by either taking the sample soon after shutdown or by following the second option of running the engine at idle for a minimum of five minutes.

Non-aeronautical Samples. An exception to the 30-minute 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 TB 43-0211 for additional oil analysis procedural information.)

Sampling When Component Has to be Serviced with Oil. 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.

NOTE

FL58 requires 12mL of oil. Fill sample bottle completely for FL58 to ensure adequate oil for testing.

(a). General Instructions for Sampling. 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. Open the sample bottle only when ready to take the sample and replace the bottle cap immediately after taking the sample.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

(b). Dip Tube Sampling.

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

NOTES

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.

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.

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.

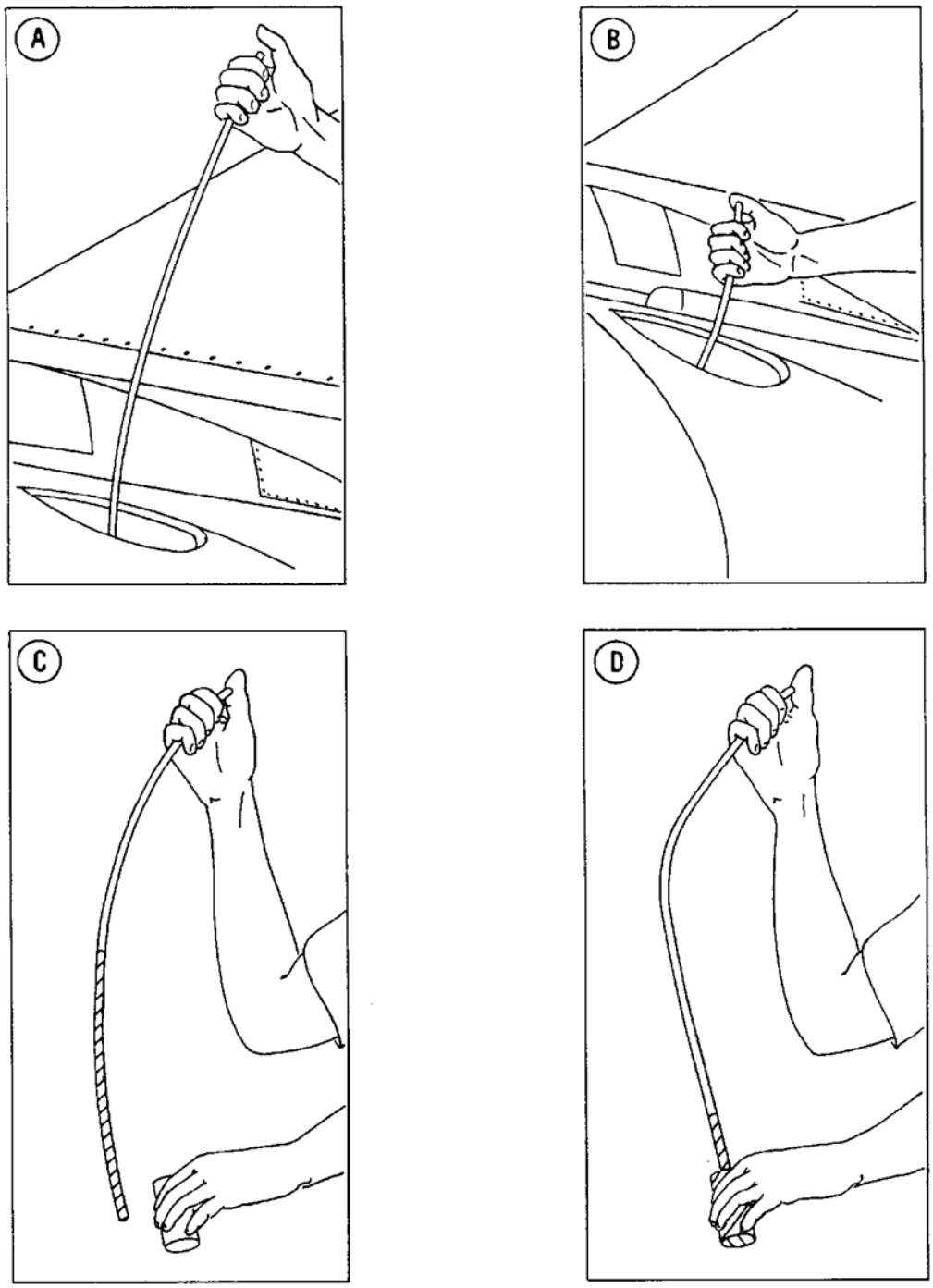


FIGURE 3. Dip Tube Sampling

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.

(c) 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. See figure 5 for a locally manufactured drain sampling kit.

3. Drain sufficient sample from the equipment to “clean” the port as shown in figure 5 view A

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

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

(d) 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.

