# STP 10-92L14-SM-TG

# Soldier's Manual and Trainer's Guide

# MOS 92L
# PETROLEUM LABORATORY SPECIALIST
# SKILL LEVELS 1, 2, 3, AND 4

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# SOLDIER'S MANUAL and TRAINER'S GUIDE

# MOS 92L

# Petroleum Laboratory Specialist
# Skill Levels 1, 2, 3 and 4

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## PREFACE

This publication is for skill levels (SLs) 1, 2, 3, and 4 Soldiers holding military occupational specialty (MOS) 92L and for trainers and first-line supervisors. It contains standardized training objectives, in the form of task summaries, to train and evaluate Soldiers on the critical tasks which support unit mission during wartime. Trainers and supervisors should ensure 92L qualified Soldiers have access to this publication. It should be given the widest possible dissemination in areas such as training areas, learning centers, and units, as well as virtual libraries.

All tasks in this publication are trained to peacetime/wartime conditions and apply to the Active Army, the Army National Guard/Army National Guard of the United States, and the US Army Reserve unless otherwise stated.

The proponent of this publication is the United States Army Training and Doctrine Command (USATRADOC). Prepare comments and recommendations using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward them directly to—

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# CHAPTER 1

## Introduction

1-1. General. This Soldier Training Publication (STP) identifies individual military occupational specialty (MOS) training requirements for Soldiers holding MOS 92L. Commanders, trainers, and Soldiers should use it to plan, conduct, and evaluate individual training in units. The STP is the primary MOS reference for supporting self-development, evaluating MOS proficiency, and training of 92L Soldiers. Commanders employ two primary methods to evaluate Soldiers' proficiency:

- Commander's evaluation. Commanders' evaluations are local tests or assessments of Soldiers' performance of MOS-specific and common tasks critical to the unit mission. They may be conducted year-round.

- Common task test (CTT). CTT test are hands-on tests used to evaluate proficiency on common tasks. Alternate written tests are provided if equipment is not available for hands-on testing.

This publication is the Soldier's primary reference to prepare for a commander's evaluation of MOS-specific tasks. It contains task summaries for all critical tasks specific to the MOS and skill level (SL). Commanders and trainers will use this Soldier's Manual/Trainer's Guide (SM/TG) to plan and conduct training and commander's evaluations.

Chapter 2, Trainers' Guide, contains information needed to plan training requirements for this MOS. The trainer's guide—

- Identifies subject areas in which Soldiers must be trained.

- Identifies critical tasks for each subject area.

- Specifies where Soldiers are initially trained on each task.

- Recommends how often each task should be trained to sustain proficiency.

- Recommends a strategy for cross-training Soldiers.

- Recommends a strategy for training Soldiers to perform higher level tasks.

Use this STP along with STP 21-1-SMCT (Soldier’s Manual of Common Tasks, Skill Level 1) and STP 21-24-SMCT (Soldier’s Manual of Common Tasks, Skill Levels 2-4), Army Training and Evaluation Programs (ARTEPs), and the Army training and doctrine manuals, FM 25-4 (How to Conduct Training Exercises), FM 7-0 (Training the Force), and FM 7-1 (Battle Focused Training), to establish effective training plans and programs that integrate individual and Soldier, leader, and collective tasks.

1-2. Task Summaries. Task summaries outline wartime performance requirements for each critical task in the STP. They provide both Soldier and trainer with the information necessary to prepare, conduct, and evaluate critical task training. As a minimum, task summaries include information Soldiers must know and skills they must perform to standard for each task. Following is the task summary format:

- Task number. The task number is a 10-digit number that identifies the task and SL. Include the task number and title in any correspondence relating to the task.

- Task title. The task title identifies the action to be performed.

- Conditions. The task conditions statement describes the field or garrison conditions under which the task will be performed and identifies the equipment, tools, references, job aids, and supporting personnel that the Soldier needs to perform the task in wartime.

- Standards. The task standards describe how well and to what level of proficiency the Soldier must perform the task under wartime conditions. Standards are typically expressed in terms of accuracy, completeness, duration, sequence, speed, and tolerance.

- Performance steps. This section provides, in detail, what is required on how to perform the task.

- Performance measures. This section identifies specific actions that the Soldier must accomplish to complete the task successfully. Performance measures appear in a GO/NO-GO rating format for easy evaluation. Some tasks may also include detailed training information in a Training Information Outline and an Evaluation Preparation Section. The Evaluation Preparation Section indicates necessary modifications to task performance in order to train and evaluate a task that cannot be trained to the wartime standard under wartime conditions. It may also include special training and evaluation preparation instructions to accommodate these modifications and any instructions that should be given to the Soldier before evaluation.

- References. This section identifies references that provide more detailed explanations of task performance requirements than are given in the task summary.

- Warnings. Warnings alert users to the possibility of immediate personal injury or equipment damage.

- Notes. Notes provide additional supportive explanations or tips relating to task performance.

- Cautions. Cautions draw the Soldiers' attention to potential errors which may invalidate the task.

1-3. Soldier's Responsibilities. Each Soldier is responsible for performing individual tasks identified by the first-line supervisor based on the unit's Mission Essential Task List (METL). Soldiers must perform tasks to the standards included in the task summary. If Soldiers have questions about tasks or which tasks in this manual they must perform, they are responsible for asking their first-line supervisor for clarification. First-line supervisors know how to perform each task or can direct Soldiers to appropriate training materials, including current field manuals, technical manuals, and Army regulations. Soldiers are responsible for using these materials to maintain performance. They are also responsible for maintaining performance of all common tasks listed in the SMCT at their current SL and below. Periodically, Soldiers should ask their supervisor or another solder to check their performance to ensure that they can perform the tasks.

1-4. NCO Self-Development and the STP. Self-development is a key component of leader development. Leaders follow planned, progressive, sequential self-development programs developed by the individual NCO and his or her first-line supervisor to enhance and sustain military competencies. Self-development consists of individual study, research, professional reading, practice, and self-assessment. The self-development concept requires all NCO, as Army professionals, to take responsibility for remaining current in all phases of their MOS. The STP is the NCO primary source for maintaining MOS proficiency. Another important resource for self-development is the Army Correspondence Course Program (ACCP). For enrollment information in this program, visit on line through the Army Institute for Professional Development (AIPD) website at http://www.atsc.army.mil/accp/aipdnew.asp.

1-5. Commander's Responsibilities. Commanders must ensure that their unit training plans prepare the unit for war by enabling Soldiers to develop and sustain proficiency in their MOS and SL tasks. Commanders should design unit training programs to provide individual training for all Soldiers assigned to the unit and to evaluate Soldier proficiency routinely as part of the commander's evaluation program. The unit training program should also integrate individual training with crew drills and other collective training. The MOS Training Plan provides information on which to base integration, cross-train, train-up, and sustainment training programs. Commanders should use the MOS Training Plan when developing unit training plans.

1-6. Trainer's Responsibilities. Training is the business of all unit leaders. First-line leaders are the principal trainers in the unit because they directly supervise Soldiers and lead crews, squads, sections, and teams.

a. Trainers can use the MOS Training Plan to determine the critical tasks each Soldier is responsible for. They should tell each Soldier which tasks he or she must be able to perform. Trainers should evaluate task performance to determine which tasks each Soldier can or cannot perform to standard. Soldiers who cannot perform a task to standard need further training. Developing effective training is explained in detail in FM 7-0.

b. Every task summary in this STP includes performance measures, which trainers may use year-round to determine if Soldiers can perform critical tasks to the specified standards. The performance measures identify what the trainer needs to observe to score a Soldier's performance. A blank space is provided for the trainer to check either the GO or NO-GO column for each performance measure. Some tasks require the trainer to watch the Soldier perform them (evaluate the process). Other tasks call for the trainer to focus on the results of the Soldier's performance (evaluate the product). Comments should not be written on the task summary.

c. Trainers can monitor the progress of their Soldiers by recording task GO/NO-GO results. Trainers may use DA Form 5164-R (Hands-On Evaluation) to record the performance measures a Soldier passed or failed. The form, which may be locally reproduced, applies to all tasks in this STP. Trainers may have DA Form 5164-R over printed with information unique to their training requirements before reproducing the form. See Appendix A for instructions on how to obtain and fill out a copy of a DA Form 5164-R.

d. Trainers may use DA Form 5165-R (Field Expedient Squad Book) to record hands-on GO/NO-GO results for a group of Soldiers (for example, a crew, section, or squad) having the same MOS and SL. This form supports conduct of commander's evaluations and can be used to record training results gathered in the field during slack time for all MOS and SLs. Use of this form is optional. See Appendix B for instructions on how to obtain and fill out a copy of a DA Form 5165-R. Trainers should work with each Soldier until tasks can be performed to specific task summary standards.

1-7. Training Support. References have been identified for each task to assist in planning and conducting training. A consolidated list of references identified by type, publication number, and title and a comprehensive glossary of acronyms, abbreviations, and definitions are included in this STP.

1-8. Environmental Training And Integration. The current US Army environmental strategy defines the Army's leadership commitment and philosophy for meeting present and future environmental challenge. It provides a framework to ensure than an environmental stewardship ethic governs all Army activities. The army's environmental vision is to be a national leader in environmental and natural resources stewardship for present and future generations, as an integral part of all Army missions. The Army's environmental vision statement communicates the Army's commitment to the environment.

a. Soldiers and leaders are expected to serve as the Army's basic environmental stewards, and have a professional and personal responsibility to understand and support protecting the environment, and conserving available resources. Soldiers and leaders must understand their specific responsibilities and duties and must perform these duties because everyone has a legitimate, as well as a moral stake in the protection of the environment and the conservation of the nation's resources. FM 3-100.4 delineates these responsibilities. Commanders and key leaders must stay current of changing federal, state, local and host nation laws and must ensure compliance.

b. Stewardship of our environment is part of our mission to maintain a trained and ready army. Strong leadership is essential for success. Each Soldier in the chain of command, including the NCO support channel, is responsible for ensuring that the army environmental strategy is implemented and the environmental stewardship become and remain an integral part of everything we do. America's Army shares with all Americans their values of democracy, equal opportunity, and wise use of environmental assets. The American people expect the Army to manage the resources entrusted to it.

## CHAPTER 2

## Trainer's Guide

2-1. General. The MOS Training Plan identifies the essential components of a unit training plan for individual training. Units have different training needs and requirements based on differences in environment, location, equipment, dispersion, and similar factors. Therefore, the MOS Training Plan should be used as a guide for conducting unit training and not a rigid standard. The MOS Training Plan consists of two parts. Each part is designed to assist the commander in preparing a unit training plan which satisfies integration, cross training, training up, and sustainment training requirements for Soldiers in this MOS.

Part One of the MOS Training Plan shows the relationship of an MOS skill level (SL) between duty position and critical tasks. These critical tasks are grouped by task commonality into subject areas.

Section I lists subject area numbers and titles used throughout the MOS Training Plan. These subject areas are used to define the training requirements for each duty position within an MOS.

Section II identifies the total training requirement for each duty position within an MOS and provides a recommendation for cross training and train-up/merger training.

Duty Position column. This column lists the duty positions of the MOS, by SL, which have different training requirements.

Subject Area column. This column lists, by numerical key (see Section I), the subject areas a Soldier must be proficient in to perform adequately in that duty position.

Cross Train column. This column lists the recommended duty position for which Soldiers should be cross trained.

Train-up/Merger column. This column lists the corresponding duty position for the next higher SL or Military Occupational Specialty Code (MOSC) the Soldier will merge into on promotion.

Part Two lists, by general subject areas, the critical tasks to be trained in an MOS and the type of training required (resident, integration, or sustainment).

Subject Area column. This column lists the subject area number and title in the same order as Section I, Part One of the MOS Training Plan.

Task Number column. This column lists the task numbers for all tasks included in the subject area.

Title column. This column lists the task title for each task in the subject area.

Training Location column. This column identifies the training location where the task is first trained to Soldier training publications standards. If the task is first trained to standard in the unit, the word “UNIT” will be in this column. If the task is first trained to standard in the training base, it will identify, by brevity code (ANCOC, BNCOC, and so on), the resident course where the task was taught. Figure 2-1 contains a list of training locations and their corresponding brevity codes.

| | |
|---|---|
| AIT | Advanced Individual Training |
| ANCOC | Advanced NCO Course |
| BNCOC | Basic NCO Course |
| UNIT | Trained in the Unit |

Figure 2-1. Training Locations

Sustainment Training Frequency column. This column indicates the recommended frequency at which the tasks should be trained to ensure Soldiers maintain task proficiency. Figure 2-2 identifies the frequency codes used in this column.

MO - Monthly
QT - Quarterly
SA - Semiannually
WK - Weekly

Figure 2-2. Sustainment Training Frequency Codes

Sustainment Training Skill Level column. This column lists the SLs of the MOS for which Soldiers must receive sustainment training to ensure they maintain proficiency to Soldier's manual standards.

| |
|---|
| 92F50<br>MSG THROUGH SGM |
| 92L40<br>SFC |
| 92L30<br>SSG |
| 92L20<br>SGT |
| 92L10<br>PV1 THROUGH SPC |

Figure 2-3. Career progression chart

2-2. Subject Area Codes.

Skill Level 1

1 Laboratory Operations
2 Operation and Maintenance of Laboratory Facilities
3 Quality Surveillance

Skill Level 2

4 Supervising Laboratory Operations
5 Supervising Operation and Maintenance of Laboratory Facilities
6 Supervising Quality Surveillance

Skill Level 3

7 Directing Laboratory Operations
8 Directing Operation and Maintenance of Laboratory Facilities
9 Directing Quality Surveillance

Skill Level 4

10 Managing Laboratory Operations
11 Managing Quality Assurance/Surveillance

2-3. Duty Position Training Requirements.

| ***MOS TRAINING PLAN<br>92L<br>PART ONE<br>SECTION II. DUTY POSITION TRAINING REQUIREMENTS*** | | | | |
|---|---|---|---|---|
| | ***Duty Position*** | ***Subject Areas*** | ***Cross Train*** | ***Train-up/Merger*** |
| SL 1 | Petroleum Laboratory Specialist<br><br>Quality Surveillance Specialist | 1-3 | NA | Senior Petroleum Specialist |
| SL 2 | Senior Petroleum Laboratory Specialist | 1-6 | NA | Petroleum Laboratory Supervisor |
| SL 3 | Petroleum Laboratory Supervisor | 1-9 | NA | Quality Surveillance Specialist<br><br>Petroleum Laboratory Supervisor |
| SL 4 | Quality Surveillance Supervisor | 1-11 | NA | Senior Petroleum Sergeant |

2.4. Task Correlation Hierarchy. Tasks at the lower SLs correlates with tasks at the next higher level. This result in a hierarchy structure which in concept form a pyramid. As a result, there are fewer tasks at the higher levels. The tasks at the highest SLs encompass all the skills that were mastered at the lower SLs. Therefore the Soldier must master lower SL tasks, in order to ascend to the next higher SL.