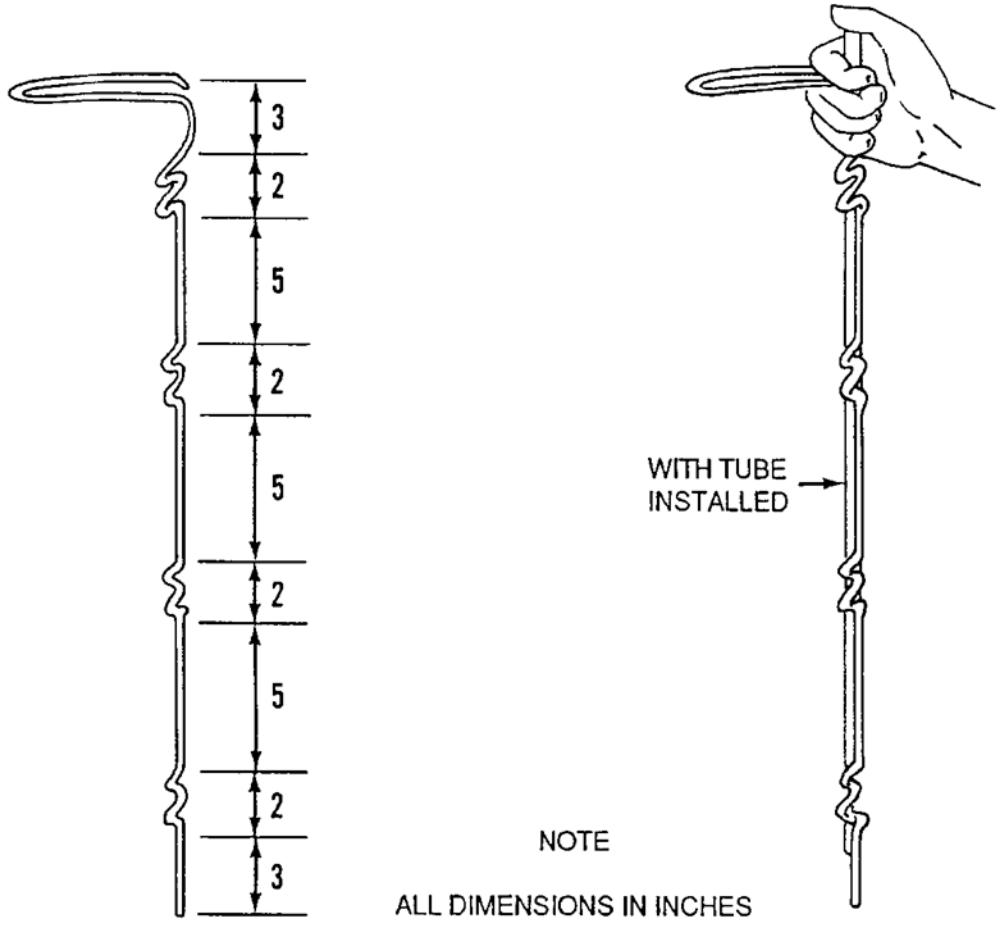


FIGURE 4. Sample Tube Straightener

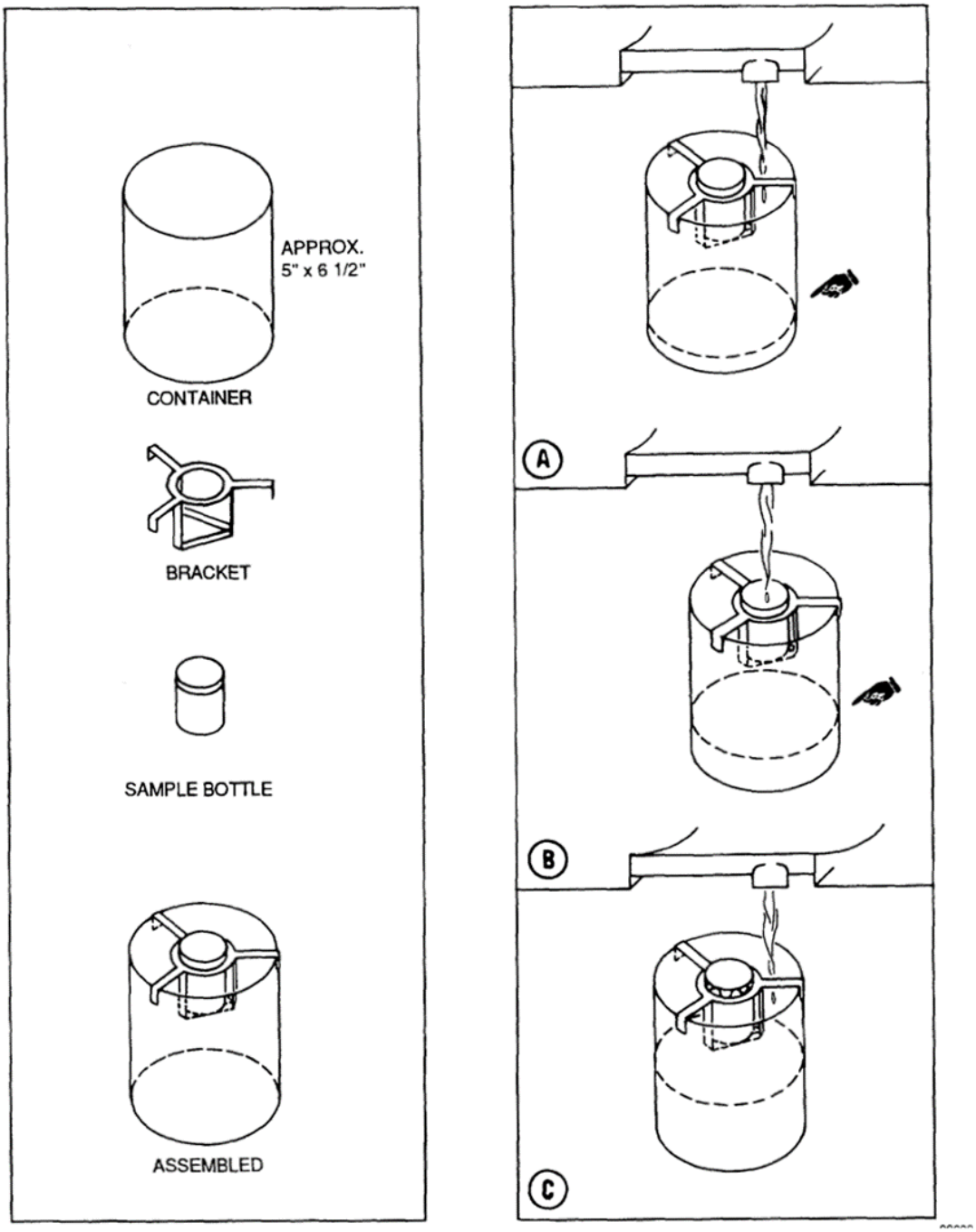


FIGURE 5. Locally Manufactured Drain Sample Kit

(e). Oil Servicing Cart Sampling.

1. Maintaining the integrity of Oil Servicing Carts is critical for ensuring the integrity of aircraft engine oil systems. Oil Servicing Carts are subject to contamination from incorrect handling and storage, environmental factors, and filling of Oil Servicing Cart reservoirs with contaminated oil 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.

2. Environmental conditions at some operating locations may drive increased potential for Oil Servicing Cart contamination. Desert, high moisture areas, exposure to salt air, or extreme cold may all introduce contamination into the Oil Servicing Cart reservoir.

3. Each base or location that has engines and/or components oil condition monitored by either Spectrometer or FL58 on a scheduled basis, and use Oil Servicing Carts to service engines and/or components, must establish a program to ensure the integrity of the Oil Servicing Carts. The program shall include local procedures to ensure Oil Servicing Carts are sampled on a routine basis within the following guidelines:

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

   b. Must be sampled whenever contamination to the Cart is suspected.

   c. Must be sampled 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 Servicing Carts for the servicing of aircraft engines will be sampled at initial opening and results known prior to addition to the Oil Servicing Cart.

   e. Must be sampled whenever contamination is suspected in an aircraft engine sample.

4. Oil Servicing Carts that are used to service engines/components that are not monitored by either Spectrometer or FL58 on a scheduled basis are exempt from these requirements.

5. Ensure that contaminated carts are handled according to local or MAJCOM policy. Refer to Volume 2, WP 021 00 for guidance on contamination with the wrong fluid.

5. 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.

NOTE

The above oil sampling kit is required for use with the FieldLab 58MA covered by Volume 5 of this manual. The mouth of the 5 dram bottle is wide enough for the FL58 syringe.

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.

NOTE

The 5-dram bottle described above is the appropriate oil sample bottle for use the the FieldLab 58MA covered by Volume 5 of this manual. The mouth of the 5 dram bottle is wide enough for the FL58 syringe.

(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.

(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.

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. 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.

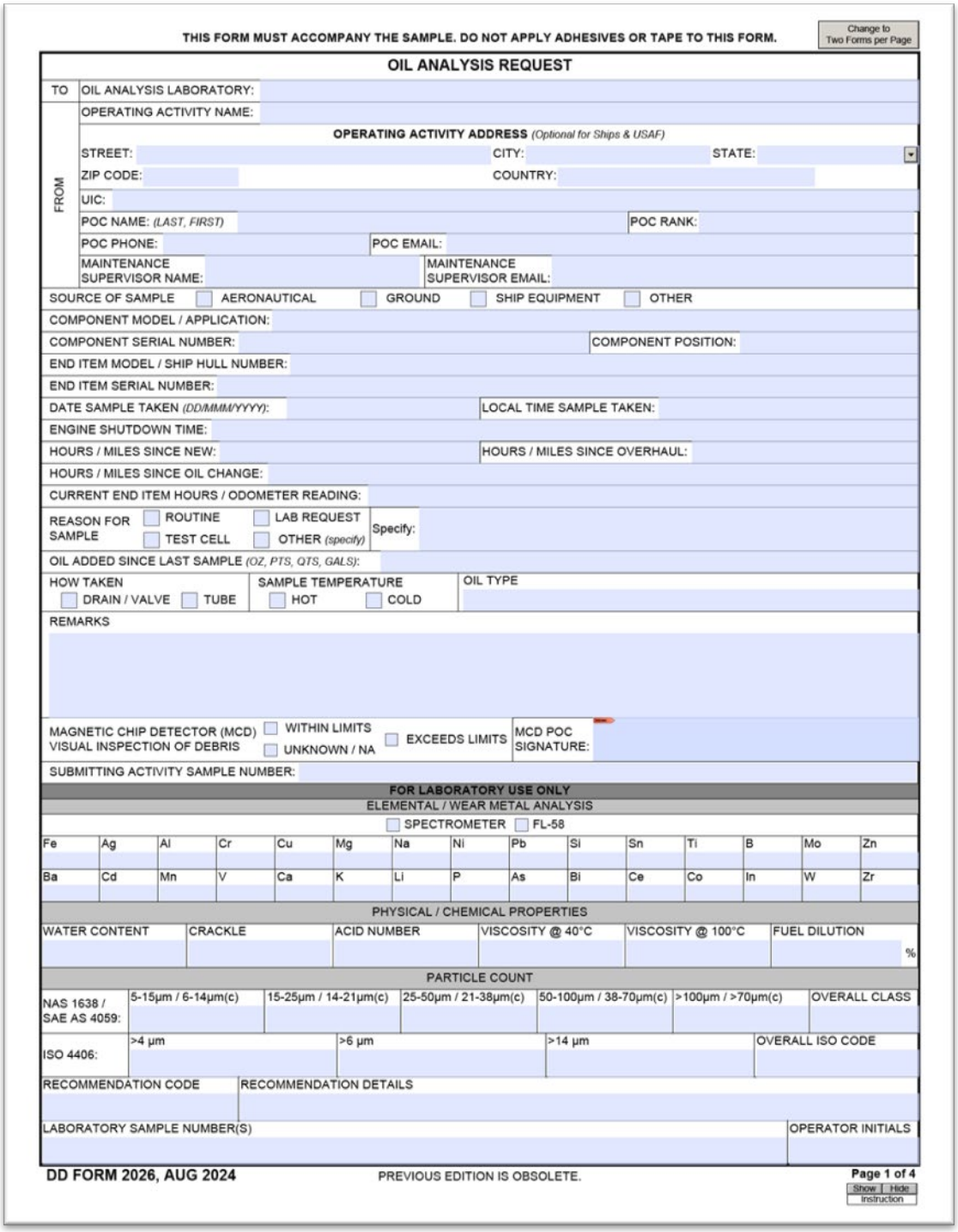
   b. Filling out DD Form 2026. Proper completion of the Oil Analysis Request by the submitting activity is a vital step in the evaluation process upon which maintenance actions are based. When forms are incomplete or erroneously completed, all other efforts to produce a valid evaluation are degraded or impossible. Figures 6 and 7 are the DD2026 form as revised in 2024. 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.

NOTE

Ships and NAVSEA Activities which are starting to sample a new piece of kit should contact NAVSEA via NOAPSupport@us.navy.mil to get the pre-printed labels and the correct nomenclature.

(1). Instructions for completing the OIL ANAYSIS REQUEST section of the DD Form 2026 are as follows:

(a). TO: OIL ANALYSIS LABORATORY. Enter the designated Oil Analysis Program (OAP) laboratory, which will perform the sample analysis, e.g., FRCSE Jacksonville, FL; Fort Liberty, NC; Columbus AFB, MS; 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 the Work Package 003 Volume 2 of the JOAP Manual (NAVAIR 17-15-50.2).



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

Change to Two Forms per Page

OIL ANALYSIS REQUEST

TO: OIL ANALYSIS LABORATORY:

FROM:
- OPERATING ACTIVITY NAME:
- OPERATING ACTIVITY ADDRESS *(Optional for Ships & USAF)*
- STREET: | CITY: | STATE:
- ZIP CODE: | COUNTRY:
- UIC:
- POC NAME: *(LAST, FIRST)* | POC RANK:
- POC PHONE: | POC EMAIL:
- MAINTENANCE SUPERVISOR NAME: | MAINTENANCE SUPERVISOR EMAIL:

SOURCE OF SAMPLE ☐ AERONAUTICAL ☐ GROUND ☐ SHIP EQUIPMENT ☐ OTHER

COMPONENT MODEL / APPLICATION:

COMPONENT SERIAL NUMBER: | COMPONENT POSITION:

END ITEM MODEL / SHIP HULL NUMBER:

END ITEM SERIAL NUMBER:

DATE SAMPLE TAKEN *(DD/MMM/YYYY)*: | LOCAL TIME SAMPLE TAKEN:

ENGINE SHUTDOWN TIME:

HOURS / MILES SINCE NEW: | HOURS / MILES SINCE OVERHAUL:

HOURS / MILES SINCE OIL CHANGE:

CURRENT END ITEM HOURS / ODOMETER READING:

REASON FOR SAMPLE ☐ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER *(specify)* | Specify:

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

HOW TAKEN ☐ DRAIN / VALVE ☐ TUBE | SAMPLE TEMPERATURE ☐ HOT ☐ COLD | OIL TYPE

REMARKS

MAGNETIC CHIP DETECTOR (MCD) VISUAL INSPECTION OF DEBRIS ☐ WITHIN LIMITS ☐ UNKNOWN / NA ☐ EXCEEDS LIMITS | MCD POC SIGNATURE:

SUBMITTING ACTIVITY SAMPLE NUMBER:

FOR LABORATORY USE ONLY

ELEMENTAL / WEAR METAL ANALYSIS

☐ SPECTROMETER ☐ FL-58

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si	Sn	Ti	B	Mo	Zn
Ba	**Cd**	**Mn**	**V**	**Ca**	**K**	**Li**	**P**	**As**	**Bi**	**Ce**	**Co**	**In**	**W**	**Zr**

PHYSICAL / CHEMICAL PROPERTIES

WATER CONTENT	CRACKLE	ACID NUMBER	VISCOSITY @ 40°C	VISCOSITY @ 100°C	FUEL DILUTION
					%

PARTICLE COUNT

NAS 1638 / SAE AS 4059:	5-15µm / 6-14µm(c)	15-25µm / 14-21µm(c)	25-50µm / 21-38µm(c)	50-100µm / 38-70µm(c)	>100µm / >70µm(c)	OVERALL CLASS

ISO 4406:	>4 µm	>6 µm	>14 µm	OVERALL ISO CODE

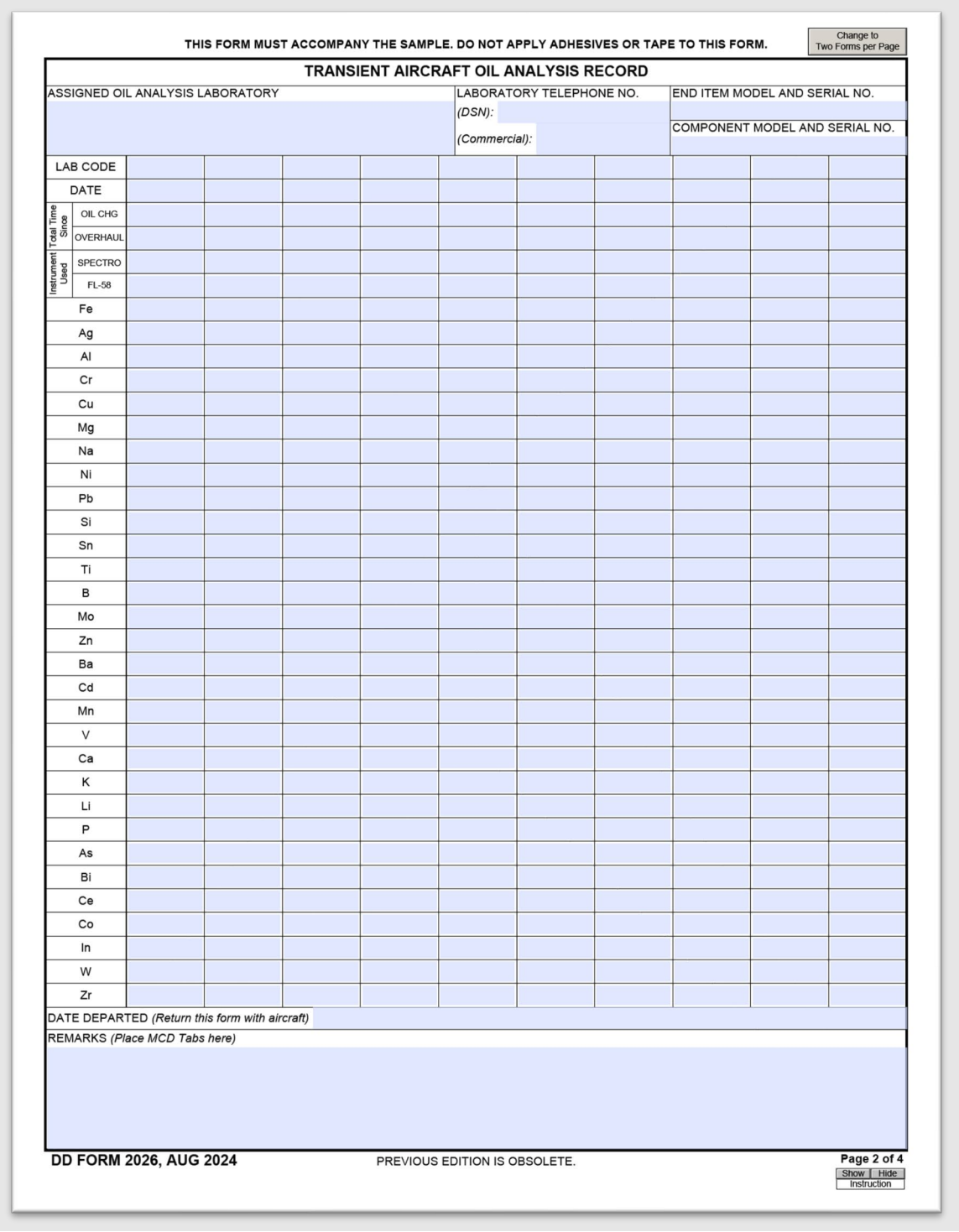
RECOMMENDATION CODE	RECOMMENDATION DETAILS

LABORATORY SAMPLE NUMBER(S)	OPERATOR INITIALS

DD FORM 2026, AUG 2024 — PREVIOUS EDITION IS OBSOLETE. — Page 1 of 4

Show | Hide Instruction

Figure 6. DD2026 Oil Analysis Request Form (Front)



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

Change to Two Forms per Page

TRANSIENT AIRCRAFT OIL ANALYSIS RECORD

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

LAB CODE										
DATE										
Total Time Since: OIL CHG										
Total Time Since: OVERHAUL										
Instrument Used: SPECTRO										
Instrument Used: FL-58										
Fe										
Ag										
Al										
Cr										
Cu										
Mg										
Na										
Ni										
Pb										
Si										
Sn										
Ti										
B										
Mo										
Zn										
Ba										
Cd										
Mn										
V										
Ca										
K										
Li										
P										
As										
Bi										
Ce										
Co										
In										
W										
Zr										

DATE DEPARTED *(Return this form with aircraft)*

REMARKS *(Place MCD Tabs here)*

DD FORM 2026, AUG 2024 PREVIOUS EDITION IS OBSOLETE. **Page 2 of 4**

Show | Hide Instruction

Figure 7. DD2026 Oil Analysis Request Form (Back)

(b). FROM.