2.5. Critical Tasks List.

| **MOS TRAINING PLAN<br>MOS 92L<br>PART TWO: CRITICAL TASKS** | | | | |
|---|---|---|---|---|
| **Task Number** | **Title** | **Training Location** | **Sustainment Tng Freq** | **Sustainment Tng SL** |
| ***Skill Level 1*** | | | | |
| ***Subject Area 1: Laboratory Operations*** | | | | |
| 101-92L-1308 | Perform Standard Test Method for Pour Point of Petroleum Oils (D-97) | AIT | MO | 1-2 |
| 101-92L-1311 | Perform Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method) (D-156) | AIT | WK | 1-2 |
| 101-92L-1406 | Perform Standard Test Method for Density, Relative Density (Specific Gravity) or API Gravity of Crude and Liquid Petroleum Products | AIT | WK | 1-2 |
| 101-92L-1316 | Perform Standard Test Method for Vapor Pressure of Petroleum Products (D-323) | AIT | MO | 1-2 |
| 101-92L-1317 | Perform Standard Test Method for Standard Viscosity-Temperature Charts for Liquid Petroleum (D-341) | AIT | QT | 1-2 |
| 101-92L-1318 | Perform Standard Test Method for Existent Gum in Fuels by Jet Evaporation (D-381) | AIT | MO | 1-2 |
| 101-92L-1337 | Perform Standard Test Method for Water Reaction of Aviation Fuels (D-1094) | AIT | WK | 1-2 |
| 101-92L-1352 | Perform Standard Test Method for Particulate Contaminant in Aviation Fuels (D-2276) | AIT | WK | 1-2 |
| 101-92L-1353 | Perform Standard Test Method for Freezing Point of Aviation Fuels (D-2386) | AIT | WK | 1-2 |
| 101-92L-1355 | Perform Standard Test Method for Cloud Point of Petroleum Oils (D-2500) | AIT | WK | 1-2 |

| Task Number | Title | Training Location | Sustainment Tng Freq | Sustainment Tng SL |
|---|---|---|---|---|
| 101-92L-1360 | Perform Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge (D-2709) | AIT | WK | 1-2 |
| 101-92L-1362 | Perform Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure) (D-3241) | AIT | MO | 1-2 |
| 101-92L-1365 | Perform Standard Test Method for Determining Micro WISM (D-3948) | AIT | WK | 1-2 |
| 101-92L-1368 | Perform Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedure) (D-4176) | AIT | WK | 1-2 |
| 101-92L-1370 | Use Standard Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel System (D-4865) | UNIT | MO | 1-2 |
| 101-92L-1371 | Perform Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels (D-5006) | AIT | WK | 1-2 |
| 101-92L-1372 | Perform Standard Test Method for Particular Contamination in Aviation Fuel by Laboratory Filtration (D-5452) | AIT | WK | 1-2 |
| 101-92L-1384 | Prepare Petroleum Laboratory Analysis Reports | AIT | WK | 1-3 |
| 101-92L-1385 | Compare Test Results to Specification Requirements | AIT | WK | 1-2 |
| 101-92L-1386 | Prepare and Standardize Chemical Solutions | AIT | MO | 1-2 |
| 101-92L-1387 | Employ Fire and Safety Measures | AIT | WK | 1-2 |
| 101-92L-1388 | Employ Environmental Stewardship Measures | AIT | WK | 1-2 |
| 101-92L-1389 | Install and Adjust Laboratory Equipment | AIT | MO | 1-2 |
| 101-92L-1395 | Operate and Maintain the Petroleum Quality Analysis System (PQAS) | AIT | MO | 1-2 |

| Task Number | Title | Training Location | Sustainment Tng Freq | Sustainment Tng SL |
|---|---|---|---|---|
| 101-92L-1398 | Perform Standard Test Method for Acidity in Aviation Turbine Fuels (D-3242) | AIT | QT | 1-2 |
| 101-92L-1399 | Perform Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter (D-4052) | AIT | QT | 1-2 |
| 101-92L-1400 | Perform Standard Test Method for Calculated Cetane Index by Four Variable Equations (D-4737) | AIT | WK | 1-2 |
| 101-92L-1401 | Perform Standard Test Method for Lead and Sulfur in Fuels by X-Ray Spectroscopy | AIT | MO | 1-2 |
| 101-92L-1402 | Perform Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method) (D-5972) | AIT | WK | 1-2 |
| 101-92L-1404 | Perform Standard Test Method for Kinematic Viscosity (D-445/D-446) | AIT | MO | 1-2 |
| 101-92L-1405 | Perform Standard Test Method for Distillation and Cetane Index of Petroleum Products | AIT | WK | 1-2 |
| 101-92L-1407 | Operate and Maintain Mobile Laboratory and 60 KW Generator Set | UNIT | QT | 1-3 |
| 101-92L-1408 | Perform Standard Test Method for Flash Points of Petroleum Products | AIT | WK | 1-2 |
| ***Subject Area 3: Quality Surveillance*** | | | | |
| 101-92L-1359 | Perform Standard Test Method for Electrical Conductivity of Aviation and Distillate Fuels Containing a Static Dissipator Additive (D-2624) | AIT | WK | 1-2 |
| 101-92L-1367 | Perform Standard Practice for Manual Sampling of Petroleum Products (D-4057) | AIT | MO | 1-2 |
| 101-92L-1393 | Operate and Maintain Petroleum Test Kits | AIT | MO | 1-2 |
| 101-92L-1394 | Sample and Gauge Petroleum Products | AIT | MO | 1-2 |

| Task Number | Title | Training Location | Sustainment Tng Freq | Sustainment Tng SL |
|---|---|---|---|---|
| ***Skill Level 2*** | | | | |
| ***Subject Area 4: Supervising Laboratory Operations*** | | | | |
| 101-92L-2300 | Supervise Laboratory Testing | UNIT | WK | 2-3 |
| 101-92L-2301 | Review Laboratory Reports | UNIT | WK | 2-3 |
| 101-92L-2302 | Supervise Preparation of Chemical Solutions | UNIT | MO | 2-3 |
| 101-92L-2303 | Supervise Fire Prevention and Safety Measures | UNIT | WK | 2-3 |
| 101-92L-2304 | Supervise Environmental Stewardship Measures | UNIT | WK | 2-3 |
| 101-92L-2314 | Supervise Operation and Maintenance of Mobile Laboratory and 60 KW Generator Sets | UNIT | QT | 2-3 |
| ***Subject Area 5: Supervising Operation and Maintenance of Laboratory Facilities*** | | | | |
| 101-92L-2305 | Supervise Installation and Adjustment of Laboratory Equipment | UNIT | MO | 2-3 |
| 101-92L-2311 | Supervise PQAS Operations | UNIT | MO | 2-3 |
| ***Subject Area 6: Supervising Quality Surveillance*** | | | | |
| 101-92L-2309 | Supervise Operation and Maintenance of Petroleum Test Kits | UNIT | MO | 2-3 |
| ***Skill Level 3*** | | | | |
| ***Subject Area 7: Directing Operation and Maintenance of Laboratory Facilities*** | | | | |
| 101-92L-3400 | Direct Laboratory Procedures | BNCOC | QT | 3-4 |
| 101-92L-3404 | Direct Mobile Laboratories Operations | BNCOC | QT | 3-4 |
| ***Subject Area 8: Directing Quality Surveillance*** | | | | |
| 101-92L-3406 | Perform Quality Surveillance at Petroleum Facilities | BNCOC | SA | 3-4 |
| 101-92L-3407 | Perform Quality Surveillance on Petroleum Vessels and Vehicles | BNCOC | SA | 3-4 |

| Task Number | Title | Training Location | Sustainment Tng Freq | Sustainment Tng SL |
|---|---|---|---|---|
| ***Skill Level 4*** | | | | |
| ***Subject Area 9: Managing Laboratory Operations*** | | | | |
| 101-92L-4406 | Validate Laboratory Procedures | ANCOC | SA | 4 |
| ***Subject Area 10: Managing Quality Surveillance*** | | | | |
| 101-92L-4407 | Implement Quality Surveillance Programs for Petroleum Facilities | ANCOC | SA | 4 |
| 101-92L-4408 | Implement Quality Surveillance Programs for Petroleum Vessels and Pipelines | ANCOC | SA | 4 |

# CHAPTER 3

## MOS/Skill Level Tasks

Skill Level 1

Subject Area 1: Laboratory Operations

### Perform Standard Test Method for Pour Point of Petroleum Oils (D-97)

### 101-92L-1308

**Conditions:** As petroleum laboratory specialist, in a field environment, you are given an operational petroleum laboratory, a cloud and pour point test bath, cloud and pour point and American Standard Test Method (ASTM) standards. Upon receipt of a petroleum sample, the requirement for performing ASTM D-97 is determined.

**Standards:** Soldier selects and prepares test apparatus, performs the test procedures, records the test results in accordance with the ASTM D-97, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult the material safety data sheet (MSDS).

   a. Test jar (cylindrical, of clear glass, flat bottom, 33.2 to 34.8 millimeters (mm) outside diameter, and 115 to 125 mm in height).
   b. Thermometers having the range specified in Section 6.2 of ASTM D-97 and conforming to the requirements prescribed in ASTM Specification E 1 for thermometers.
   c. Cork; to fit the test jar, bored centrally for the test thermometer.
   d. Jacket ; watertight, cylindrical, metal, flat-bottomed, 115 +/-3-mm depth, with inside diameter of 44.2 to 45.8 mm.
   e. Disk; cork or felt, 6-mm thick to fit loosely inside the jacket.
   f. Gasket; to fit snugly around the outside of the test jar and loosely inside the jacket.
   g. Bath or baths; maintained in accordance with prescribed temperatures with a firm support to hold the jacket vertical.

2. Prepare the reagents.

WARNING: THE REAGENTS LISTED ARE FLAMMABLE AND VAPOR HARMFUL. CARE SHOULD BE TAKEN WHEN HANDLING ALL CHEMICALS.

   a. Acetone.
   b. Alcohol, Methanol.
   c. Alcohol, Ethanol.
   d. Petroleum Naphtha.
   e. Solid Carbon Dioxide.

3. Perform the test procedure.

4. Calculate and report test results.

**Performance Steps**

5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

6. Prepare apparatus and sample for automatic procedure.

NOTE: Use ASTM D-5949 for automatic procedure.

   a. Press change settings to Pour, press button to the right of Run mode. Press Pour and ensure FUELS is displayed next to Sample Type. If not, press the button to the right of Sample Type and Press Fuels. Ensure preheat is OFF, temperature is Celsius and pour resolution is 3. Press Save Changes.
   b. Locate 150µL pipet and pipet tips. Pipete 150µL of sample. Wipe excess fuel from the tip of the pipet. Slowly disperse the sample into the sample cup taking care not to touch the sample cup bottom or the sides. Remove the sample, using a Q-tip (with plastic rod) to ensure previous samples are removed.
   c. Disperse another 150µL of sample into the sample cup. Close lid and lock. Press RUN.

NOTE: Do not open lid when instrument is operating.

   d. After completion of test, turn off the warning message; remember the sample cup must heat up first. Instrument will show 'run complete' on screen. Touch control panel button to return to the analyzer control panel. Open lid and remove sample with plastic Q-tip taking care not to scratch the mirrored sample.

7. Perform automatic procedure.

8. Clean and conduct PMCS on apparatus.
   a. Squeeze 2-Propanol onto a clean Q-tip and swab in and around the sample cup removing all fuel residue.
   b. Allow to air dry for a few seconds and close lid.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Prepared the reagents. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Calculated and reported test results. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |
| 6. Prepared apparatus and sample for automatic procedure. | ____ | ____ |
| 7. Performed automatic procedure. | ____ | ____ |
| 8. Cleaned and conducted PMCS on apparatus. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
| --- | --- |
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method) (D-156)**

**101-92L-1311**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given an operational petroleum laboratory, a saybolt chromometer, refined oils, and American Standard Test Method (ASTM) standards. Upon receipt of a petroleum sample you are required to perform test procedures based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Standardize the Saybolt chromometer in accordance with ASTM D-156.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

2. Verify that the sample has been taken in accordance with ASTM D-4057.
3. Prepare the test sample.
   a. Filter the sample through a sufficient number of qualitative filter papers until clear when it is turbid.
   b. Do not heat the sample excessively when preparing petroleum wax for testing.
4. Perform test procedure in accordance with Section 10 of ASTM D-156.
   a. Perform the test procedure for refined oils.
   b. Perform the test procedure for white oils.
5. Perform the test procedure for petroleum wax in accordance with Section 11 of ASTM D-156.
6. Report the recorded color units as "Saybolt color _____." When the sample has been filtered, add the words "(sample filtered)."
7. Prepare apparatus for automatic Saybolt. Power up apparatus and let instrument warm/cool to room temperature. Make sure there is not condensation in the instrument or on the lens and the chamber is empty.
8. Press "ZERO" (not the number 0) and wait until the measurement is complete. Press MENU, press the arrow under Scale, press the arrow under Previous, press the arrow under Saybolt and Press the arrow under Set. Instrument will display SAYBOLT.
9. Fill a plastic, disposable 50mm cell 3/4 full with sample.

NOTE: Do not touch clear glass sides.

10. Place plastic cell in cell holder. Hold lid. Gently place cell in the cell reader to the far right. Close lid. Press 'Read'. When measurement is complete, open lid and remove sample.

NOTE: If sample spilled inside the unit, immediately clean up.

11. Dispose of sample, discard plastic cell in the trash.

NOTE: If the 50 mm plastic disposable cell supply is exhausted: use the large glass cell for SAYBOLT color determination. DO NOT TOUCH the clear glass sides. Hold the cell by the opaque sides.

**Performance Steps**

12. Discard fuel in proper waste container. Rinse the cell with 2-Propanol and discard in proper solvent waste. Rinse the cell with Acetone and discard properly. Dry the cell with air until there is no sign of moisture. Store cell in appropriate storage area.

NOTE: Every 2 hours, press the "ZERO" button (not the number 0). Filters should be returned to DC Glass ANNUALLY for cleaning and verification.

13. Perform PMCS for applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Standardized the Saybolt chromometer in accordance with ASTM D-156. | ____ | ____ |
| 2. Verified that the sample was taken in accordance with ASTM D-4057. | ____ | ____ |
| 3. Prepared the test sample. | ____ | ____ |
| 4. Performed test procedure in accordance with Section 10 of ASTM D-156. | ____ | ____ |
| 5. Performed the test procedure for petroleum wax in accordance with Section 11 of ASTM D-156. | ____ | ____ |
| 6. Reported the recorded color units as "Saybolt color _____." | ____ | ____ |
| 7. Prepared apparatus for automatic Saybolt. | ____ | ____ |
| 8. Pressed "ZERO" (not the number 0) and waited until the measurement was completed. | ____ | ____ |
| 9. Filled a plastic, disposable 50mm cell 3/4 full with sample. | ____ | ____ |
| 10. Placed plastic cell in cell holder. | ____ | ____ |
| 11. Disposed of sample, discarded plastic cell in the trash. | ____ | ____ |
| 12. Discarded fuel in proper waste container. | ____ | ____ |
| 13. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Density, Relative Density (Specific Gravity) or API Gravity of Crude and Liquid Petroleum Products (D-287, D-1298)**

**101-92L-1406**

**Conditions:** As a petroleum laboratory specialist in a field environment, you are given an operational petroleum laboratory, all necessary materials, FM 10-67-2, MIL-STD-3004A, upon receipt of petroleum products you conduct testing procedures based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the American Standard Test Method (ASTM D-287, D-1298), performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus for ASTM D-1298.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of the fire extinguishers is readily available and keep all exits clear. Perform only one test at a time. Follow the procedures as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult the material safety data sheet (MSDS).

   a. Hydrometer - glass, graduated in units of density, relative density or American Petroleum Institute (API) Gravity as required.
   b. Thermometers having ranges shown in Table 2 of ASTM D-1298 and conforming to ASTM specifications.
   c. Hydrometer Cylinders - clear glass or plastic.
   d. Constant temperature bath.

2. Perform the test procedure.
   a. Transfer the sample into the clean hydrometer cylinder without splashing.
   b. Insert the appropriate thermometer or temperature measurement device and stir the test portion with a stirring rod. Record the temperature of the sample to the nearest 0.1 degrees Celsius (C) and remove the thermometer/temperature device.
   c. Lower the hydrometer gently into the sample. When the hydrometer has settled, depress it about two scale divisions into the liquid and the release it.
   d. Read the hydrometer to the nearest 1/5 full scale division when the hydrometer has come to rest, floating freely, free from air bubbles and away from the walls of the cylinder.