1. OPERATING ACTIVITY NAME. Enter the designation of the operating activity submitting the sample. Examples: “VMM-363”, “HSM-41”, “USS TRIPOLI (LHA-7)”, “337 Med Co A.”, “A Company, 1-8 CAV”. Air Force, enter unit and name of base or location;.

2. OPERATING ACTIVITY ADDRESS. Enter complete address information for the operating activity. This is optional for Ships and USAF activities;

3. UIC. Enter the six-character unit identification code (Ex: N00421).

4. POC NAME / RANK. Enter the name and rank of the person submitting the sample.

5. POC PHONE / EMAIL. Enter the phone number and email address of the person submitting the sample.

6. MAINTENANCE SUPERVISOR NAME / EMAIL. Enter the name and email address of the Maintenance Supervisor responsible for the submitted sample. For Navy- enter information for the Maintenance Material Control Officer (MMCO) or other responsible individual.

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

(d). COMPONENT MODEL/APPLICATION. Enter the designation or description of the component/equipment (ex: engine, gearbox, etc) being sampled. For engines, include the type, model, and series. Examples of engines or components include: “F100-PW-220”, “T64-GE-416A”, “J85-GE-5”, “42/INT GBX”, “90/TAIL GBX”, “MAIN XMSN”, “GTCP36-50”, “LM 2500 GTE Hydraulic Start Unit”, “AVDS-1790-2DR”, “Hydraulic Valve Control Station 1”..

(e). COMPONENT SERIAL NUMBER. Enter complete serial number of the component/equipment being sampled. Examples: “BH648916”, “A235-00076”, “714651”. 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. The Component Serial Number (CSN) on the DD 2026 form should be in the format of ship hull number followed by “-“, followed by a number indicating equipment location/number, followed by “/”, followed by the equipment abbreviation. Shipboard Examples: DDG56-1A/HYDSTRSERVO, LPD24-PORT/ANCHGE, CG66-FWDPORT/RSD, LCS22-1/WJHPU, etc.

NOTES

The next revisions of JOAP Manual Vol 4 (revision after Change 1 - 1 July 2022) and NSTM 262 (Vol 1 Rev 13) will list the CSNs for NOAP ship equipment lubricating oil samples. Use the CSNs in these manuals when completing DD 2026 forms for sample submission to the NOAP labs. Using the correct CSN is critical for proper sample processing at the NOAP labs and data flow into the Consolidated Machinery Assessment System (CMAS). If a required sample point or CSN is not in these manuals, contact the NSWCPD C331 Lubricants team at NSWCPD_Lubricants@us.navy.mil for additional guidance.

NAVSEA has created partially pre-filled DD 2026 forms for most ship classes, complete with appropriate CSNs. These pre-completed forms are available for download from the NSWCPD C331 lubricants portal at https://intelshare.intelink.gov/sites/NSWCPD/LOQM/. Using these pre-completed forms helps to ensure proper nomenclature is being used.

Intelink users will need to request access when visiting the site for the first time. Use a common access card (CAC) to enter the portal followed by a justification for access (e.g. LOQM). An email will be sent when access is granted. After receiving access, see the “Ship Resources” section for ship specific folders containing the DD Form 2026 forms.

(f). COMPONENT POSITION. If applicable, enter position or position number of the component. This is common for engines and some gearboxes. Examples: “#1”, “#2”, “LEFT”, “RIGHT”, “PORT”, “STARBOARD”, “N/A”.

(g). END ITEM MODEL/SHIP HULL NUMBER. Enter mission, design and series (type, model, series) of end item which contains the component or system being sampled. This is often an aircraft or vehicle. Examples: “MH-60R”, “CVN-68”, “F-16C”, ”CV-22B”, “Cat-130GNS”, “M32A-60”.

(h). END ITEM SERIAL NUMBER. Enter the complete end item serial number (aircraft bureau number). Examples: “162516”, “168650”, “900946”, “09-0043”, “1220493”.

(i). DATE SAMPLE TAKEN (DD/MMM/YYYY). Enter the date in the format day/month/year on which the sample was taken, e.g., 03DEC2023 for December 3, 2023.

(j). LOCAL TIME SAMPLE TAKEN. Enter local time sample was taken using 24 hour clock, e.g., 0700, 1600, 2200, etc.

(k). ENGINE SHUTDOWN TIME. Enter local time the engine was shutdown prior to oil sampling using the 24-hour clock.

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.

(l). HOURS / MILES SINCE NEW. Enter the total hours/miles since new of the component being sampled to the nearest whole hour/mile (round up if 0.5 or above). Indicate if the number reported is in hours or miles. Examples: “1200 Hours”, “1200 Miles”.

(m). HOURS / MILES SINCE OVERHAUL. Enter the total hours/miles since overhaul of the component 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 reported. Indicate if the number reported is in hours or miles. Air Force personnel will normally enter total

flying hours. For Navy ship equipment enter hours if known, otherwise leave blank. Examples: “110 Hours”, “110 Miles”.

(n). HOURS / MILES SINCE OIL CHANGE. Enter hours/miles since oil change on the component being sampled to the nearest whole hour/mile (round up if 0.5 or above). Indicate if the number reported is in hours or miles. For Navy ship equipment enter hours if known, otherwise leave blank. Examples: “25 Hours”, “25 Miles”.

(o). CURRENT END ITEM HOURS / ODOMETER READING. If available, enter the miles or hours of the aircraft or vehicle upon which the component is installed. This is equivalent to the odometer reading. Specify if hours or miles are reported. Examples: “2200 Hours” or “2200 Miles”.

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.

(p). REASON FOR SAMPLE. Enter reason for taking sample. Mark applicable block; if "Other" block is marked, specify reason for sample, e.g., initial sample, warning light, etc.

NOTE

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.

(q). OIL ADDED SINCE LAST SAMPLE. Enter the quantity of oil added since the last sample and specify the measurement used. Examples: “5 ounces”, “2 gallons”, “5 pints”.

(r). HOW TAKEN. Mark the appropriate block. See Volume 1, Work Package 003 of the JOAP Manual for definitions of Tube, Drain, or Valve sampling.

(s). SAMPLE TEMPERATURE. Mark the appropriate block.

(t). OIL TYPE. Enter the specification number, product designation or product name. Examples: “MIL-PRF-23699 CI”, “DOD-PRF-85734”, “MIL-PRF-7808 Gr 4”, “MIL-PRF-2104".

(u). REMARKS. Enter any pertinent sample information. On initial samples of new equipment, provide the JOAP laboratory with the following:

(1). System oil capacity.

(2). Sampling / Oil change interval.

(3). Minor maintenance actions within the oil system.

(v). MAGNETIC CHIP DETECTOR (MCD) VISUAL INSPECTION OF DEBRIS. If visual inspection of MCD is required, Air Force or Army customers are to check the appropriate block for the debris observed on the chip detector, i.e. “WITHIN LIMITS”, “EXCEEDS LIMITS”. If not required, the submitter should mark “UNKNOWN/NA”. The person conducting the inspection must sign the MCD Point of Contact (POC) signature block (not OAP lab personnel).

(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.

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.