NOTE: The correct reading is that point on the hydrometer scale at which the principle surface of the liquid cuts the scale by placing the eye slightly below the level of the liquid and slowly raising it until the surface, first seen as a distorted eclipse, appears to become a straight line cutting the hydrometer scale.

   e. Repeat the temperature reading, record the temperature of the test portion to the nearest 0.1degree C. If temperature differs from previous reading by more than 0.5 degree C, repeat the hydrometer and thermometer observations until the temperature becomes stable within a 0.5 degree C.

3. Calculate test results. Apply thermometer corrections to temperature readings observed and record the average of those two temperatures to the nearest 0.1 degree C.

4. Identify the three primary tables (D-1250).
   a. Table 5 and Table 6 - in terms of degree API.
      (1) Table 5A (Volume I) - Generalized crude oils, correction of observed API Gravity to API at 60 degrees Fahrenheit (F).
      (2) Table 6A (Volume I) - generalized crude oils, correction of volume to 60 degrees F against API Gravity at 60 degrees F.
      (3) Table 5B (Volume II) - generalized products, correction of observed API Gravity to API

**Performance Steps**

Gravity at 60 degrees F.

(4) Table 6B (Volume II) - generalized products, correction of volume to 60 degrees F against API Gravity at 60 degrees F.

b. Table 23 and Table 24 - in terms of relative density.

(1) Table 23A - generalized crude oils, correction of observed relative density 60 degrees F.

(2) Table 24A - generalized crude oils, correction of volume to 60 degrees F against relative density 60 degrees F.

c. Table 53 and Table 54 - in terms of density in kilogram per cubic meter.

5. Select the appropriate Volume and Table to use when:
   a. Correcting observed API Gravity to API Gravity at 60 degrees F. Use Table 5A and Table 5B.
   b. Correcting volume to 60 degrees F against API Gravity at 60 degrees F. Use Table 6A and Table 6B.

6. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

7. Select and prepare test apparatus for ASTM D-287.
   a. Hydrometer - glass, graduated in degrees API as listed in Table 1 of the ASTM.
   b. Thermometers having a range from -5 to +215 degrees F and conforming to the requirement for thermometer 12 F.
   c. Hydrometer cylinders - clear glass or plastic. The cylinder may have a lip on the rim for pouring convenience.

8. Perform the test procedure.
   a. Adjust the temperature of the sample.
   b. Transfer the sample into the clean hydrometer cylinder without splashing.
   c. Lower the hydrometer gently into the sample. When the hydrometer has settled, depress it about two scale divisions into the liquid and then release it.
   d. Read the hydrometer to the nearest scale division when the hydrometer has come to rest, floating freely, and the temperature of the sample is constant to 0.2 degrees F (0.1 degrees C).

NOTE: The correct reading is that point on the hydrometer scale at which the surface of the liquid cuts the scale.

   e. Observe the temperature of the sample to the nearest 0.2 degrees F (0.1 degrees C) immediately before and after the observation of the gravity, the liquid in the cylinder being thoroughly but cautiously stirred with the thermometer and the whole mercury thread being immersed.
   f. Make a reading with nontransparent liquids. Observe the point on the hydrometer scale to which the sample rises above its main surface, placing the eye slightly above the plane surface of the liquid.

NOTE: The temperature before the before and after taking the observed API reading must be within +/-1 degree F.

   g. Repeat the temperature and gravity observations, when the temperature is not within +/-1 degree F, until the temperature is within that range.
   h. Record the mean of the thermometer reading before and after the final hydrometer reading, to the nearest 1 degree F, as the temperature of the test.

9. Calculate the test results.
   a. Correct hydrometer reading for opaque liquids.
   b. Correct all hydrometer readings to 60 degrees F (15.56 degrees C).

**Performance Steps**

10. Repeat the corrected hydrometer reading as degrees API or as API gravity.
11. Perform PMCS on applicable equipment.
12. Select and prepare the Hand Held Density Meter (DMA 35N).
13. Attach filling tube to the port on the bottom of the density meter by screwing the tube clockwise by hand until some resistance against turning can be felt.

WARNING: DO NOT USE TOOLS.

14. Push the ON/OFF key for at least 2 seconds. When the °C starts to flash, the instrument is in the measuring mode. Ensure the function is set to API B in the top right corner PERFORM DENSITY CHECK. Run known fuel sample on the DMA 4500.
15. Run the sample fuel sample on the DMA 35N.
    a. Depress plunger. Insert tube into sample. Slowly release plunger drawing sample into the U-tube. Remove tube from sample and place over waste container. Depress plunger and place in sample again. Slowly release plunger.
    b. Make sure there are no bubbles in the U-tube. Allow device to make measurement. Record API number. Depress plunger over waste container to remove sample. Using a teri-towel, wipe the tube to remove excess fuel and avoid contamination with other samples.
16. Compare API results. If results are +/-0.3, the DMA35N is ready for field analysis. If the results are not within the 0.3 tolerance, clean the DMA35N with iso-propanol. Retest the same fuel. If the results is +/-0.3, density meter is ready for field analysis. If the results exceed the 0.3 tolerance, perform adjustment.
17. Readjustment of apparatus.
    a. Clean DMA35N with iso-propanol.

NOTE: Make sure iso-propanol remains in the U-tube.

    b. Depress plunger. Insert tube into ultra pure water (standards that are used for the DMA 4500). SLOWLY release plunger drawing the ultra pure water into the U-tube. Remove from tube and place over waste container to remove the water. Depress plunger. Place tube in ultra pure water again.
    c. SLOWLY release plunger drawing the water into the tube. Make sure there are no bubbles in the U-tube. Press the ON/OFF button to turn the meter off. Press the ON/OFF button and the Recall/Delete button at the same time. The measured density and ADJ are displayed.

NOTE: The water temperature has to be between 15° C and 25° C, the density must be between 0.900 and 1.100g/cm$^3$.

    d. The instrument checks the stability of the reading during 10 subsequent measuring sequences. Upon stability, the density deviation between the measured and theoretical water density are displayed.
    e. Press the button on the back of the meter (small black button that is not labeled) to store the readjustment. Repeat density check with sample tested on the DMA 4500. Compare the results and ensure the results are +/-0.3. If within 0.3, meter is ready, if not within tolerance 0.3 perform readjustment again and make sure the readjustment was saved.
18. Cleaning the U-tube. Ensure U-tube is empty. Wipe fill tube with teri-towel. Depress plunger and place tube in iso-propanol. Release plunger and allow iso-propanol to enter the tube. Depress plunger over solvent waste container to remove the solvent. Repeat steps 17 d and e several times to ensure the U-tube is clean and free of deposits. Depress the plunger several times to remove the excess solvent. Remove the tube and put away.
19. Perform PMCS on applicable equipment.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared test apparatus for ASTM D-1298. | ____ | ____ |
| 2. Performed the test procedure. | ____ | ____ |
| 3. Calculated test results. | ____ | ____ |
| 4. Identified the three primary tables (D-1250). | ____ | ____ |
| 5. Selected the appropriate Volume and Table to use. | ____ | ____ |
| 6. Performed PMCS on applicable equipment. | ____ | ____ |
| 7. Selected and prepared test apparatus for ASTM D-287. | ____ | ____ |
| 8. Performed the test procedure. | ____ | ____ |
| 9. Calculated the test results. | ____ | ____ |
| 10. Repeated the corrected hydrometer reading as degrees API or as API gravity. | ____ | ____ |
| 11. Performed PMCS on applicable equipment. | ____ | ____ |
| 12. Selected and prepared the Hand Held Density Meter (DMA 35N). | ____ | ____ |
| 13. Attached filling tube to the port on the bottom of the density meter. | ____ | ____ |
| 14. Pushed the ON/OFF key for at least 2 seconds. | ____ | ____ |
| 15. Ran the sample fuel sample on the DMA 35N. | ____ | ____ |
| 16. Compared API results. | ____ | ____ |
| 17. Readjusted apparatus. | ____ | ____ |
| 18. Cleaned the U-tube. | ____ | ____ |
| 19. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

**Perform Standard Test Method for Vapor Pressure of Petroleum Products (D-323)**

**101-92L-1316**

**Conditions:** As a petroleum specialist in a field or garrison environment, you are given an operational petroleum laboratory, all materials and manuals needed, sample for testing, product specification, American Standard Test Method (ASTM) D-323 and ASTM D-6378, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDS) for all hazardous materials present in the workplace. Upon receipt of sample product the laboratory specialist conduct test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus in accordance with Annex A1 of ASTM D-323.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

2. Strictly adhere to the precautions given in the test procedure.
    a. Check all gauges against a manometer after each test.
    b. Check all apparatus before and during each test for both liquid and vapor leaks.
    c. Handle samples with care to avoid losses through evaporation and even slight changes in composition.
    d. Thoroughly purge the pressure gauge, the liquid chamber, and the vapor chamber to be sure they are free of residual sample.
    e. Shake the apparatus vigorously as directed to ensure equilibrium.
3. Perform test procedure A for petroleum products having Reid vapor pressures below 180 kPa (26 psi).
4. Perform test procedure C for petroleum products having Reid vapor pressures above 180 kPa (26 psi).
5. Perform test procedure D for aviation gasoline approximately 50 kPa (7 psi) Reid vapor pressure.

NOTE: Procedure D may not be applicable; use of aviation gasoline (AVGAS) in US Army equipment, rare to nonexistent.

6. Report the results observed in the test procedure after correcting for any difference between the gauge and manometer to the nearest 0.25 kPa (0.05 psi) as the Reid vapor pressure.
7. Prepare apparatus for ASTM D-6378 automatic procedures.
    a. Secure waste container by tightening the nut and attach sample tube with luer to the sample port. Turn instrument on by pressing the round button. A red light emitting diode (LED) light will come on indicating that the unit is powered on. Allow 15 seconds for apparatus to load.
    b. The instrument will automatically go to the measuring window. Choose Standard from the drop down box ATSM D-6378, choose sample ID and press enter. Change Operator name.
    c. NO. Measure should be 1. Place sampling line directly in AVGAS sample. Ensure the sampling line is submerged. Touch the Settings Tab at the top of the screen. Ensure the Rinsing Cycles field read 5. Touch the Measure Tab to return the Measuring page.

**Performance Steps**

8. Press RUN. The instrument will rinse 5 times and then begin the test. During the run cycle the RUN option will be red and can not be selected again until it is white. As soon as the measurement was started, the screen changes from the settings to the measuring screen. The measuring screen provides information about the status for the measurement including information about the actual temperature and pressure inside the measuring cell.
9. Remove the sampling line from the sample when the test is complete. Record the psi value and manually input into the computer. Press OK.
10. Remove the waste container and dispose of the fuels as appropriate at the end of the day. Remove the sampling tube with luer. Store apparatus properly.
11. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus in accordance with Annex A1 of ASTM D-323. | ____ | ____ |
| 2. Adhered strictly to the precautions given in the test procedure. | ____ | ____ |
| 3. Performed test procedure A for petroleum products having Reid vapor pressures below 180 kPa (26 psi). | ____ | ____ |
| 4. Performed test procedure C for petroleum products having Reid vapor pressures above 180 kPa (26 psi). | ____ | ____ |
| 5. Performed test procedure D for aviation gasoline approximately 50 kPa (7 psi) Reid vapor pressure. | ____ | ____ |
| NOTE: Procedure D may not be applicable; use of AVGAS in US Army equipment, rare to nonexistent. | | |
| 6. Reported the results observed in the test procedure after correcting for any difference between the gauge and manometer to the nearest 0.25 kPa (0.05 psi) as the Reid vapor pressure. | ____ | ____ |
| 7. Prepared apparatus for ASTM D-6378 automatic procedures. | ____ | ____ |
| 8. Pressed RUN. | ____ | ____ |
| 9. Removed the sampling line from the sample when the test was completed. Recorded the psi value and manually inputted into the computer. Pressed OK. | ____ | ____ |
| 10. Removed the waste container and disposed of the fuels as appropriate at the end of the day. Removed the sampling tube with luer. Stored apparatus properly. | ____ | ____ |
| 11. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
| --- | --- |
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Standard Viscosity-Temperature Charts for Liquid Petroleum (D-341)**

**101-92L-1317**

**Conditions:** As a petroleum specialist in a field or garrison environment, you are given an operational petroleum laboratory, all materials and manuals needed, sample for testing, product specification, American Standard Test Method (ASTM) D-341, equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDS) for all hazardous materials present in the workplace. Upon receipt of sample product the laboratory specialist conduct test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

NOTE: The charts in the method are designed to permit kinematic viscosity-temperature data for a petroleum oil or fraction, and hydrocarbons in general, to plot as a straight line over a wide range. Seven charts are available for use.

1. Select appropriate chart.
   a. Charts I, II, V, and VI are preferred when convenience and accuracy of plotting are desired.
   b. Chart VII is the middle range section of Chart I at somewhat reduced scale. It is provided for convenience in connection with reports and data evaluation.
   c. Charts III and IV are the same as Charts I and II and are provided in greatly reduced scale for convenience in connection with reports or quick evaluation of data.
2. Perform procedure.
   a. Plot two known kinematic viscosity-temperature points on the chart in the ASTM.
   b. Draw a sharply defined straight line through them.
   c. Record the kinematic viscosity at the corresponding desired temperature and vice versa.
3. Report the results in accordance with ASTM D-341, and give results to your supervisor.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected appropriate chart. | ____ | ____ |
| 2. Performed procedure. | ____ | ____ |
| 3. Reported the results in accordance with ASTM and gave results to your supervisor. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Existent Gum in Fuels by Jet Evaporation (D-381)**

**101-92L-1318**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory all materials and manuals needed, sample for testing, product specification, American Standard Test Method (ASTM) D-381, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDS) for all hazardous materials present in the workplace. Upon receipt of sample, there is a requirement to conduct test procedure ASTM D-381.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with ASTM D-381, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Balance: capable of reproducing weighs to 0.1 mg.
   b. Beakers: 100-mL capacity each beaker in the set must be marked with an identifying number or letter, reserving the lowest weight beaker for use as a tare.
   c. Cooling vessel: a desiccator or other type of tightly covered vessel for cooling the beakers before weighing. The use of a drying agent is not recommended.
   d. Evaporation bath: a solid metal block or liquid bath may be used.

CAUTION: IF A LIQUID-FILLED BATH IS USED, ENSURE THAT THE FLASH POINT OF THE LIQUID IS AT LEAST 30° C HIGHER THAN THE HIGHEST BATH TEMPERATURE EXPECTED.

   e. Flowmeter: capable of metering a flow of air or steam equivalent to 1000 mL for each outlet.
   f. Steam superheater: gas-fired or electrically heated, capable of delivering to the bath the required amount of steam at 232 degrees C.
   g. Thermometer: having a range of -5 degrees to +400 degrees C (ASTM No. 3C or IP 73C).

2. Prepare chemical and other pertinent materials.
   a. Gum Solvent: a mixture of equal volumes of toluene and acetone.
   b. N-Heptane: ASTM knock test grade, conforming to the requirements listed in the ASTM.
   c. Air: supply of filtered air at a pressure not more than 34.5 kPa (5 psi).
   d. Steam: supply of steam free of oily residue and at a pressure not less than 34.4 kPa (5 psi).

3. Assemble the air or steam-jet apparatus.

WARNING: THE EVAPORATION BATH MUST BE PROVIDED WITH AN EFFECTIVE EXHAUST HOOD TO CONTROL VAPORS. THE SAMPLE AND SOLVENT VAPORS EVAPORATED DURING THE PERFORMANCE OF THIS TEST PROCEDURE CAN BE EXTREMELY FLAMMABLE OR COMBUSTIBLE AND HAZARDOUS FROM THE INHALATION.

4. Perform the test procedure.

5. Calculate the results in accordance with ASTM D-381.

**Performance Steps**

6. Report the gum values to the nearest 1 mg/100 mL, as existent or unwashed gum by ASTM D-381.
7. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Prepared chemical and other pertinent materials. | ____ | ____ |
| 3. Assembled the air or steam-jet apparatus. | ____ | ____ |
| 4. Performed the test procedure. | ____ | ____ |
| 5. Calculated the results in accordance with the ASTM. | ____ | ____ |
| 6. Reported the gum values to the nearest 1 mg/100 mL, as existent or unwashed gum by ASTM D-381. | ____ | ____ |
| 7. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Water Reaction of Aviation Fuels (D-1094)**

**101-92L-1337**

**Conditions:** As a petroleum laboratory specialist, in a field environment, you are given an operational petroleum laboratory, American Standard Test Method (ASTM) standards D-1094. Upon receipt of sample product the laboratory specialist conducts test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Graduated glass cylinder glass-stopper, 100-mL, with 1-mL graduations.
   b. Clean the graduated cylinder thoroughly in accordance with washing instruction described in the ASTM.

2. Select and prepare the reagents.
   a. Glass cleaning solution. Saturate concentrated sulfuric acid with potassium dichromate or sodium dichromate.
   b. Acetone.
   c. n-Hexane.
   d. Phosphate Buffer Solution (ph7). Dissolve 1.15 g of potassium Monohydrogen phosphate, anhydrous and 0.47 g of potassium dihydrogen phosphate, anhydrous I 100-mL of water.

WARNING: CHEMICALS LISTED ARE CORROSIVE, HEALTH HAZARD, AND AN OXIDIZING AGENT. TAKE PRECAUTION WHEN HANDLING THEM.

3. Perform the test procedures.

4. Report the results to include the following:
   a. Change in volume of the aqueous layer to the nearest 0.5 mL.
   b. Rating of the condition of the interface in accordance with Table 1 of ASTM D-1094.
   c. Rating of the degree of separation in accordance with Table 2 of ASTM D-1094.

5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents. | ____ | ____ |
| 3. Performed the test procedures. | ____ | ____ |
| 4. Reported the results. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Particulate Contaminant in Aviation Fuels (D-2276)**

**101-92L-1352**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, pump vacuum, multimeter, oven, analytical balance, American Standard Test Method (ASTM) standard D-2276, and MIL-STD-3004A. Upon receipt of sample product the laboratory specialist conduct test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Analytical Balance: single or double pan, the precision standard deviation of which must be 0.07 mg or better.
   b. Oven: of the static type.
   c. Petri dishes: approximately 125 mm in diameter.
   d. Forceps: flat bladed with unserrated, nonpointed tips.
   e. Vacuum system.
   f. Test membrane filters: plain, 37-mm diameter, nominal pore size 0.8 micron.
   g. Control membrane filters: 37-mm diameter, nominal pore size 0.8 micron.
   h. Dispenser for flushing fluid: 0.45-micron membrane filters to be provided in the delivery line.
   i. Field monitor: should be complete with protective plugs and 34-mm support pads.
   j. Air ionizer: for the balance case.
   k. Multimeter/VOM.
   l. Flushing apparatus.
   m. Ground/bond wire - No. 10 through 19, bare stranded flexible stainless steel or copper.

2. Select and prepare the reagents.
   a. Isopropyl alcohol, reagent grade.

WARNING: ISOPROPYL ALCOHOL IS FLAMMABLE.

   b. Liquid Detergent, water-soluble.
   c. Petroleum spirit (petroleum ether or IP petroleum spirit 40/60) having boiling range from 35 degrees to 60 degrees C.

WARNING: PETROLEUM SPIRIT IS EXTREMELY FLAMMABLE AND HARMFUL IF INHALED. VAPORS ARE EASILY IGNITED BY ELECTROSTATIC DISCHARGES, CAUSING FLASH FIRE.

3. Prepare the test and control membrane filters and field monitor prior to sampling.
4. Collect an aviation turbine fuel sample for particulate contamination in accordance with Annex A2 of ASTM D-2276 (when required).
5. Prepare the test apparatus.
6. Perform the test procedure.
7. Calculate the test results.

**Performance Steps**

8. Report the results to the nearest 0.01 mg/L and also the sample volume used in the test.

9. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents. | ____ | ____ |
| 3. Prepared the test and control membrane filters and field monitor prior to sampling. | ____ | ____ |
| 4. Collected an aviation turbine fuel sample for particulate contamination in accordance with Annex A2 of ASTM D-2276 (when required). | ____ | ____ |
| 5. Prepared the test apparatus. | ____ | ____ |
| 6. Performed the test procedure. | ____ | ____ |
| 7. Calculated the test results. | ____ | ____ |
| 8. Reported the results to the nearest 0.01 mg/L, and also the sample volume used in the test. | ____ | ____ |
| 9. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | AR 200-1 |
| MIL-STD-3004A | AR 200-2 |
| | FM 10-67-2 |
| | FM 3-100.4 |
| | FM 4-20.13 |

**Perform Standard Test Method for Freezing Point of Aviation Fuels (D-2386)**

**101-92L-1353**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given a freezing point apparatus and American Standard Test Method (ASTM) standard D-2386. Upon receipt of sample product the laboratory specialist conduct test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Jacket sample tube.
   b. Gland.
   c. Collar: moisture-proof collars may be used instead of the above gland to prevent condensation of moisture.
   d. Stirrer: shall be made of 1.6-mm brass rod bent into a smooth three-loop spiral at the bottom.
   e. Vacuum flask: an unsilvered vacuum flask having minimum dimensions described in the ASTM shall be used.

CAUTION: THE VACUUM FLASK PRESENTS AN IMPLOSION HAZARD.

   f. Thermometers: a total immersion type, having a range from -80 degrees to +20 degrees C, designated as ASTM No. 114C/IP No. 14C.

2. Select and prepare the reagents and materials.
   a. Acetone: technical grade acetone is suitable for the cooling bath, provided it does not leave a residue on drying.
   b. Ethanol or ethyl alcohol: a commercial or technical grade of dry ethanol is suitable for the cooling bath.
   c. Isopropyl alcohol.
   d. Methanol or methyl alcohol.

WARNING: ACETONE, ETHANOL, ETHYL ALCOHOL, ISOPROPYL ALCOHOL, AND METHANOL ARE EXTREMELY FLAMMABLE. METHANOL OR METHYL ALCOHOL IS TOXIC AS WELL AS EXTREMELY FLAMMABLE.

   e. Carbon dioxide (solid) or dry ice.
   f. Liquid nitrogen.

WARNING: CARBON DIOXIDE AND DRY ICE ARE EXTREMELY COLD, -78 DEGREES C. LIQUID NITROGEN AND CARBON DIOXIDE LIBERATE GASSES THAT CAN CAUSE SUFFOCATION. CONTACT WITH SKIN CAUSE BURNS, FREEZING, OR BOTH. TAKE PRECAUTIONS WHEN HANDLING CHEMICALS.

3. Perform the test procedure.

**Performance Steps**

4. Report the temperature of crystal disappearance to the nearest 0.5 degrees C.
5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents and materials. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Reported the temperature of crystal disappearance to the nearest 0.5 degrees C. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Cloud Point of Petroleum Oils (D-2500)**

**101-92L-1355**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given a functional petroleum laboratory, a test bath, cloud and pour point jar, and American Standard Test Method (ASTM) standard D-2500. Upon receipt of sample product the laboratory specialist conducts test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM D-2500, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Test jar: clear, cylindrical glass, flat bottom, 33.2- to 34.8-mm outside diameter and 115 and 125 mm height.
   b. Thermometer: having ranges of -38 degrees to +50 degrees C (ASTM 5C/IP1C) for high cloud/pour and -80 degrees to +20 degrees C (ASTM 6C/IP2C) for low cloud/pour.
   c. Jacket: metal or glass, watertight, cylindrical, flat bottom, about 115 mm in depth.
   d. Disk cork or felt, 6 mm thick to fit loosely inside the jacket.
   e. Gasket: ring form, about 5 mm in thickness, to fit snugly around the outside of the test jar and loosely inside the jacket.
   f. Bath or baths: maintained at prescribed temperatures with a firm support to hold the jacket vertical.

2. Select and prepare the reagents and materials.
   a. Acetone: technical grade acetone is suitable for the cooling bath, provided it does not leave a residue on drying.

WARNING: ACETONE IS EXTREMELY FLAMMABLE.

   b. Calcium chloride.
   c. Carbon dioxide (solid) or dry ice.
   d. Ethanol or ethyl alcohol.

WARNING: ETHANOL AND ETHYL ALCOHOL ARE FLAMMABLE. DENATURED CANNOT BE MADE NONTOXIC.

   e. Methanol or methyl alcohol.

WARNING: METHANOL AND METHYL ALCOHOL ARE FLAMMABLE AND VAPOR HARMFUL.

   f. Petroleum naphtha.

WARNING: PETROLEUM NAPHTHA IS COMBUSTIBLE AND VAPOR HARMFUL.

   g. Sodium chloride crystals.
   h. Sodium Sulfate: a reagent grade of anhydrous sodium sulfate should be used when required.

3. Perform the test procedure.

4. Report the temperature recorded during the test procedure as the cloud point, in accordance with the ASTM D-2500.

NOTE: Report the cloud point, to the nearest 1 degree C, at which any cloud is observed at the bottom of the test jar, which is confirmed by continued cooling.

**Performance Steps**

5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

6. Perform test procedure on automatic apparatus.

NOTE: For automatic procedure use ASTM D-5773.

a. Press change settings to Cloud, press button to the right of RUN mode. Press Cloud and ensure FUELS is displayed next to Sample Type. If not, press the button to the right of Sample Type and Press Fuels. Ensure preheat is OFF, temperature is Celsius and Cloud resolution is 3. Press Save Changes.
b. Locate 150µL pipet and pipet tips. Pipete 150µL of sample. Wipe excess fuel from the tip of pipet. Slowly disperse the sample into the sample cup taking care not to touch the sample cup bottom or the sides. Remove the sample, using a Q-tip (with plastic rod) to ensure previous samples are removed.
c. Disperse another 150µL of sample into the sample cup. Close lid and lock. Press RUN.

NOTE: Do not open lid when instrument is operating.

d. After completion of test, turn off the warning message; remember the sample cup must heat up first. Instrument will show 'run complete' on screen. Touch control panel button to return to the analyzer control panel. Open lid and remove sample with plastic Q-tip taking care not to scratch the mirrored sample.
e. Clean apparatus after completing test for the day.
   (1) Squeeze 2-Propanol onto a clean Q-tip and swab in and around the sample cup removing all fuel residue.
   (2) Allow to air dry for a few seconds and close lid.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

7. Report the temperature as the automatic cloud point according to ASTM D-5773.

8. Perform PMCS on applicable equipment.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents and materials. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Reported the temperature recorded during the test procedure as the cloud point, in accordance with the ASTM D-2500. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |
| 6. Performed test procedure on automatic apparatus. | ____ | ____ |
| 7. Reported the temperature as the automatic cloud point according to ASTM D-5773. | ____ | ____ |
| 8. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge (D-2709)**

**101-92L-1360**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational laboratory, all materials needed: petroleum testing facility, sample for testing, product specification, American Standard Test Method (ASTM) D-2709, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDSs) for all hazardous materials present in the workplace. Upon receipt of sample product the laboratory specialist conduct test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with ASTM D-2709, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Prepare and select the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Centrifuge: capable of whirling two or more filled centrifuge tubes at a speed that can be controlled to give a relative centrifugal force (rcf) of 800 +, or - 60 at the tip of the tube.
   b. Centrifuge tube: cone-shaped, 100 mL with capillary tip capable of measuring 0.01 mL and readable by estimation to 0.005 percent.
   c. Centrifuge tube: pear-shaped, 100 mL, with tube tip having graduation of 0.01 mL over the range 0 to 0.2 mL.

2. Verify that the sample has been taken in accordance with procedures prescribed in ASTM D-4057.

3. Perform the test procedure.

4. Report the test results.
   a. Report the volume of the combined water and sediment read from the tube as the percentage of the total sample, since a 100 mL sample was used.
   b. Report results lower than 0.005 percent as either 0 or 0.005 volume percent.

5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Prepared and selected the test apparatus. | ____ | ____ |
| 2. Verified that the sample has been taken in accordance with procedures prescribed in ASTM D-4057. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Reported the test results. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure) (D-3241)**

**101-92L-1362**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given all materials needed: sample for testing, product specification, American Standard Test Method (ASTM) D-3241, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDSs) for all hazardous materials present in the workplace. Upon receipt of a petroleum laboratory specialist conduct test procedures based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performed the test procedures, recorded the test results in accordance with the ASTM D-3241, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gave the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Jet Fuel Thermal Oxidation Tester (JFTOT).

CAUTION: DO NOT ATTEMPT TO OPERATE THE JFTOT APPARATUS WITHOUT FIRST BECOMING ACQUAINTED WITH ALL THE COMPONENTS AND THE FUNCTION OF EACH.

   b. Heater tube deposit rating apparatus.
   c. Visual tube rater.

2. Select and prepare the reagents and materials.
   a. Use distilled (preferred) or deionized water or n-Heptane (technical grade, 95 mol percent minimum purity) as general cleaning solvents.
   b. Use trisolvent (equal mixture of acetone, toluene, and isopropanol) as a specific solvent to clean internal (working) surface of test section only.

WARNING: ACETONE, TOLUENE, AND ISOPROPANOL ARE EXTREMELY FLAMMABLE. VAPORS ARE HARMFUL. IRRITATION TO THE SKIN, EYES, AND MUCOUS MEMBRANE MAY OCCUR WITH CONTACT. ACETONE VAPOR MAY CAUSE FLASH FIRE.

   c. Use dry calcium sulfate + cobalt granules (97 + 3 mix) in the aeration dryer.

3. Verify that the standard operating conditions are met.
   a. Fuel quantity of 450 mL minimum for the test plus approximately 50 mL for the system is on hand.
   b. Filter the fuel through a single layer of general-purpose, retentive, qualitative filter paper followed by a 6-minute aeration at 1.5-L/minute air flow rate for a maximum of 600 mL sample using spare stone of porosity C.
   c. Verify that fuel system pressure is set at 3.45 MPa (500 psi) +/-10 percent gauge.
   d. Verify that thermocouple position is set at 39 mm.
   e. Preset the heater tube control temperature as specified in applicable specification.
   f. Set the fuel flow rate at 2.7- to 3.3-mL/minute or 20 drops of fuel in 9.0 +/-1.0 second.
   g. Verify that the minimum amount of fuel pumped during the test is 405 mL.
   h. Verify that the test duration time is 150 +/-2 minutes.

**Performance Steps**

4. Perform checks of the key components at required frequency.
   a. Calibrate a thermocouple when first installed and then normally every 30 to 50 tests thereafter, but at least every 6 months.
   b. Standardize the differential pressure cell once a year or when installing a new cell.
   c. Check the aeration dryer at least monthly and change if color indicates significant absorption of water.
   d. Perform two checks of the flow rate for each test as described in the procedure section.
   e. Check for leakage at least once a year on the filter bypass valve for Models 202, 203, and 215.
5. Perform the test procedure.
6. Evaluate the heater tube.
   a. Visually rate the deposits on the heater tube in accordance with Annex A1 of ASTM D-3241.
   b. Return the tube to the original container, record data, and retain the tube for a visual record as appropriate.
7. Report the following:
   a. Heater tube control temperature. This is the test temperature of the fuel.
   b. Heater tube deposit rating(s).
   c. Maximum pressure drop across the filter during the test or the time to reach a pressure differential of 25 mm Hg.
   d. Test time that corresponds to the heater tube deposit rating if the test is terminated because of pressure drop failure and the normal 150-minute test time was not completed.
   e. Spent fuel at the end of a normal test. This will be the amount on top of floating piston or total fluid in displaced water beaker, depending on the model of JFTOT used.
8. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents and materials. | ____ | ____ |
| 3. Verified that the standard operating conditions are met. | ____ | ____ |
| 4. Performed checks of the key components at required frequency. | ____ | ____ |
| 5. Performed the test procedure. | ____ | ____ |
| 6. Evaluated the heater tube. | ____ | ____ |
| 7. Reported the heater tube control temperature, heater tube deposit rating(s), maximum pressure drop, test time, and spent fuel at the end of a normal test. | ____ | ____ |
| 8. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
| --- | --- |
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Test Method for Determining Micro WISM (D-3948)**

**101-92L-1365**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, materials needed: petroleum testing facility, sample for testing, product specification, American Standard Test Method (ASTM) D-3948, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDSs) for all hazardous materials present in the workplace. Upon receipt of petroleum samples, it is determined that you must perform ASTM D-3948 on the sample.