(2). FOR LABORATORY USE ONLY section of the DD Form 2026. This section of the form is completed by the laboratory personnel performing the analysis of the oil sample. It is rarely used since most oil analyses are automated and use computer systems to record results and provide results back to customers. Consult JOAP Manual Volume 2 for details on when and if this section of the form must be completed. Laboratory personnel must consult JOAP Manual Volumes 3, 4, and/or 5 for details on which tests are to be performed based on the component from which the sample has been extracted. These volumes also provide limits along with guidance on the interpretation of the results.

(a). WEAR METAL ANALYSIS. Check the appropriate block for the wear metal instrument used, i.e. “SPECTROMETER” or “FL-58”. Fill in all values obtained for each wear metal as indicated by the instrument.

(b). PHYSICAL / CHEMICAL PROPERTIES. Fill in the results for the tests performed.

(c). PARTICLE COUNT. Fill in the results along with the Overall NAS Class and/or Overall ISO Code, if performed.

(d). RECOMMENDATION CODE. Enter the appropriate recommendation code based upon the oil analysis test results.

(e). RECOMMENDATION DETAILS. Provide any additional information appropriate based on the results obtained.

(f). LABORATORY SAMPLE NUMBER(S). Enter the sample identification number assigned by the laboratory.

(g). OPERATOR INITIALS. The laboratory operator enters their initials.

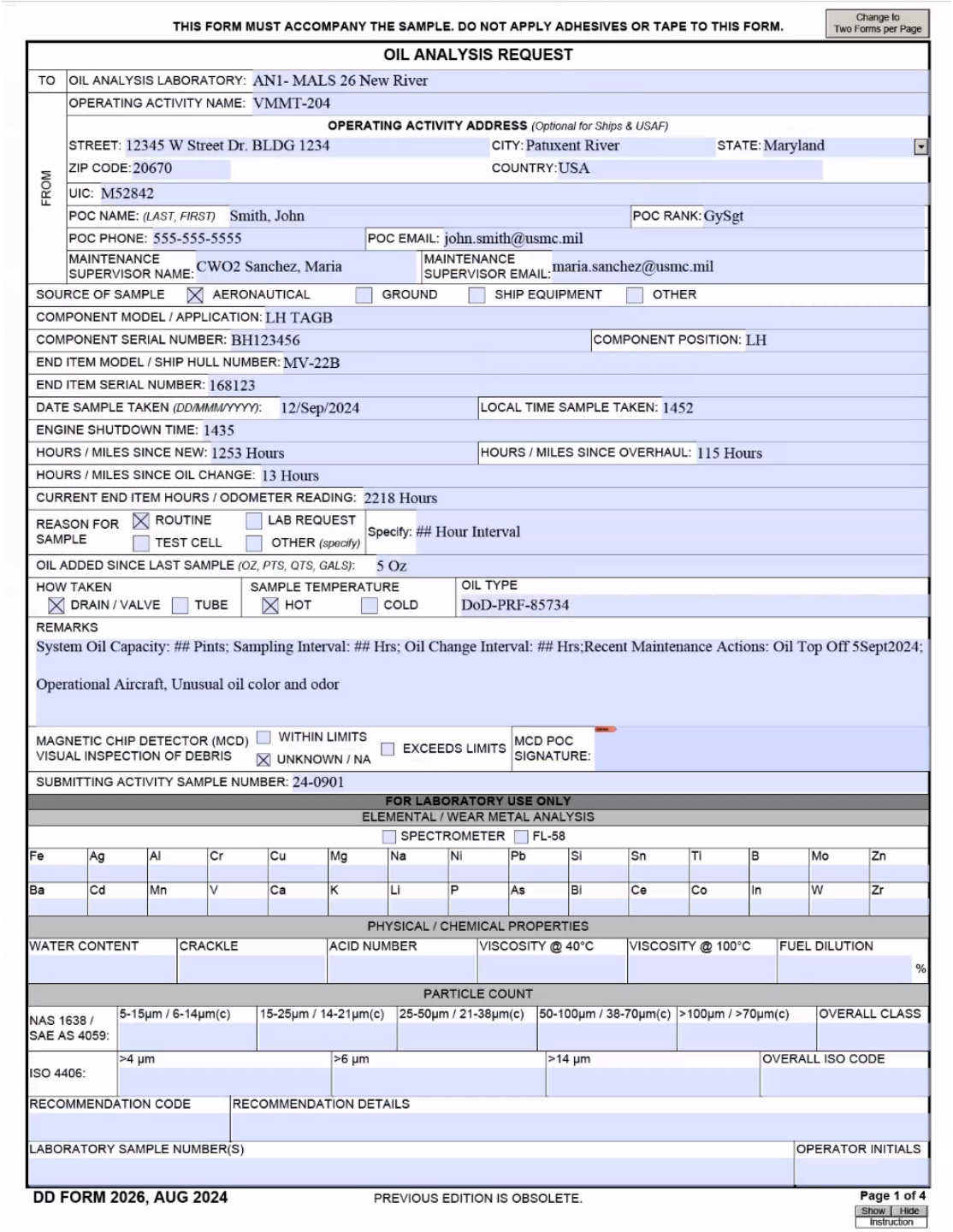
(3). TRANSIENT AIRCRAFT OIL ANALYSIS RECORD. This section of the form is on the reverse or back side (Figure 7). It is used in the uncommon situation where the oil analysis servicing of a specific component is being transitioned from one oil analysis laboratory to another and the losing laboratory is not equipped with an automated data system. The oil analysis records for the

component being transferred are entered on this form by the losing laboratory's operator so that a hard copy of the results can be delivered to the receiving oil analysis laboratory. JOAP Manual Volume 2 includes details on how and when this section of the form is to be used. An example of a transit aircraft oil analysis record (Side 2 of DD Form 2026), is provided by Figure 11.

(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 available. 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 5.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.

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, 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. If data is not entered into AF AETC software database while at en route laboratory the home-station laboratory will enter the data from the en route locations upon receipt.

(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.



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

Change to Two Forms per Page

OIL ANALYSIS REQUEST

TO
OIL ANALYSIS LABORATORY: AN1- MALS 26 New River

FROM
OPERATING ACTIVITY NAME: VMMT-204

OPERATING ACTIVITY ADDRESS *(Optional for Ships & USAF)*

STREET: 12345 W Street Dr. BLDG 1234 | CITY: Patuxent River | STATE: Maryland
ZIP CODE: 20670 | COUNTRY: USA
UIC: M52842
POC NAME: *(LAST, FIRST)* Smith, John | POC RANK: GySgt
POC PHONE: 555-555-5555 | POC EMAIL: john.smith@usmc.mil
MAINTENANCE SUPERVISOR NAME: CWO2 Sanchez, Maria | MAINTENANCE SUPERVISOR EMAIL: maria.sanchez@usmc.mil

SOURCE OF SAMPLE ☒ AERONAUTICAL ☐ GROUND ☐ SHIP EQUIPMENT ☐ OTHER
COMPONENT MODEL / APPLICATION: LH TAGB
COMPONENT SERIAL NUMBER: BH123456 | COMPONENT POSITION: LH
END ITEM MODEL / SHIP HULL NUMBER: MV-22B
END ITEM SERIAL NUMBER: 168123
DATE SAMPLE TAKEN *(DD/MMM/YYYY)*: 12/Sep/2024 | LOCAL TIME SAMPLE TAKEN: 1452
ENGINE SHUTDOWN TIME: 1435
HOURS / MILES SINCE NEW: 1253 Hours | HOURS / MILES SINCE OVERHAUL: 115 Hours
HOURS / MILES SINCE OIL CHANGE: 13 Hours
CURRENT END ITEM HOURS / ODOMETER READING: 2218 Hours
REASON FOR SAMPLE ☒ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER *(specify)* | Specify: ## Hour Interval
OIL ADDED SINCE LAST SAMPLE *(OZ, PTS, QTS, GALS)*: 5 Oz
HOW TAKEN ☒ DRAIN / VALVE ☐ TUBE | SAMPLE TEMPERATURE ☒ HOT ☐ COLD | OIL TYPE: DoD-PRF-85734

REMARKS
System Oil Capacity: ## Pints; Sampling Interval: ## Hrs; Oil Change Interval: ## Hrs;Recent Maintenance Actions: Oil Top Off 5Sept2024;