**Standards:** Soldier selects and prepares the required test apparatus, performed the test procedures, recorded the test results in accordance with the ASTM D-3948, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gave the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Micro-separometer.
   b. Syringe plug: a plastic plug used to stopper the syringe during the CLEAN and EMULSION cycle.
   c. Vials: 25-mm outside diameter vial pre-marked for proper for proper alignment in the turbidimeter well.
   d. Alumicel, coalescer.
   e. Pipet, with plastic tip: an automatic hand pipet with a disposable plastic tip.
   f. Wire aid: a piece of wire with a loop on one end, used during test to release the air trapped in the barrel of the syringe when the plunger is being inserted.
   g. Water container.
   h. Beaker, catch pan, or plastic container.

2. Select and prepare the reagents.
   a. Aerosol OT (Sodium Dioctyl, Sulfosuccinate), solid (100 percent) dry bis-2-ethylhexyl sodium sulfosuccinate.
   b. Toluene, ACS reagent grade.

WARNING: TOLUENE IS FLAMMABLE AND VAPOR HARMFUL.

   c. Dispersing agent: toulene solution containing 1 mg of aerosol OT per mL of toluene.
   d. Reference fluids.

3. Perform the test procedure.

4. Report the results as the MSEP-A rating for Mode A operation or MSEP-B rating for Mode B operation.

5. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Reported the results as the MSEP-A rating for Mode A operation or MSEP-B rating for Mode B operation. | ____ | ____ |
| 5. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedure) (D-4176)**

**101-92L-1368**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given all necessary equipment and materials and American Standard Test Method (ASTM D-4176). Upon receipt of a petroleum product a laboratory specialist will conduct test procedures based on product specification and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

   a. Cylindrical, container: clear glass, capable of holding 1.0 +/-0.1-L of fuel and having a diameter of 100 +/-10 mm.
   b. Bar chart (paper card)--laminated in clear plastic, having five parallel lines of different widths and meeting descriptions in Section 7 of ASTM D-4176.

2. Clean the sample bottle in accordance with ASTM D-4057.

3. Draw the sample quickly to avoid contamination of the sample from outside sources.

NOTE: Both field testing and laboratory testing must be performed immediately after drawing the sample. Do not subsample or transfer the sample to a secondary container. Perform the test with the sample drawn in the original container.

4. Perform the test procedure.
   a. Procedure 1--visually check a sample for field-testing.
      (1) Check visually for evidence of water or particulate contamination.
      (2) Hold sample up to light and visually examine for haze or lack of clarity.
      (3) Swirl sample to produce a vortex and examine the bottom of the vortex for particulate matter.
   b. Procedure 2--rate the appearance of a sample using the bar chart.
      (1) Place sample container into a well lighted area, avoiding light reflections on the front of the container as much as possible.
      (2) Place bar chart directly behind the container, with lines towards the container and parallel with the container bottom.
      (3) Face container and chart, and compare the appearance of the chart through the sample.
      (4) Place the photographs next to the container, so that they are lighted similarly to the sample.
      (5) Select the photograph closest in appearance to the sample.

**Performance Steps**

5. Record any special observation, such as a particularly heavy contamination with water or solids or a darker than usual color which made ratings difficult.
6. Report the results to include the type of fuel; the source of the fuel (sample point); and the date, time, and approximate temperature of the sample.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Cleaned the sample bottle in accordance with ASTM D-4057. | ____ | ____ |
| 3. Drew the sample quickly to avoid contamination of the sample from outside sources. | ____ | ____ |
| 4. Performed the test procedure. | ____ | ____ |
| 5. Recorded any special observation, such as a particularly heavy contamination with water or solids or a darker than usual color which made ratings difficult. | ____ | ____ |
| 6. Reported the results to include the type of fuel; the source of the fuel (sample point); and the date, time, and approximate temperature of the sample. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Use Standard Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel System (D-4865)**

**101-92L-1370**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given all materials, manuals and American Standard Test Method (ASTM D-4865). Upon receipt of a petroleum sample you conduct test procedures based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM D-4865, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

NOTE: This guide is intended to increase the awareness of potential operating problems and hazards resulting from electrostatic charge accumulation. This guide describes how static electricity may be generated in petroleum fuel systems, types of equipment conducive to charge generation, and method for the safe dissipation of such charges.

1. Identify ignition principles.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

   a. For ignition to occur, it is necessary to have an ignition source of sufficient energy and a mixture of fuel and air in the flammable range.
   b. The second requirement for ignition is a spark discharge of sufficient energy and duration.

2. Identify how charges are generated.
   a. Whenever a hydrocarbon liquid flows with respect to another surface, a charge is generated in the liquid and an equal but opposite charge is imposed on that surface.
   b. When fuel flows, one set of charges is swept along with the fuel while the opposite charges which accumulated along the wall surface usually leaks to ground. This increases the charge rate which is inversely related to the conductivity.

3. Identify practical problems (sources) that may generate electrostatic charges.
   a. Microfilters and filter separators are prolific generators of electrostatic charges. Many additive in fuel increase the level of charge generation upon filtration. Most common filter media such as fiberglass, paper, and cloth as well as solid adsorbents are potent charge generators.
   b. Flow velocity is an important parameter in charge generation because the delivery of more fuel per second delivers more charge per second. This results in higher surface voltage.
   c. Certain types of pumps, such as centrifugal or vane pumps, can be prolific charge generators due to high exit velocities at impellers.
   d. Splash filling of a storage tank or tank truck represents another mode of charge generation. Spraying of droplets causes charges to separate, leading to the development of charged mist and foam as well as charged accumulation.
   e. Conductive objects exposed to charged fuel become charge accumulators if unbonded to the receiving vessel. Conductive objects are not always metal. A piece of ice can act as a charge collector and a surface pool of free water can accumulate a high surface charge. Objects dropped into a tank such as pencils, flashlights, or sample thief parts are a source of dangerous accumulators.
   g. Loading of diesel fuel into a truck which previously carried gasoline and still contains vapors or liquid gasoline is especially dangerous. The combination of a flammable vapor space and charged diesel fuel presents a potential explosion hazard if an electrostatic discharge occurs.

**Performance Steps**

h. While fueling aircraft, bonding between the aircraft and the fueler is required to prevent a voltage differential from developing between them. Grounding is not required (see NFPA Standard No. 407). Grounding does not provide any additional benefit in a properly bonded system during fueling operations.
i. Filling of storage tank or tanker compartment can lead to charge generation even when splash loading is avoided. The movement of air bubbles or water droplets through the bulk fuel as the tank contents settle is a charge generation mechanism and will cause a high charge level to accumulate in a low conductivity fuel.
j. Filling an empty filter-separator vessel can create an electrostatic hazard if liquid is not introduced slowly.

4. Identify possible approaches to alleviate electrostatic charge.
   a. Reduce line velocity - the reduction of flow rate through a filter may not reduce charge density significantly but it will reduce current flow and will increase residence time downstream of the filter.
   b. Relaxation time - during tank truck loading or storage tank filling, high charge densities caused by filters or similar flow obstructions should be relaxed by providing at least 30 residence time downstream of the filter before product reaches a loading arm or fill pipe.
   c. Eliminate splash loading - when trucks are top loaded with overhead lines, these lines should reach to the bottom of the compartment to avoid dropping the product with subsequent splashing.
   d. Eliminate unbonded charge collectors - unbonded, loose objects in a compartment or tank are a major hazard and must be eliminated by periodic compartment inspections to ensure proper cleanliness.
   e. Eliminate flammable vapor in ullage spaces - system operation should be checked to ensure the nonflammability of the ullage space.
   f. Use low-charging filters - select low-charging filters.
   g. Use additive to control the effects of electrostatic charging. Conductivity improver additives (also called static dissipator or anti static additives) increase the conductivity of fuel and increase the rate of charge dissipation.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Identified ignition principles. | ____ | ____ |
| 2. Identified how charges are generated. | ____ | ____ |
| 3. Identified practical problems (sources) that may generate electrostatic charges. | ____ | ____ |
| 4. Identified possible approaches to alleviate electrostatic charges. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels (D-5006)**

**101-92L-1371**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory and materials needed: sample for testing, product specification, American Standard Test Method (ASTM) D-5006, all equipment listed in the ASTM, a hazardous materials spill kit, and a maintained file of material safety data sheets (MSDSs) for all hazardous materials present in the workplace. Upon receipt of a fuel sample you must perform test procedures in accordance with specification requirements and any special information.

**Standards:** Soldier selected and prepared the required test apparatus, performed the test procedures, recorded the test results in accordance with the ASTM, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gave the recorded test results to his/her immediate supervisor.

**Performance Steps**

NOTE: This ASTM describes a technique for measuring the concentration of Diethylene Glycol Monomethyl Ether (DiEGME) in aviation fuels. Precision estimates have been determined for the DiEGME additives using specific extrication ratios with a wide variety of fuel types.

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Refractometer.
   b. Extraction vessel: any suitable vessel of at least 200 mL, with provisions for isolating a small column of water extract.
   c. Measuring vessel: any vessel capable of measuring up to 160 mL of fuel to an accuracy of +/-2 mL, such as a 250-mL graduated cylinder or other calibrated container.
   d. Water dispenser--2.0 mL pipettes are preferred, but syringes or burettes not exceeding 5.0 mL capacity that can dispense 2.0 +/-0.2 mL may be used.
   e. Thermometer: the thermometer must have suitable range to measure air and fuel temperature in the field and must be accurate to +/-1°C.
   f. Water: use distilled or deionized water to perform the extraction procedure. Potable water may be used.

2. Calibrate the refractometer.

NOTE: See the operation manual for details.

3. Perform the test procedure.

NOTE: Extraction procedure for the HB refractometer (Temperature Compensated, Direct Reading).

   a. Locate thermometer and refractometer where they will remain at ambient temperature during the procedure.
   b. Measure 160 mL of fuel to be tested into the extraction vessel.
   c. Measure 2.0 mL of water into the extraction vessel.

NOTE: Extraction procedure for the Brix scale refractometer, non temperature compensated.

   d. Same as step a.
   e. Measure 80 mL of the fuel to be tested into the extraction vessel.
   f. Measure 1.0 mL of water into the extraction vessel.

**Performance Steps**

g. Procedure for the determination of fuel system icing inhibitor.
   (1) Shake the extraction vessel vigorously for a minimum of 5 minutes for all fuels.
   (2) Allow extraction vessel to sit undisturbed at ambient temperature for a period of at least 2 minutes.

CAUTION: FUEL ENTRAINED IN WATER CAUSES AN INDISTINCT REFRACTOMETER READING. IN MOST CASES FUEL RESIDUE CAN BE ELIMINATED BY SLOWLY LOWERING THE REFRACTOMETER COVER. THE SURFACE TENSION OF WATER WILL SWEEP FUEL OFF THE PRISM SURFACE.

   (3) Open the cover of the refractometer prism and wipe clean with a tissue.
   (4) Place several drops of water used for the extraction on the prism face.
   (5) Close the cover and view the scale through the eyepiece.
      (a) Adjust the focus if necessary.
      (b) Observe the position of the shadow line on the numbered scale.
   (6) Rotate the zero adjustment knob or set screw so that the shadow line intersects at 0.0 on the HB or Brix scale refractometer.
   (7) Repeat step 3.
   (8) Isolate several drops of the water extract from the extraction vessel and place on the prism face.
      (a) If separatory funnel is used, collect some extract into a smaller container.
      (b) Transfer several drops to the prism with a clean eyedropper, syringe, or pipette.
   (9) When extraction vessel is a dropping bottle.
      (a) Place bottle right side up, remove cap, squeeze slightly and replace the cap while the bottle is under a slight vacuum.
      (b) Invert the bottle and allow the water extract to settle to the bottom.
      (c) Uncap the bottle and squeeze it gently until several drops of extract are collected on a tissue held in the same hand as the refractometer.
      (d) Now allow the drops to fall on the prism face.
   (10) Slowly lower the prism cover into place using the same technique as described in step 5 above.
   (11) Observe and record the position of the shadow line.

NOTE: Record the ambient temperature to the nearest degree centigrade using a thermometer.

4. Calibrate and record the results.
   a. For the HB refractometer: record the readings obtained to two significant figures as the final result in volume percent DiEGME.

NOTE: Report the reading in volume percent from the left-hand scale marked JP-5 or M.

   b. For the non-temperature compensated refractometer with Brix scale - first apply the temperature correction factor from Table 1, ASTM D-5006. Calculate the volume percent DEGME as follows:

$$\text{Volume percent FSII} = \frac{2 \times \text{Temperature Corrected Scale Reading}}{100}$$

5. Report the following:
   a. Type of fuel analyzed.
   b. The volume percent DiEGME found.
   c. The temperature (°C) of the analysis.

**Performance Steps**

6. Perform PMCS on applicable equipment.
    a. Wash apparatus with soap and water.
    b. Dry all items.

NOTE: Treat the refractometer as an optical instrument. Avoid damage to the lens and window elements. Store in protective case. Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Calibrated the refractometer. | ____ | ____ |
| 3. Performed the test procedure. | ____ | ____ |
| 4. Calibrated and recorded the results. | ____ | ____ |
| 5. Reported type of fuel analyzed, the volume percent DiEGME found, and the temperature (°C) of the analysis. | ____ | ____ |
| 6. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Particular Contamination in Aviation Fuel by Laboratory Filtration (D-5452)**

**101-92L-1372**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, given all materials, manuals and American Standard Test Method (ASTM) standards. Upon receipt of a petroleum laboratory specialist conduct test procedures based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

NOTE: This ASTM covers the gravimetric determination by filtration of particulate contamination in a sample of aviation turbine fuel delivered to a laboratory.

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

a. Analytical balance: single- or double-pan, the precision standard deviation of which must be 0.07 mg or better.
b. Oven: of the static type (without fan-assisted air circulation) controlling to 90 +/-5° C.
c. Petri dishes: approximately 125 mm in diameter with removable glass supports for membrane filters.
d. Forceps: flat-bladed with serrated, nonpointed tips.
e. Vacuum system.
f. Test membrane filter: plain, 47-mm diameter, nominal pore size 0.8 micron.
g. Control membrane filter: 47-mm diameter, nominal pore size 0.8 micron.

NOTE: Matched weight membrane filters, 47-mm diameter, nominal pore size 0.8 micron may be used as test and control membrane filter if so desired. Use of matched weight membrane filters precludes the necessity for carrying out the procedure for the preparation of test and control membrane filters.

h. Dispenser for flushing fluid.
i. Air ionizer.
j. Filtration apparatus: consisting of a funnel and a funnel base with filter support.
k. Support apparatus: having adjustable heights, integral spill collection pan at the base and an edge on the can shelf to prevent the can from slipping off.
l. Dispensing cap or plug: with approximately 9.5 mm inside diameter hose barb 32 mm long on which a 75 to 100 mm long piece of fuel resistant, flexible, plastic tubing is installed.
m. Feed container: preferably the same container in which the sample was collected.
n. Graduated receiving flask: shall be glass into which the filtration apparatus is fitted and equipped with a sidearm to connect the vacuum system.
o. Safety flask: shall be glass containing a sidearm attached to the receiving flask with a fuel and solvent resistant rubber hose and shall be connected to the vacuum system.
p. Ground/bond wire, No. 10 through No. 19 (0.912-2.59 mm) bare-stranded flexible, stainless steel or copper installed in the flasks and grounded.
q. Plastic film: polyethylene, or any other clear film not adversely affected by flushing fluids.
r. Multimeter/VOM: used to determine whether electrical continuity is 10 ohms or less between two points.