Operational Aircraft, Unusual oil color and odor

MAGNETIC CHIP DETECTOR (MCD) VISUAL INSPECTION OF DEBRIS ☐ WITHIN LIMITS ☒ UNKNOWN / NA ☐ EXCEEDS LIMITS | MCD POC SIGNATURE:
SUBMITTING ACTIVITY SAMPLE NUMBER: 24-0901

FOR LABORATORY USE ONLY

ELEMENTAL / WEAR METAL ANALYSIS
☐ SPECTROMETER ☐ FL-58

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si	Sn	Ti	B	Mo	Zn
Ba	Cd	Mn	V	Ca	K	Li	P	As	Bi	Ce	Co	In	W	Zr

PHYSICAL / CHEMICAL PROPERTIES

WATER CONTENT	CRACKLE	ACID NUMBER	VISCOSITY @ 40°C	VISCOSITY @ 100°C	FUEL DILUTION
					%

PARTICLE COUNT

NAS 1638 / SAE AS 4059:	5-15µm / 6-14µm(c)	15-25µm / 14-21µm(c)	25-50µm / 21-38µm(c)	50-100µm / 38-70µm(c)	>100µm / >70µm(c)	OVERALL CLASS

ISO 4406:	>4 µm	>6 µm	>14 µm	OVERALL ISO CODE

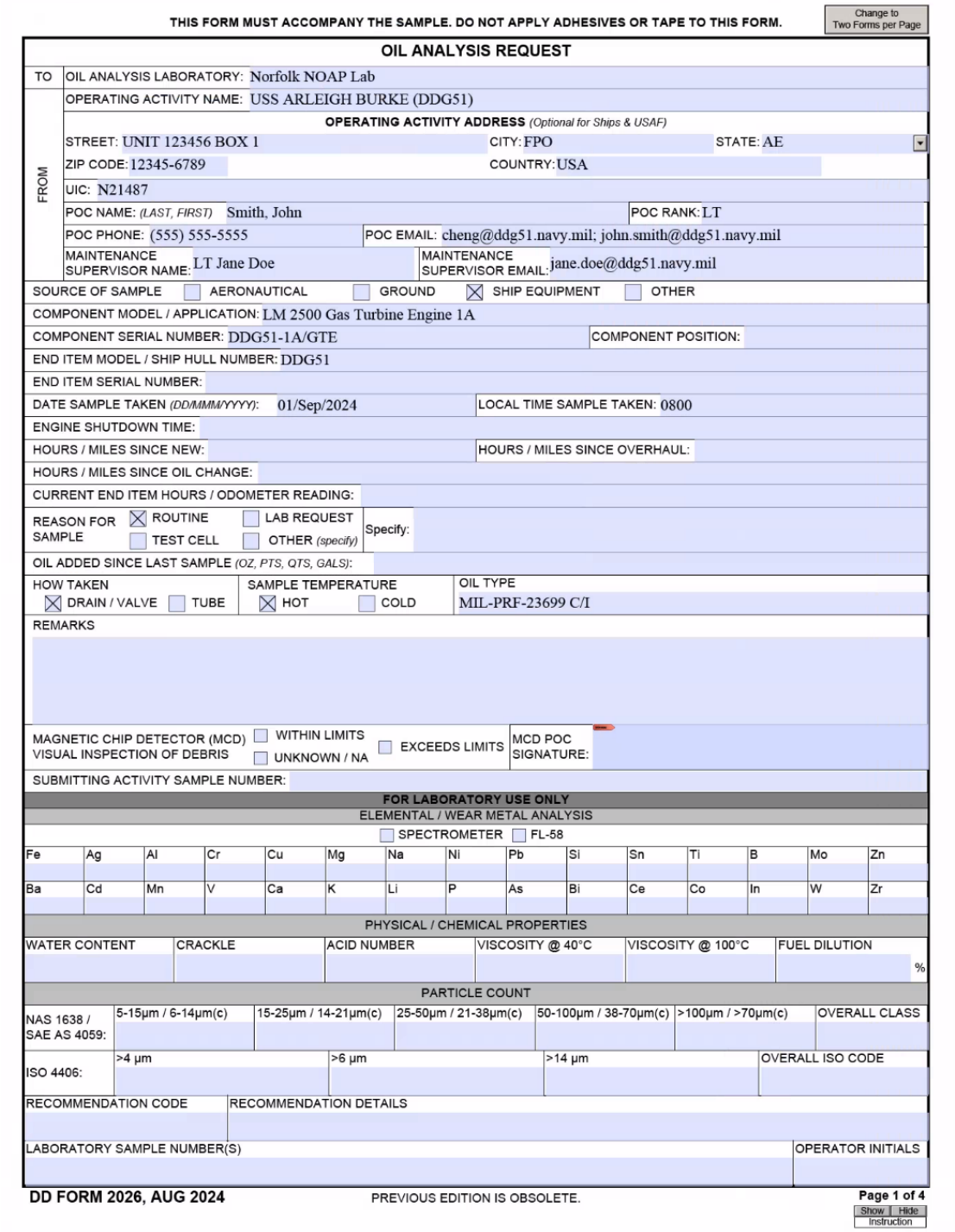
RECOMMENDATION CODE	RECOMMENDATION DETAILS

LABORATORY SAMPLE NUMBER(S)	OPERATOR INITIALS

DD FORM 2026, AUG 2024 PREVIOUS EDITION IS OBSOLETE. Page 1 of 4

Show | Hide Instruction

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.

Change to Two Forms per Page

OIL ANALYSIS REQUEST

TO
OIL ANALYSIS LABORATORY: Norfolk NOAP Lab

FROM
OPERATING ACTIVITY NAME: USS ARLEIGH BURKE (DDG51)
OPERATING ACTIVITY ADDRESS *(Optional for Ships & USAF)*
STREET: UNIT 123456 BOX 1 | CITY: FPO | STATE: AE
ZIP CODE: 12345-6789 | COUNTRY: USA
UIC: N21487
POC NAME: *(LAST, FIRST)* Smith, John | POC RANK: LT
POC PHONE: (555) 555-5555 | POC EMAIL: cheng@ddg51.navy.mil; john.smith@ddg51.navy.mil
MAINTENANCE SUPERVISOR NAME: LT Jane Doe | MAINTENANCE SUPERVISOR EMAIL: jane.doe@ddg51.navy.mil

SOURCE OF SAMPLE ☐ AERONAUTICAL ☐ GROUND ☒ SHIP EQUIPMENT ☐ OTHER
COMPONENT MODEL / APPLICATION: LM 2500 Gas Turbine Engine 1A
COMPONENT SERIAL NUMBER: DDG51-1A/GTE | COMPONENT POSITION:
END ITEM MODEL / SHIP HULL NUMBER: DDG51
END ITEM SERIAL NUMBER:
DATE SAMPLE TAKEN *(DD/MMM/YYYY)*: 01/Sep/2024 | LOCAL TIME SAMPLE TAKEN: 0800
ENGINE SHUTDOWN TIME:
HOURS / MILES SINCE NEW: | HOURS / MILES SINCE OVERHAUL:
HOURS / MILES SINCE OIL CHANGE:
CURRENT END ITEM HOURS / ODOMETER READING:
REASON FOR SAMPLE ☒ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER *(specify)* | Specify:
OIL ADDED SINCE LAST SAMPLE *(OZ, PTS, QTS, GALS)*:

HOW TAKEN	SAMPLE TEMPERATURE	OIL TYPE
☒ DRAIN / VALVE ☐ TUBE	☒ HOT ☐ COLD	MIL-PRF-23699 C/I

REMARKS

MAGNETIC CHIP DETECTOR (MCD) / VISUAL INSPECTION OF DEBRIS ☐ WITHIN LIMITS ☐ UNKNOWN / NA ☐ EXCEEDS LIMITS | MCD POC SIGNATURE:
SUBMITTING ACTIVITY SAMPLE NUMBER:

FOR LABORATORY USE ONLY

ELEMENTAL / WEAR METAL ANALYSIS
☐ SPECTROMETER ☐ FL-58

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si	Sn	Ti	B	Mo	Zn
Ba	Cd	Mn	V	Ca	K	Li	P	As	Bi	Ce	Co	In	W	Zr

PHYSICAL / CHEMICAL PROPERTIES

WATER CONTENT	CRACKLE	ACID NUMBER	VISCOSITY @ 40°C	VISCOSITY @ 100°C	FUEL DILUTION
					%

PARTICLE COUNT

	5-15µm / 6-14µm(c)	15-25µm / 14-21µm(c)	25-50µm / 21-38µm(c)	50-100µm / 38-70µm(c)	>100µm / >70µm(c)	OVERALL CLASS
NAS 1638 / SAE AS 4059:						

	>4 µm	>6 µm	>14 µm	OVERALL ISO CODE
ISO 4406:				

RECOMMENDATION CODE	RECOMMENDATION DETAILS

LABORATORY SAMPLE NUMBER(S)	OPERATOR INITIALS

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Show Hide Instruction

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

THIS FORM MUST ACCOMPANY THE SAMPLE. DO NOT APPLY ADHESIVES OR TAPE TO THIS FORM. Change to Two Forms per Page

OIL ANALYSIS REQUEST

TO: OIL ANALYSIS LABORATORY: LUKE AFB

FROM:
OPERATING ACTIVITY NAME: AETC
OPERATING ACTIVITY ADDRESS (Optional for Ships & USAF)
STREET: 14242 W SPAD ST | CITY: LUKE AFB | STATE: ARIZONA
ZIP CODE: 85309 | COUNTRY:
UIC:
POC NAME: (LAST, FIRST) DOE, JOHN | POC RANK: SSGT
POC PHONE: 623-856-1234 | POC EMAIL: JOHN.DOE@US.AF.MIL
MAINTENANCE SUPERVISOR NAME: JOHN SMITH, MSGT | MAINTENANCE SUPERVISOR EMAIL: JOHN.SMITH12@US.AF.MIL

SOURCE OF SAMPLE: ☒ AERONAUTICAL ☐ GROUND ☐ SHIP EQUIPMENT ☐ OTHER
COMPONENT MODEL / APPLICATION: F100-PW-220B
COMPONENT SERIAL NUMBER: 537123 | COMPONENT POSITION: 1
END ITEM MODEL / SHIP HULL NUMBER: F-16A
END ITEM SERIAL NUMBER: 83-0615-1
DATE SAMPLE TAKEN (DD/MMM/YYYY): 9/SEP/2024 | LOCAL TIME SAMPLE TAKEN: 0745
ENGINE SHUTDOWN TIME: 0715
HOURS / MILES SINCE NEW: 1200 HOURS | HOURS / MILES SINCE OVERHAUL: 400 HOURS
HOURS / MILES SINCE OIL CHANGE: 20.5 HOURS
CURRENT END ITEM HOURS / ODOMETER READING: 3900 HOURS
REASON FOR SAMPLE: ☒ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER (specify) | Specify:
OIL ADDED SINCE LAST SAMPLE (OZ, PTS, QTS, GALS): 2 QTS
HOW TAKEN: ☐ DRAIN / VALVE ☒ TUBE | SAMPLE TEMPERATURE: ☒ HOT ☐ COLD | OIL TYPE: MIL-PRF-7808
REMARKS
MAGNETIC CHIP DETECTOR (MCD) / VISUAL INSPECTION OF DEBRIS: ☒ WITHIN LIMITS ☐ UNKNOWN / NA ☐ EXCEEDS LIMITS | MCD POC SIGNATURE:
SUBMITTING ACTIVITY SAMPLE NUMBER: 23456

FOR LABORATORY USE ONLY

ELEMENTAL / WEAR METAL ANALYSIS
☐ SPECTROMETER ☐ FL-58

Fe	Ag	Al	Cr	Cu	Mg	Na	Ni	Pb	Si	Sn	Ti	B	Mo	Zn
Ba	**Cd**	**Mn**	**V**	**Ca**	**K**	**Li**	**P**	**As**	**Bi**	**Ce**	**Co**	**In**	**W**	**Zr**

PHYSICAL / CHEMICAL PROPERTIES

WATER CONTENT	CRACKLE	ACID NUMBER	VISCOSITY @ 40°C	VISCOSITY @ 100°C	FUEL DILUTION
					%

PARTICLE COUNT

	5-15µm / 6-14µm(c)	15-25µm / 14-21µm(c)	25-50µm / 21-38µm(c)	50-100µm / 38-70µm(c)	>100µm / >70µm(c)	OVERALL CLASS
NAS 1638 / SAE AS 4059:						

	>4 µm	>6 µm	>14 µm	OVERALL ISO CODE
ISO 4406:				

RECOMMENDATION CODE	RECOMMENDATION DETAILS

LABORATORY SAMPLE NUMBER(S)	OPERATOR INITIALS

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FIGURE 10. Oil Analysis Request, DD Form 2026 – Lab Request Sample (Submitted by an Air Force)

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

Change to Two Forms per Page

TRANSIENT AIRCRAFT OIL ANALYSIS RECORD

ASSIGNED OIL ANALYSIS LABORATORY	LABORATORY TELEPHONE NO.	END ITEM MODEL AND SERIAL NO.
AN1- MALS 26 New River	*(DSN):* 555-5555	MV-22B, 168123
	(Commercial): 555-555-5555	COMPONENT MODEL AND SERIAL NO. LH TAGB, BH123456

LAB CODE		AN1	AN1	ANM	ANM	AN1	ANP	ANM	ANM	ANM	ANM
DATE		Oct 1, 2023	Jan 1, 2024	Apr 1, 2024	Jun 1, 2024	Aug 1, 2024					
Total Time Since	OIL CHG	10	42	0	28	64					
	OVERHAUL	1000	1032	1061	1089	1125					
Instrument Used	SPECTRO	X	X	X	X	X					
	FL-58										
Fe		4.647	47.472	0.103	0.801	1.012					
Ag		0.083	1.023	0.003	0.198	0.203					
Al		0.391	0.313	0.004	0.003	0.010					
Cr		0.009	0.313	0.002	0.002	0.005					
Cu		0.062	1.334	0.001	0.001	0.003					
Mg		0.824	0.313	0.901	1.199	1.200					
Na		0.147	1.234	0.203	0.312	0.432					
Ni		0.148	0.323	0.512	0.411	0.510					
Pb		0.066	0.233	0.003	0.003	0.002					
Si		3.934	10.247	0.102	1.401	1.403					
Sn		3.568	5.457	2.800	2.901	2.910					
Ti		0.247	0.637	0.092	0.093	0.109					
B		0.130	0.418	0.085	0.095	0.100					
Mo		0.106	0.316	0.001	0.096	0.198					
Zn		0.698	6.009	0.003	0.002	0.003					
Ba		0.029	0.084	0.099	0.100	0.100					
Cd		0.492	0.893	0.003	0.198	0.201					
Mn		1.221	1.933	2.090	2.411	2.500					
V		0.331	0.686	0.400	0.512	0.612					
Ca		0.100	0.318	0.031	0.300	0.400					
K		0.057	0.122	0.101	0.100	0.200					
Li		0.000	0.100	0.001	0.000	0.100					
P		1784.7	2096.8	1964.0	1899.1	1809.1					
As		9.357	10.638	9.899	12.209	12.200					
Bi		3.421	4.434	4.702	4.709	4.710					
Ce		0.003	0.002	0.001	0.003	0.004					
Co		0.100	0.271	0.400	0.411	0.410					
In		2.271	2.821	1.602	1.609	1.502					
W		1.929	2.978	3.589	3.901	3.809					
Zr		0.002	0.003	0.001	0.002	0.003					

DATE DEPARTED *(Return this form with aircraft)* 10/5/2024

REMARKS *(Place MCD Tabs here)*

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Show | Hide Instruction

FIGURE 11. Transit Aircraft Oil Analysis Record, DD Form 2026 (Side 2)

7. 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 12.

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.

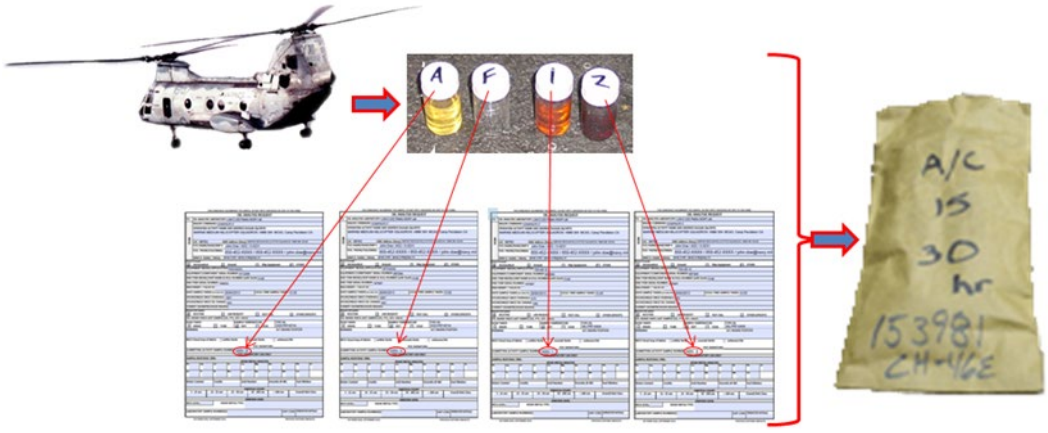

FIGURE 12. Submitting Multiple Samples and Linking to Applicable Oil Analysis Request Forms via the Activity Sample Number

8. FEEDBACK TO AIR FORCE OAP ON ACTION(S) TAKEN

All Air Force personnel will complete an Air Force OAP Feedback Form, Figure 13, when laboratory recommendation code H, R, or T has been used. The completed Feedback Form will be forwarded to af.oil.analysis@us.af.mil.