**Performance Steps**

2. Select and prepare the reagents.
    a. Water: reference to water shall be understood to mean reagent water as defined by Type III of Specification D-1193, unless otherwise indicated.
    b. Isopropyl alcohol.

WARNING: ISOPROPYL ALCOHOL IS FLAMMABLE.

    c. Liquid detergent: water-soluble.
    d. Flushing fluids: petroleum spirit (also know as petroleum ether or IP Petroleum Spirit 40/60) having boiling range from 35° to 60° C.

WARNING: PETROLEUM SPIRIT IS EXTREMELY FLAMMABLE. AND HARMFUL IF INHALED. VAPORS ARE EASILY IGNITED BY ELECTROSTATIC DISCHARGES, CAUSING A FLASH FIRE. SAFETY PRECAUTIONS SHOULD BE TAKEN TO AVOID STATIC DISCHARGE.

    e. Filtered fluid: filtered fluids are fluids filtered through a nominal 0.45-micron membrane filter.

3. Prepare the filtration apparatus.

4. Prepare the sample containers.

5. Prepare the test and control membrane filters.

6. Perform the test procedure.

7. Calculate and report the results.
    a. Subtract the initial mass of the test membrane filter, W1, from the final mass, W2.
    b. Subtract the initial mass of the control membrane filter, W3, from the final mass, W4.
    c. Calculate total contaminant in milligrams per liter as follows:

$$\frac{(W2 - W1) - (W4 - W3)}{\text{Volume filtered, L}}$$

NOTE: If matched-weight membranes have been used for the test, the W1 = W3 and the corrected weight of contaminant in performance step 7c (W2 - W4).

    d. Report the particulate contamination to the nearest 0.01 mg/L and also report the sample volume used in the test.

8. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory standing operating procedure (SOP). Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents. | ____ | ____ |
| 3. Prepared the filtration apparatus. | ____ | ____ |
| 4. Prepared the sample containers. | ____ | ____ |
| 5. Prepared the test and control membrane filters. | ____ | ____ |
| 6. Performed the test procedure. | ____ | ____ |
| 7. Calculated and reported the results. | ____ | ____ |
| 8. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Prepare Petroleum Laboratory Analysis Reports**

**101-92L-1384**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, all materials: DA Form 1804 (Petroleum Sample), product specification and MIL-STD-3004A, sample test results. Upon receipt of the test results, you are required to analyze them and compare them to the product specification.

**Standards:** Soldier prepares a petroleum laboratory analysis report for each product tested using the products test results and specification in accordance with MIL-STD-3004A, FM 10-67-2, and gives completed report to his supervisor.

**Performance Steps**

1. Determine if entries on the sample tag are complete. Verify that the following information is annotated.
   a. Product name and grade.
   b. Unit name and sample number.
   c. Source of sample.
   d. Quantity sample represents.
   e. Sampler's name.
   f. Date sampled.
   g. Type of sample.
2. Transfer the information from the sample tag to the laboratory sample logbook and assign a laboratory sample number.
3. Determine the type of test to be performed.
   a. Refer to DA Form 1804 for type of sample and any pertinent information about the sample.
   b. Refer to product specification.
4. Record the specification limits on DA Form 2077 (Petroleum Products Laboratory Analysis Report) work copy.
5. Verify product use limits in accordance with MIL-STD-3004A.
6. Enter the date tests are started in the laboratory logbook and on the laboratory reports.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Determined if entries on the sample tag were completed. Verified that information was annotated. | ____ | ____ |
| 2. Transferred the information from the sample tag to the laboratory sample logbook and assigned a laboratory sample number. | ____ | ____ |
| 3. Determined type of test to be performed. | ____ | ____ |
| 4. Recorded the specification limits on DA Form 2077 (Petroleum Products Laboratory Analysis Report) work copy. | ____ | ____ |
| 5. Verified product use limits in accordance with MIL-STD-3004A. | ____ | ____ |
| 6. Entered the date tests are started in the laboratory logbook and on the laboratory report. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | |
| DA FORM 1804 | |
| DA FORM 2077 | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

**Compare Test Results to Specification Requirements**

**101-92L-1385**

**Conditions:** As a petroleum specialist with a petroleum laboratory in a field or garrison environment, given a completed DA Form 2077 (Petroleum Products Laboratory Analysis Report), product specifications, MIL-STD-3004A or local memorandum on which all required test results, of a sample have been recorded. Based on petroleum testing and a DA Form 2077 the laboratory specialists will analysis the results depending on the products requirements and characteristics.

**Standards:** Soldier compares test results to specification requirements, determines disposition of product based on his/her comparison of the test results with the specification requirements. Communicate decision to the laboratory noncommissioned officer in charge (NCOIC) or supervisor.

**Performance Steps**

1. Evaluate the test results.
   a. Compare the results on the DA Form 2077 to the federal or military specification limits.
   b. Compare results to deterioration limits listed in MIL-STD-3004A, if the product does not meet specification limits.
2. Determine if sample's suitability for use.
   a. On Grade: product meets all specification requirements. Product can be used as intended.
   b. Suitable for Use: product is either deteriorated or contaminated to the point where one or more tests do not meet specification requirements but meet use limits in accordance with MIL-STD-3004A. Product should be used as soon as possible.
   c. Not Suitable for Use: product fails to meet one or more use limits or specification requirements that have no use limit. Product must be downgraded or blended as recommended.
3. Annotate the sample's suitability. Enter determination of the product in the remark section on the DA Form 2077.
4. Explain whatever recommendation is made using DA Form 2077 entries or local memorandum, product specification, and tables listed in applicable publications, as well as FM 10-67-2.

**Evaluation Preparation:** See condition and standard statements. Have all publications ready.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Evaluated the test results. | ____ | ____ |
| 2. Determined the sample's suitability for use. | ____ | ____ |
| 3. Annotated the sample's suitability. | ____ | ____ |
| 4. Explained whatever recommendation were made using DA Form 2077 entries or local memorandum, product specification, and tables listed in applicable publications, as well as FM 10-67-2. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| DA FORM 2077 | |
| MIL-STD-3004A | |

**Prepare Standardized Chemical Solutions**

**101-92L-1386**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational laboratory, materials and manuals needed: solutes, primary standard, applicable glassware, analytical balance, labels, FM 10-67-2, a hazardous materials spill kit, and a file of material safety data sheets (MSDSs) for all hazardous materials present in the workplace. Upon receipt of petroleum products the laboratory specialist will prepare and standardize chemical solutions that are required for specific petroleum testing procedures.

**Standards:** Soldier performs all steps in sequence which is required to prepare and standardize chemical solutions which are required to complete testing procedures to obtain complete and accurate results in accordance with FM 10-67-2 and laboratory SOP.

**Performance Steps**

1. Clean and prepare the glassware.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Wash the glassware with soap and water, rinse with tap water, and then distilled water.
   b. Air-dry in the inverted position if time permits or in drying oven.
   c. If chemical cleaning is necessary, soak in chromic acid for 6 hours, rinse with tap water, and then distilled water.

NOTE: Chemicals are inherently dangerous. Exercise appropriate cautions when handling these products.

2. Determine the amount of solute needed to prepare a solution.
   a. Determine the amount of solid solute needed, using the following equation:

$$W = \frac{(v)(N)(MEW)}{DFP}$$

Where:
W = Weight of solute needed (in g),
V = Volume solution to be prepared (in mL),
N = Desired normality of solution to be prepared,
MEW = Mili-equivalent weigh of solute, grams/milli-equivalents

To determine MEW, the EW must first be determined:

$$EW = \frac{\text{Molecular Weight}}{\text{Total Positive Valence}}$$

Then:
The MEW will be determined:

$$MEW = \frac{\text{Equivalent Weight}}{1000}$$

**Performance Steps**

EXAMPLE 1: The MEW of KOH would be determined as follows:

| Element | Valence | Formula Weight |
|---|---|---|
| Potassium (K) | +1 | 39.1020 |
| Oxygen (O) | -2 | 15.9994 |
| Hydrogen (H) | +1 | 1.00797 |
| | +1 | 56.10937 (Total molecular weight) |

NOTE: Valence will never be zero.

$$EW = \frac{56.10937}{1} = 56.10937$$

$$MEW = \frac{56.10937}{1000} = .0561$$

EXAMPLE 2: What is the weight of solute needed to make 1000 mL of 0.1N KOH?

$$W = \frac{(1000)(.1)(0.0561)}{0.85}$$

W = 6.6 Grams needed

b. Determine the volume of liquid needed, using the following equation:

$$V1 = \frac{(V2)(N)(MEW)}{(DFP)(SPGR)}$$

Where:
V1 = Volume of solute needed
V2 = Volume of solution to be prepared, in mL
N = Desired normality of solution to be prepared
MEW = Mili-equivalent weight of the solution
DFP = Decimal fractional purity of solute
SPGR = Specific gravity of solute

3. Weigh a substance using the appropriate balance.
   a. Use the analytical balance.
      (1) Press the TARE on the balance to zero the display. Place a sheet of quantitative filter paper on the pan of the balance.
      (2) Use a clean, dry spatula to carefully measure the required quantity of solute calculated.
      (3) Read the display weight after the display is stable, indicated by the no-motion symbol switches on or off.
      (4) Record the weight of the solute for reference.
      (5) Maintain and care for the balance.

**Performance Steps**

b. Use the Havard Trip balance.
   (1) Zero the balance. Adjust the knurled zero knob at the right end of the beam, if the scale is not balanced at zero when set upon the working surface.
   (2) Weigh substance. Place the substance to be weighed on the left platform of the balance. Move the poises to a position that will restore the scale to balance. The lower poise is moved to the right until the first notch is reached which causes the right platform of the scale to drop. The lower poise is then moved back one notch, which will cause the right platform to rise again. The upper poise is then moved to the right until the scale is brought into balance.
   (3) Read the results directly from the beams by adding the amount indicated on the lower and upper beams.
   (4) Record the weight of the solute for reference.
   (5) Maintain and care for balance.

c. Use the triple beam balance. This balance is used when precise weighing is not required.
   (1) Level and zero the balance. Select a reasonably flat and level surface on which to use the balance. Adjust the knob at the left end of the beam to obtain zero balance.
   (2) Weigh a substance. Place the substance to be weighed on the load receiving platform. Move the center poise to the first notch where it causes the beam pointer to drop, then move it back one notch and the pointer will rise.
   (3) Read the results as the weight of the substance by adding the values indicated by the poises.
   (4) Maintain and care for balance.

4. Dissolve the measured solute. Completely dissolve the measured solute into the measured amount of distilled water (or other solute if required) used in the calculation verifying the container is stoppered and labeled.

5. Select a primary standard.

NOTE: A primary standard should have a high equivalent weight, usually greater than 50 grams. It should be chemically stable and should not absorb atmospheric moisture readily. It should also react completely when neutralized.

a. Primary standards that are used to standardize acids:
   (1) Anhydrous sodium carbonate ($Na_2CO_3$) is a basic primary standard. Its equivalent weight is 53 grams.
   (2) Other common primary standards are: potassium bicarbonate ($KHCO_3$), thallous carbonate ($Tl_2CO_3$), borax ($Na_2B_4O_7.1OH_2O$), and sodium oxalate ($Na_2C_2O_4$).

b. Primary standard that used to standardize bases:
   (1) Potassium biphthalate (KHP), also known as potassium acid phthalate and potassium hydrogen pthalate has an equivalent weight of 204.22 grams.
   (2) Other common primary standards are: oxalic acid ($H_2C_2O_4$), oxalic acid dihydrate ($H_2C_2O_4.2H_2O$), benzoic acid ($C_6H_5COOH$), and sufamic acid ($NH_2SO_3H$).

6. Calculate the weight of primary standard required. Use the following equation:

$$\text{Weight Needed (mg)} = \frac{(N)(vol)(MEW)}{DFP}$$

Where:
N = Normality of the solution to be neutralized
vol = the quantity, in mls, of solution to be neutralized
DFP = Decimal fractional purity of the standard

**Performance Steps**

7. Prepare the primary standard.
    a. Weigh a clean, dry Erlenmeyer flask on the analytical balance.
    b. Add the grams of primary standard calculated in 6 above. Record the weight to the fourth decimal place.
    c. Dissolve the primary standard in an unmeasured quantity of distilled water.
    d. Add two or three drops of indicator to the solution.

NOTE: Indicators are dyes that change the color, depending on the degree of acidity or alkalinity, of a solution. They also show the concentration of hydrogen ion of a solution and they can be used in volumetric analysis to mark the end point of titration, the point of completion of a neutralization reaction.

8. Standardize the solution.

CAUTION: NEVER DISPOSE OF USED CHEMICALS IN DRAINAGE SYSTEMS OR TRASH RECEPTACLES. ALWAYS DISPOSE OF USED CHEMICAL IN APPROVED, MARKED CONTAINERS.

    a. Set up the titration apparatus
        (1) Verify that the burettes are clean and serviceable, to include tips and proper fitting stopcocks.
        (2) Rinse burettes several times with solution to be titrated.
    b. Charge burettes with solution. Zero burettes before titration. It is not necessarily the zero mL point, but some recorded level of reference.
    c. Titrate the primary standard in the Erlenmeyer flask with the solution in the burette.
        (1) Swirl the flask during titration to ensure homogenous mixing. Wash down the insides of the flask to ensure no titration solution is clinging to the sides of the flask.
        (2) Titrate slowly as the end point approaches.
        (3) Record the volume of solution used to reach the end point.
    d. Repeat the titration procedure at least two additional times.

9. Calculate the normality to four decimal places. Perform calculations for each titration using the following equation:

$$N = \frac{(W)\ (DFP)}{(MEW)\ (V)}$$

    Where:
    N = Normality of solution
    W = Weight of primary standard used in gr
    DFP = Decimal fractional purity of primary standard
    MEW = Mili-equivalent weight of primary standard
    V = Volume of solution used, mL

10. Obtain the average value of the normality titrated. If any solution differs from the means by +/- 0.0005N, rerun the titration process.

11. Label the standardized solution for identification. Include the date standardized and the normality.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDSs.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Cleaned and prepared the glassware. | ____ | ____ |
| 2. Determined the amount of solute needed to prepare a solution. | ____ | ____ |
| 3. Weighed a substance using the appropriate balance. | ____ | ____ |
| 4. Dissolved the measured solute. | ____ | ____ |
| 5. Selected a primary standard. | ____ | ____ |
| 6. Calculated the weight of primary standard required. | ____ | ____ |
| 7. Prepared the primary standard. | ____ | ____ |
| 8. Standardized the solution. | ____ | ____ |
| 9. Calculated the normality to four decimal places. | ____ | ____ |
| 10. Obtained the average value of the normality titrated. | ____ | ____ |
| 11. Labeled the standardized solution for identification. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

**Required**
FM 10-67-2

**Related**
ASTM STANDARDS
FM 3-100.4

**Employ Fire and Safety Measures**

**101-92L-1387**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, FM 10-67-1, FM 10-67-2, FM 3-100.4, and AR 385-10. During all testing procedures the petroleum laboratory specialist must be aware of all hazards, (especially fire) that may occur in a petroleum laboratory.

**Standards:** Soldier performs all steps necessary to identify and report fire hazards, as well as all other safety hazards to a supervisor; identifies and corrects oxygen leaks, keeps flammable materials from flame sources, properly stores chemicals, and dispenses of used or shelf life expired chemicals in accordance with standing operating procedure (SOP) and applicable publications.

**Performance Steps**

1. Identify fire hazards.
    a. Check for sources of ignition such as open flames, operating muffle furnaces, exposed resistance coil heaters, non-explosion proof switches, and non-explosion proof motors.
    b. Check for flammable liquids such as volatile petroleum products, solvents, and chemicals such as acetone and alcohol.
    c. Move flammable debris away from hazardous areas when possible.
        (1) Keep oily rags in a metal, airtight, closed container. Do not store oily rags in cabinets or drawers.
        (2) Limit the number of flammable substance at workstation.
        (3) Make certain that there are no open flame or exposed heating elements nearby when pouring highly volatile liquids.
    d. Use flammable liquids near a source of ignition ONLY if a test procedure requires it.

2. Identify the different types of fire extinguishers and the classes of fire they will extinguish.
    a. Soda-acid extinguisher: the most common type of water solution extinguisher that uses gas pressure as the expellant and is used for Class A fires only.
    b. Antifreeze extinguisher: contains a calcium chloride solution and is used for Class A fires.
    c. Loaded-steam extinguisher: charged with alkali-metal salt solution and other salts and used on Class A fires and small Class B fires.
    d. Carbon dioxide extinguishers - charged with carbon dioxide and used for Class B and C fires.
    e. Dry chemical extinguisher - the chief agent is sodium bicarbonate powder with additives that produce water repellency and free flow. Used for Class B and C fires.
    f. Purple K Extinguishers - the chief agent is potassium bicarbonate. Used for Class B and C fires.

3. Demonstrate knowledge or explain the procedures for extinguishing fires.
    a. Know location of fire extinguishers.
    b. Be familiar with the nature of petroleum and chemical and electrical fires.
        (1) Do not use water for extinguishing oil fires because it will spread the fire.
        (2) Do not use water on electrical fires because water is a conductor of electricity.

4. Observe all safety precautions.
    a. Always be mindful of test in progress.
    b. Do not attempt to perform tests simultaneously unless each test can be given the required attention.
    c. Whenever in doubt concerning any operation, consult the laboratory supervisor for advice.
    d. Do not attempt unauthorized shortcuts to save time.
    e. Wear goggles and rubber gloves when it is necessary to break up chemicals and handle acids and bases.
    f. Immediately rinse any contaminate from your skin and eyes.
    g. Do not handle mercury with your bare hands.

**Performance Steps**

h. Be familiar with the laboratory emergency response SOP in event emergencies.
i. When ending daily operations, make a thorough check of laboratory equipment to ensure no hazards may develop while the laboratory is unattended.

5. Identify and correct oxygen leaks.
   a. Check for leaks in an oxygen-carrying system by applying soapy water to joints and fittings.
   b. Listen for hissing sounds.
   c. Check unexplained drops in pressure.

6. Properly store chemicals and solvents.
   a. Store volatile materials in well ventilated areas.
   b. Store chemicals away from other chemicals with which they may react violently.
      (1) Store volatile acids separate from volatile bases, including weak acids and bases such as acetic acid and ammonium hydroxide.
      (2) Dispose of all unlabeled chemicals.
   c. Mark clearly with the word "POISON" all highly poisonous materials such as potassium cyanide, chloroform, and tetraethyl lead, and store them in locked containers, if possible.
   d. Report to supervisor highly poisonous materials on hand that are not needed.
   e. Store heavy and bulky containers of chemicals on or near the floor.

7. Dispense chemical reagents.
   a. Hold reagent bottle stoppers between fingers while pouring reagent. Never place the cap or stopper on a counter where it may come in contact with a contaminating agent.
   b. Close reagent and sample bottles tightly.
   c. Flush and dry the outside of engraved reagent bottles before returning them to the shelf.
   d. Wipe dry the outside of reagent bottles that have paper labels before returning bottles to the shelf.
   e. Always pour acid into water and never pour water into acid.
   f. Clean up chemical and liquid spills immediately.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Identified fire hazards. | ____ | ____ |
| 2. Identified the different types of fire extinguishers and the classes of fire they will extinguish. | ____ | ____ |
| 3. Demonstrated knowledge or explained the procedures for extinguishing fires. | ____ | ____ |
| 4. Observed all safety precautions. | ____ | ____ |
| 5. Identified and corrected oxygen leaks. | ____ | ____ |
| 6. Stored chemicals and solvents properly. | ____ | ____ |
| 7. Dispensed chemical reagents. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
| --- | --- |
| AR 385-10 | |
| FM 10-67-1 | |
| FM 10-67-2 | |
| FM 3-100.4 | |

**Employ Environmental Stewardship Measures**

**101-92L-1388**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given hazardous waste material or other waste material that might generate hazardous waste. Materials needed: FM 3-100.4, FM 10-67-2, material to clean up hazardous spills, material safety data sheets (MSDSs) for all hazardous materials in the workplace, State and local hazmat regulations, and installation SOP (ISCP). Upon assignment to a petroleum related facility, you are required to find ways to protect the environment, and react to potential or actual environment damage.

**Standards:** Soldier performs all necessary procedures to protect the environment in accordance with FM 3-100.4. The Soldier also disposes of all hazardous waste/materials in accordance with laboratory standing operating procedure (SOP), operation orders, local regulations, and/or host nation guidelines.

**Performance Steps**

1. Comply with environmental laws and local procedures for environmental protection.
    a. As part of unit in processing, read unit environmental SOP. Be alert for local laws which are different than those you are use to.
    b. Prevent environmental damage and pollution by applying environmental awareness to daily activities.
    c. Identify the environmental risks associated with individual and team tasks as identified by the appropriate MSDS.
    d. Support the Army's recycling program.
    e. Report hazardous material and waste spills immediately.
    f. Make sound environmental decisions in the absence of a supervisor or proper guidance by reviewing the following:
        (1) Training.
        (2) Guidance from the chain of command.
        (3) Concept of right and wrong.

2. Use all safety equipment required by local policy or law when handling hazardous materials and waste.
    a. Examine MSDS to determine specific hazards associated with hazardous materials.
    b. Identify local policies on the appropriate safety equipment for counteracting health hazards associated with hazardous materials.

3. Select correct handling procedures for materials and wastes.
    a. Consult MSDS for specific guidance on handling hazardous materials.
    b. Know local SOP for handling hazardous materials.

4. Maintain a clean and safe work area.
    a. Clean as you go to minimize spread of hazardous wastes.
    b. Dispose of hazardous wastes and related contaminated materials in accordance with local procedures in an environmentally safe manner. Do not throw hazardous materials in the trash or down the drain.

5. Prevent spills of hazardous substances.
    a. Continually inspect chemical and solvent containers for initial signs of leakage.
    b. Inspect testing equipment (hose connection, glassware) prior to use for serviceability.
    c. Use drip pan when refueling equipment (generator, water pump).
    d. Store waste products in clearly marked, sealable, leak-free containers.

NOTE: Containers should be as small as possible to minimize size of leaks (for example, do not use 600-gallon containers to store waste fuel if smaller containers are available and can be emptied often enough to support the mission).

**Performance Steps**

6. Follow correct procedures for responding to spills.

NOTE: Before beginning any operations involving petroleum products, have on hand equipment to contain and clean up spills. This includes items such as drip pans, sufficient size containers to hold any waste fuel generated, absorbents, shovels to dig up contaminated soil, containers to hold contaminated soil, and other contaminated materials.

   a. Cease operations immediately when a spill occurs.
   b. Take steps to minimize further spillage. Plug containers that are leaking and return to upright position.
   c. Begin cleanup immediately.
      (1) Apply absorbent to land-based spills.
      (2) Use appropriate available measures to remove waterborne spills.
         (a) Determine cleanup method to be used on waterborne spills by the type of product, where the spill occurs, weather conditions, and other special considerations (closeness to drinking water source, fishing grounds, wildlife habitats, bathing beaches, and recreational areas).
         (b) Contain the spill using floating booms, if available.
         (c) Remove product using chemical dispersants and approved absorbents.
      (3) Collect and turn-in contaminated soil and absorbents in approved containers in accordance with local policies.
   d. Conduct repairs or otherwise correct the problem that caused the spill.
   e. Report a spill to the chain of command and local environmental coordinator (as necessary per unit environmental SOP).

7. Report spills and other violations per local Installation Spill Control Plan (ISCP) and Spill Control Contingency Plan (SCCP).

8. Turn-in hazardous substances per local operating procedures.
   a. Consult unit hazardous lists and MSDS to determine if a material is hazardous and to determine any special handling requirements.
   b. Ensure hazardous substances are in durable, leak proof containers appropriate for the type of hazardous material.
   c. Ensure containers are labeled in accordance with local SOP.
   d. Contact SSA for turn-in procedures.
   e. Transport substances to turn-in point in accordance with hazardous material transporting procedures as outlined in unit SOP.

9. Demonstrate or explain conservation of resources.
   a. Recover usable items; recycle and reuse them whenever possible.
   b. Do not stockpile items, particularly hazardous material. Order only what is needed.
   c. Use nonhazardous substitutes for items whenever possible.
   d. Consolidate potentially environmentally damaging activities in one location to minimize damage.
      (1) Vary routes or training sites to preserve the land.
      (2) Change vehicle oil on a fleet of vehicles in one spot.
      (3) Practice water crossing techniques on dry land prior to crossing the actual water crossing site.

**Evaluation Preparation:** See condition and standard statements. Have all environmental guidelines and environment protection equipment and materials.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Complied with environmental law and local procedures for environmental protection. | ____ | ____ |
| 2. Used all safety equipment required by local policy or law when handling hazardous materials and waste. | ____ | ____ |
| 3. Selected correct handling procedures for materials and waste. | ____ | ____ |
| 4. Maintained a clean and safe work area. | ____ | ____ |
| 5. Prevented spills of hazardous substances. | ____ | ____ |
| 6. Followed correct procedures for responding to spills. | ____ | ____ |
| 7. Reported spills and other violations per local ISCP and SCCP. | ____ | ____ |
| 8. Turned in hazardous substances per local operating procedures. | ____ | ____ |
| 9. Demonstrated or explained conservation of resources. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| FM 10-67-2 | AR 385-10 |
| FM 3-100.4 | |

**Install Laboratory Equipment**

**101-92L-1389**

**Conditions:** As a petroleum specialist in a field or garrison environment, you are given an operational petroleum laboratory, materials and manuals needed: a constant temperature bath, thermoregulators with required replacement liquids, thermometers, and an oven manufacture's instruction for specific equipment, petroleum laboratory specialist are required to install and or adjust petroleum laboratory equipment to ensure proper testing procedures are maintained.

**Standards:** Soldier performs all steps in sequence which is required to install and adjust designated laboratory equipment in accordance with equipment manual.

**Performance Steps**

1. Install and adjust mercury-to-mercury regulator.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

   a. Inspect the thermoregulator.
      (1) Ensure there are no air bubbles in the mercury reservoir.
      (2) Make sure there are no breaks in the mercury columns.
      (3) Heat the mercury to rejoin it if bubbles or breaks are present.

CAUTION: NEVER HANDLE MERCURY WITH BARE HANDS. IF SPILLS OCCUR, ENSURE ADEQUATE VENTILATION IS PROVIDED. COVER SPILL WITH SULFUR. CLEAN UP THE MERCURY AND SULFUR TOGETHER AND PUT THEM IN A SUITABLY LABELED CONTAINER.

   b. Set the regulator.
      (1) Set a bath to the desired temperature using another regulator and standard thermometer.
      (2) Position the thermoregulator in the bath, ensuring the bath liquid level is above the mercury level of the regulator.
      (3) Make sure the mercury meets the contact leads of the regulator. Do the following if it does not:
         (a) Remove the regulator and heat gently in an upright position.
         (b) Turn the regulator horizontal with the expansion chamber tip in the mercury.
         (c) Allow the regulator to cool until the expansion chamber is filled.
      (4) Allow the regulator to cool in the bath for at least two minutes.
      (5) Remove the regulator from the bath. Invert and tap it against your hand to move the mercury into the expansion chamber.
      (6) Install the regulator and allow the temperature to become stable for at least two hours.
      (7) Test the performance of the regulator by observing the temperature using a standard thermometer.

2. Set a wire-to-mercury thermometer.
   a. Select the regulator based on desired temperature needed.
   b. Ensure the relay box is 50 microamperes or less current draw.
   c. Check the regulator to ensure the mercury column is not separated.
   d. Set the approximate temperature needed by turning the magnetic movable ring on the top and observing the pointer level.
   e. Mount the regulator about 1 inch from the heat source in the bath.
   f. Turn on the heat.
   g. Allow the bath to be stable for five minutes.
   h. Adjust the movable magnetic ring to adjust the temperature.
   i. Use a standard temperature to check the bath temperature.

NOTE: Always store thermoregulators vertically to maintain calibration and to prevent mercury spillage.

**Performance Steps**

3. Set oven temperature.
   a. Adjust rheostat clockwise to desired setting.
   b. Allow 1 hour for the temperature to stabilize.
   c. Using a standard thermometer, that has been calibrated and has the required range, observe the temperature of the oven.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Installed and adjusted a mercury-to-mercury regulator. | ____ | ____ |
| 2. Set a wire-to-mercury thermometer. | ____ | ____ |
| 3. Set the oven temperature. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| FM 10-67-2 | |

**Operate the Petroleum Quality Analysis System (PQAS)**

**101-92L-1395**

**Conditions:** As petroleum laboratory specialist, in a field or garrison environment, you are given an operational Petroleum Quality Analysis System (PQAS), TM 9-2330-392-14&P and all other necessary manuals, petroleum specialist is required to set up the laboratory to conduct testing procedures and perform preventive maintenance checks and services (PMCS) on all equipment.

**Standards:** Soldier operates the PQAS in accordance with TM 9-2330-392-14&P, use test equipment to perform test procedures in accordance with equipment manuals and American Standard Test Method (ASTM).

**Performance Steps**

1. Select a suitable site that provides the following:
    a. Ample space for maneuvering and assembling.
    b. Level, firm, well-drained terrain relatively free from surface rock and large stones.
    c. Accessible to tactical vehicles.
    d. Sheltered from high winds.
    e. Downstream from personnel assembly areas.

2. Setup the PQAS.
    a. Uncouple and position the trailer close to the PQAS, then secure and stabilize it in accordance with TM 9-2330-392-14&P.

WARNING: DO NOT PLACE ANY PART OF YOUR BODY UNDER THE TRAILER TONGUE WHILE IT IS BEING MOVED OR STATIONARY. LANDING WHEEL COULD COLLAPSE AND CAUSE SERIOUS INJURY OR DEATH.

    b. Position the PQAS on level terrain with sufficient room for the tent and boot wall.

NOTE: Use leveling devices to level the PQAS.

    c. Ground the PQAS using the following steps:

NOTE: The rod must be buried below the moisture level. If you cannot do this, replace the grounding rod with an 8-foot electrode.

        (1) Select a grounding site as close as possible to the PQAS.
        (2) Remove the grounding rods, driver/puller, and grounding cable from the trailer.
        (3) Remove any and all grease, paint, and oil from the rods.
        (4) Attach the first grounding rod to the driver/puller.
        (5) Drive the grounding rod into the ground for approximately 30 inches.

CAUTION: DO NOT ALLOW THE GROUNDING ROD TO ROTATE WHEN DISCONNECTING THE DRIVER/PULLER FROM IT. THE GROUNDING SECTIONS MUST REMAIN SCREWED TOGETHER TO ENSURE A GOOD ELECTRICAL GROUND.