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 13. Air Force OAP Feedback Form

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JOAP PROGRAMS AND REPORTS

Table of Contents

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

2. Background. The JOAP was established to maximize the efficient use of limited spectrometer resources for oil analysis within the DoD. Using multiple spectrometers for analyzing oil samples meant that the instruments needed to be calibrated and standardized in such a way that comparable results could be obtained from different spectrometers. As a result detailed procedures were developed to standardize the spectrometers followed by programs to “Correlate” the results and then “Certify” each instrument and laboratory. These programs compose the JOAP Certification Program which is summarized below and administered by the individual Service Oil Analysis Program Managers. Details are presented in Volume 2 of this manual with the Correlation Program addressed in Work Package 001 which covers Spectrometer Operating procedures and the Certification Program(s) addressed in Work Packages 002, 003 and 004 which cover the operating procedures of the Army, Navy, and Air Force OAP’s respectively.

3. JOAP Certification Program.

   a. Purpose. To ensure that all participating laboratories produce similar / comparable results when conducting tests with oil analysis instruments/systems and can be used to analyze both inter-service as well as intra-service oil samples.

b. Policy.

(1) Each laboratory is categorized as either “authorized” or “unauthorized” by their applicable Service Oil Analysis Program manager based upon their laboratory facilities, personnel qualifications and adherence to JOAP and Service specific guidelines

(2) 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 if employing an Atomic Emission Rotrode spectrometer. 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.

(3) 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.

(4) USAF units with FL58 that do not operate atomic emission rotrode spectrometers are not certified under the JOAP Certification Program. The FL58 does not require correlation.

c. Certification Procedures. The Army, Navy and Air Force OAP Managers certify their respective laboratories upon their initial establishment or relocation based on the Service specific procedures and criterial detailed in Volume 2 Work Packages 002, 003 and 004. Satisfactory participation in the JOAP Correlation Program is required for all laboratories that employ AER spectrometer(s). In addition the Service Program shall consider the following operating requirements when evaluating a specific laboratory for certification:

(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 2, WP 002 01).

d. Levels of Participation for Laboratory with AER Spectrometer(s). Based upon qualifications and performance, the Service OAP Manager places eligible laboratories/spectrometers in the following categories:

(1) Certified Spectrometer (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 must be submitted as part of the correlation program requirements by 1 March each year to the respective Service Program Manager.

When a laboratory or spectrometer certification is withdrawn because of a one month correlation 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 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 spectrometer's 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 per spectrometer assigned to the laboratory. If a 2nd failure is received within a three month timeframe the spectrometer 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 submitted for scoring.

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

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

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

(1) Complete one certification kit set or a previous quarter's sample set that has been identified by the Correlation Team and receive a score of 80 percent or above.

(2) For Initial Certification, forward, Air Force and Navy Labs must complete the forms required by their respective , sign and forward the applicable Certification Verification Checklist (figures 1 through 6) to their Service Program Manager. See Volume 2 WP 002, 003, 004 for detailed information and appropriate forms. ; who will forward to the Air Force OAP Correlation Team.

f. Existing Laboratory Procedure.

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

(2) Uncertified Spectrometer. 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. Unless late submittal is authorized by the Service PMO (who notifies the AF OAP Office upon request).

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 6.

(c) Failure to submit an annual approved verification checklist (Air Force and Navy only).

(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.

(f) Laboratory is deactivated.

(g) Upon direction of the Service Program Manager.

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

4. Laboratories with Spectrometer 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 score 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.

5. Deployed Spectrometers.

a. Deployable laboratory spectrometers must have a full standardization completed prior to use at deployed

location to verify serviceability. If a successful full standardization can't be achieved the operator will perform the appropriate trouble shooting procedures.

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 above full standardization is not required.

b. After the spectrometer has returned from the deployment, laboratory personnel must ensure that the spectrometer is again fully operational by performing a complete standardization upon return to laboratory and prior to re-deployment. This will ensure that the spectrometer is fully operational and reduce the risk of deploying or storing an unserviceable spectrometer.

6. 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 2 WP 003 01

(3) Army. Meet all of the requirements of Volume 2, 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 2 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.

7. 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) operating AER spectrometers will participate in the JOAP Correlation Program. The applicable Service 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 JOAP Correlation Team for current fees and processing instructions. See Volume 2 Work Package 001 02 for details.

(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. JOAP Correlation Procedures are detailed in Volume 2 WP 001 02.

8. 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 850-452-8469 (DSN) 459-8469

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

NOTE

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

(2) Spectro Scientific, Inc. offers a spectrometer maintenance course. For additional information call 1-978-431-1120/1130.

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 459-8469 COMM 850-452-8469
US Coast Guard:	AETCM Dukes Training Quota Management Center Chesapeake VA COMM 757-366-6582

9. 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 NAS Patuxent River MD. 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 2 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 2 Work Packages 002 through 004.

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JOAP REPORT CODES
Table 1 - Standard Laboratory Findings / Recommendation Codes

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Table 1 - STANDARD LABORATORY FINDINGS / RECOMMENDATION CODES

FINDING/REC CODE	EQUIPMENT OPERATING NORMALLY RECOMMENDATION
A	Sample results normal; continue routine sampling.
X	Analysis results supplied to customer; no recommendation required.
Z	Previous recommendation still applies.
FINDING CODE	**LAB REQUESTED RESAMPLES (Requires Resample)**
B*	Resample as soon as possible; do not change oil. <State reason>
C*	Resample after *** hours; do not change oil. <State reason>
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. <State reason>
F*	Do not change oil. Submit resample after ground or test run. Do not operate until after receipt of laboratory result or advice. <State reason>
G*	Contamination**** suspected. Do not change oil. Resample and submit sample of new oil that services this unit.
P*	Do not fly or operate; do not change oil; resubmit resample as soon as possible. <State reason>
Q*	Normal PPM reading was obtained from test cell run after maintenance where oil lubricated parts were changed/removed/replaced. Monitor engine closely after installation to ensure a normal trend before release to routine sampling.
FINDING CODE	**DATA SUBMISSION ISSUE (Requires Feedback)**
D	Documentation error can include: missing DD Form 2026 or sample request, 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.
FINDING CODE	**MECHANICAL ISSUE RECOMMENDATIONS (Requires Feedback)**
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.
FINDING CODE	**CONTAMINATION RECOMMENDATIONS (Requires Resample)**
J	Contamination of **** confirmed. Change oil. <Add instructions based on Work Package>
WA	Water Contamination confirmed. Take action to remove water and/or change oil. <Add instructions based on Work Package>
FINDING CODE	**OIL CONDITION STATEMENTS – Refer to JOAP Manual Volume 4 Work Package 101 for specific recommendations**
FD	Fuel Dilution <Add instructions based on Work Package 101>
FP	Flash Point Low <Add instructions based on Work Package 101>
NN	Acid or Base Number Abnormal <Add instructions based on Work Package 101>
PC	Particle Count Excessive <Add instructions based on Work Package 101>
VS	Viscosity (High/Low) <Add instructions based on Work Package 101>

NOTES:
* Resample (red cap) required.
** Maintenance feedback required; advise laboratory of findings (AF laboratory personnel will complete maintenance feedback form in Vol 1 WP 003 00 figure 13).
*** Laboratory will specify amount.
**** Contamination is defined as coolant, silicon, fuel, unknown, etc. and not wear metals or water. Use the appropriate wear metal recommendation codes for increasing trends or elevated wear metal conditions. Use “WA” for water contamination only.

Table 2 – 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

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