        (6) Remove the driver/puller from the first grounding rod.
        (7) Repeat steps 3, 4, and 5 for the second and third grounding rod and drive the third rod into the ground until only 12 inches remains above the ground.
        (8) Remove the driver/puller from the third grounding rod and return it to the trailer.
        (9) Attach the grounding cable to the grounding rod and secure it with the clamp and screws.
        (10) Attach the other end of the cable to the PQAS shelter.
    d. Inspect the exterior of the PQAS and trailer for damages that may have occurred during movement or shipment. If any damages are found, report to supervisor.
    e. Roll up and secure the tunnel covers
    f. Connect the Auxiliary Power Unit (APU) fuel lines to the vehicle fuel tank connectors and the APU battery cable to the vehicle battery power connector.
    g. Release and lift power entry panel cover and check that the circuit breakers for the panel and the APU are in the 'OFF' position.

**Performance Steps**

h. Remove the connector plugs and connect the electrical cable to the power entry panel lower connector and the Electrical Control Unit (ECU) electrical cable to the panel's upper connector.
i. Install the APU exhaust pipe extension and attach the hooked end to the shelter roadside lift ring.

3. Assemble PQAS boot wall and Modular Command Post System (MCPS) tent.
   a. Remove the bootwall and tent components from the trailer.
   b. Unpack the tent and boot wall components and inspect them for general condition. Record deficiencies on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) and report to supervisor.
   c. Attach the bootwall to the PQAS.

WARNING: WHEN CLIMBING UP AND DOWN SHELTER STEPS, USE SUPPORT HANDLES OR STEP HANDHOLDS IN ALL CASES. FAILURE TO DO SO COULD RESULT IN SEVERE INJURY OR DEATH. A THREE POINT CONTACT MUST BE MAINTAINED AT ALL TIME WHILE ON THE SHELTER ROOF.

(1) Place the elastic end of the bootwall around the rear of the shelter roof and position the two pockets over the roof corners.

NOTE: The surface of the PQAS bootwall and the PQAS shelter have corresponding hook and pile strips. Make sure the strips are pressed firmly together to keep rainwater out and interior lighting in. Remove ladder before proceeding.

(2) From inside the bootwall, align the hook fastener on the upper bootwall flap with the pile fastener strip on the roof and press them together.
(3) Assemble the bootwall support beams and secure them to the bootwall with three wide hook and pile bands.
(4) Position the ends of the bootwall support beams on the two shelter brackets and secure them with the quick release pins.

   d. Raise and secure shelter roof.

(1) Remove the quick release pins that secure the locking bars to the four locking plate assemblies

CAUTION: USE BOTH HANDS TO HOLD POWER DRILL TO AVOID INJURY. DRILL HAS HIGH TORQUE. EXERCISE CARE WHEN RAISING THE ROOF. PERSONNEL SHOULD WATCH BOTH SIDES OF THE SHELTER FOR QUICK RELEASE PIN-HOLE ALIGNMENT.

(2) Use the ratchet to turn the drive gear fitting clockwise to raise the shelter roof slowly, watch the alignment of the quick release pin holes and stop when the holes are aligned
(3) Install the quick release pins to secure the locking bars to the locking plate assemblies.

NOTE: Insert the quick release pins from front to rear.

(4) From inside the bootwall, loop the buckle straps around the locking bars, fasten quick release pins, and draw buckle straps snugly.
(5) From the outside of the bootwall, stretch the elastic end of the bootwall around the lower rear corners of the shelter.
(6) From inside the bootwall, align the hook fasteners strips of the side flaps of the bootwall with pile fastener strip on the rear of the shelter roof and shelter and press them together. Ensure both side flaps are secured under the upper one.
(7) Align the hook fastener strip on the bootwall skirt with pile fastener strips on the lower rear surface of the shelter and press them together.

   e. Secure the bootwall to the tent.

NOTE: Refer to TM 10-5410-229-13&P, position and assemble the tent without the rear wall prior to performing this step.

(1) From inside the tent, align the tent with the bootwall and fasten to roof cap assembly with quick release fasteners.

NOTE: Keep hook and pile fasteners apart until quick release fasteners are secured.

(2) From inside the tent, starting at the center of the bootwall, line up the pile strip portion of the hook and pile fastener on bootwall and the hook strip portion of the roof cap assembly and press together, working toward end to prevent wrinkles.

**Performance Steps**

(3) From outside the tent, overlap bootwall at the corners of each outside tent wall, align them and press them together.

NOTE: Strap assemblies always line up with corresponding strap assemblies.

(4) Fasten row of quick release fasteners on both the inside and outside corners of each wall and draw buckle straps tight.
(5) Pull roof cap assembly corner flaps down and press hook and pile fasteners together tightly to keep rainwater out and interior lights in.
(6) Roll up and secure boot wall flap to provide access to the PQAS shelter.
(7) Install ladder and handrail, level and secure in position to provide stable footing for entry and exit of the shelter.

4. Start the PQAS.

WARNING: DO NOT APPLY ELECTRICAL POWER TO THE SHELTER INTERIOR COMPONENT OR CIRCUIT BREAKERS BEFORE SUCCESSFULLY PURGING THE SHELTER. AN EXPLOSION COULD OCCUR WHICH COULD RESULT IN SERIOUS INJURY OR DEATH.

a. Ensure fuel line connectors and battery cables are connected, check that circuit breakers on the power entry panel are in the 'OFF' position, and recheck that the PQAS is still properly grounded.

NOTE: If shore power is used, follow the grounding procedure and ensure that the power cable is hardwired to a 120/240 VAC source.

b. Turn emergency stop button to reset.
c. Press standby touch pad to 'ON'.

NOTE: If the temperature is below 5 degrees F (-15 degrees C), press and hold 'Cold Start' for 20 seconds and keep touchpad pressed while performing next step.

d. Momentarily press 'Generator' touchpad to start APU motor. If motor does not start within 20 seconds, release button, wait a minimum of 60 seconds, and repeat.

NOTE: A delay of a few seconds may be experienced from the time the generator touchpad is pressed until the motor start depending on the ambient temperature. Also, the motor will start at a relatively low speed and will increase to normal speed of about 3,400 to 3,500 RPM.

e. Move ECU fresh air intake lever to 'OPEN' position and move the shelter return air valve to 'PURGE' position.

NOTE: The purge cycle can be performed with either APU or Shore power. The appropriate electrical cable must first be connected to the power entry panel.

f. Open air vent by securing the air vent baffle in the lowest position.
g. Unscrew shelter purge port plug.
h. Set ECU control panel changeover switch to 'O' position and the heating power selection switch to the 'I' position.

NOTE: The purge button will illuminate whenever the ECU fan is operational, whether purging the shelter or heating or cooling the shelter.

i. Press purge button.
j. Unscrew personnel door port plug and insert Probe Gas Analyzer (PGA) tube assembly into port.

NOTE: The PGA probe must remain inserted into the shelter for a minimum of two minutes to properly sense the air/gas condition in the shelter. Alarm will sound if air is unsafe.

k. Install personnel door port plug when a favorable reading is determined by the PGA.
l. Switch APU circuit breaker to the 'ON' position.
m. Move the shelter return air lever to 'Normal' position.
n. Set ECU fresh air intake lever to desired position.
o. Move the changeover switch to desired position ('1' for heating and '2' for cooling).
p. Select and set the desired temperature.
q. Set shelter power entry circuit breaker to the 'ON' position.

5. Perform petroleum analysis test procedures in accordance with appropriate test procedures found in ASTM and MIL-STD-3004A.

6. Perform during-operations PMCS on the PQAS and tent assembly.

**Performance Steps**

7. Shutdown the PQAS.

CAUTION: FAILURE TO COMPLETE ALL STEPS OF THE ECU/APU SHUTDOWN PROCEDURE CAN RESULT IN DAMAGE TO THEM. THE APU CIRCUIT BREAKER AND SHELTER MAIN CIRCUIT BREAKER WILL AUTOMATICALLY TRIP TO THE 'OFF' POSITION WHENEVER APU OR SHORE POWER IS REMOVED OR DISCONNECTED FROM THE POWER ENTRY PANEL DO NOT SWITCH THEM OFF.

   a. Remove all electrical loads by turning off all power using equipment in the PQAS.
   b. Move heating power selection switch to '1' position and the changeover switch to the '0' position.

CAUTION: ALLOW APU MOTOR TO RUN FOR APPROXIMATELY 3 MINUTES AFTER REMOVAL OF LOAD TO PREVENT DAMAGES FROM EXCESS HEAT.

   c. Press Generator touchpad to stop APU, when generator light extinguishes, press Standby.
   d. Press emergency stop button.

8. Perform after-operations PMCS on PQAS and tent assembly.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected the site. | ____ | ____ |
| 2. Setup the PQAS. | ____ | ____ |
| 3. Assembled PQAS bootwall and MCPS tent. | ____ | ____ |
| 4. Started the PQAS. | ____ | ____ |
| 5. Performed petroleum analysis test procedures in accordance with appropriate test procedures found in ASTM and MIL-STD-3004A | ____ | ____ |
| 6. Performed during-operations PMCS on PQAS and tent assembly. | ____ | ____ |
| 7. Shutdown the PQAS. | ____ | ____ |
| 8. Performed after-operations PMCS on PQAS and tent assembly. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | MIL-STD-3004A |
| TM 9-2330-392-14&P | |

**Perform Standard Test Method for Acidity in Aviation Turbine Fuels (D-3242)**

**101-92L-1398**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, given petroleum laboratory, and American Standard Test Method (ASTM D-3242) standards, FM 10-67-2, petroleum products received by petroleum specialist are tested based on product specification.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM D-3242, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.
    a. 25 mL buret graduated in 0.1mL, or 10 mL buret graduated in 0.05 mL.

NOTE: An automated buret capable of delivering 0.05 mL or smaller increments can be used; however, the precision may be different.

    b. Clean the apparatus in accordance with laboratory SOP instructions for cleaning glassware.

2. Select and prepare the reagents.
    a. Use only reagent grade chemicals (reagents shall conform to the specifications of the committee on analytical reagents of the American Chemical Society).
    b. Use distilled water in accordance with specification ASTM D-1193.
    c. p-Naphtholbenzein indicator solution.
        (1) See Annex A.1 of the ASTM for specification.
        (2) Prepare solution of p-Naphtolbenzein in titration solvent equal to 10 (+ or -) 0.01 g/L.
    d. Nitrogen, dry-type, carbon dioxide-free.

WARNING: NITROGEN GAS USED IS COMPRESSED UNDER HIGH PRESSURE, IT REDUCES OXYGEN AVAILABLE FOR BREATHING.

    e. Standardize potassium hydroxide solution (standard alcoholic 0.01N).
        (1) Add 0.6 g of solid KOH to approximately 1 liter of anhydrous isopropyl alcohol (containing less than 0.9 percent water) in a 2-L Erlenmeyer flask.

WARNING: THE ABOVE MIXTURE IS HIGHLY CORROSIVE TO ALL BODY TISSUE, BOTH IN SOLID AND SOLUTION FORM. IT IS FLAMMABLE, KEEP AWAY FROM SPARKS AND OPEN FLAMES, VAPOR IS HARMFUL.

        (2) Gently boil the mixture for 10 to 15 minutes, while stirring to prevent the solids from forming a cake at the bottom.
        (3) Add at least 0.2 g of barium hydroxide (Ba(OH))2 and gently boil again for 5 to 10 minutes.

WARNING: POISONOUS IF INGESTED. STRONGLY ALKALINE, CAUSE SEVERE IRRITATION PRODUCING DERMATITIS.

        (4) Cool to room temperature and allow to stand for several hours.
        (5) Filter the supernatant liquid through a fine sintered glass or porcelain filtering funnel. Avoid unnecessary exposure to carbon dioxide during filtration.
        (6) Store the solution in a chemically resistant dispensing bottle out of contact with cork, rubber, or saponifiable stopcock lubricant and protected by a guard tube containing soda lime.

NOTE: The standard alcoholic solutions should be standardized at temperatures close to those employed in the titration of samples.

    f. Standardize potassium hydroxide solution (standardize frequent enough to detect changes of 0.0002N).
        (1) Weigh approximately 0.02 g of potassium acid phthalate, which has been dried for at least 1 hour at 110 (+, or - 1 degree C).
        (2) Dissolve the potassium phthalate in 40 mL (+, or - 1mL) and free of (CO)2.

**Performance Steps**

(3) Titrate with KOH alcoholic solution to either of the following:
(a) For electrometric titration, titrate to a well defined inflection point at the same voltage as that of the buffer solution
(b) For calorimetric titration, add 6 drops of phenolphthalein indicator solution and titrate to the appearance of a permanent pink color.

g. Perform blank titration on the water used to dissolve the potassium acid phthalate.
h. Calculate the normality using the following equation:

$$\text{Normality} = \frac{Wp \times 1000}{204.23 \times V - Vb}$$

Where:
Wp = weight of potassium acid phthalate in g,
204.23 = molecular weight of the potassium acid phthalate,
V = volume of titrant used to titrate the salt to the specific endpoint in mL, and
Vb = volume of titrant used to titrate the blank in mL.

i. Dissolve 0.1 g (+, or - 0.01) of pure solid phenolphthalein in 50 mL of water, free of (CO)2, and 50 mL of ethanol.
j. Add 500 mL of toluene and 5 ML of water to 495 mL of anhydrous isopropyl alcohol (titration solvent).

WARNING: FLAMMABLE, VAPOR HARMFUL, KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.

3. Perform the test procedures.
a. Introduce 100 (+, or -) 5g of the sample weighed to the nearest 0.5g, into a 500mL wide-mouth Erlenmeyer flask.
b. Add 100 mL of the titration solvent and 0.1 mL of the indicator solution.
c. Introduce nitrogen through a 6 to 8 mm outside diameter glass tube to a point within 5 mm of the flask bottom at a rate of 600 to 800 mL/minute.
d. Bubble the solution for 3 minutes (+, or -) 30 seconds with occasional mixing.

WARNING: THE VAPOR FROM THIS TREATMENT CONTAINS TOULENE AND SHOULD BE REMOVED WITH ADEQUATE VENTILLATION.

e. Continue the nitrogen addition and titrate without delay at a temperature below 30 degrees C.
(1) Add 0.01 N KOH solution increments.
(2) Swirl to disperse until a green endpoint is reached that persists for 15 seconds.

NOTE: The temperature can be measured by any suitable temperature measuring device.

f. Perform a blank titration on 100mL of the titration solvent and 0.1 mL of the indicator solution, then repeat step (e).

NOTE: Because the acid number can vary while the Quality Control sample is in storage, an out-of-control situation may arise, which directly relates to the stability of the QC sample. See ASTM, Section 9, for more information on Quality Control Checks.

4. Perform the calculations.
a. Calculate the acid numbers as follows:

$$\text{Acid Number, mg of KOH/g} = [(A-B)\ N \times 56.1] / W$$

Where:
A = KOH solution required for titration of the sample (mL),
B = KOH solution required for titration of the blank (mL),
N = Normality of the KOH solution, and
W = Sample used, (g).

**Performance Steps**

5. Report the result to the nearest 0.001 mg KOH/g as Acid Number.
6. Perform PMCS on all apparatus and equipment used in the ASTM.
   a. Clean and dry all glassware in accordance with laboratory SOP.
   b. Perform necessary repairs on equipment or report damages to supervisor.
7. Give test results and deficiencies to supervisor.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents. | ____ | ____ |
| 3. Performed the test procedures. | ____ | ____ |
| 4. Performed the calculations. | ____ | ____ |
| 5. Reported the result to the nearest 0.001mg KOH/g as Acid Number. | ____ | ____ |
| 6. Performed PMCS on all apparatus and equipment used in the ASTM. | ____ | ____ |
| 7. Gave test results to immediate supervisor. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 3-100.4 |
| FM 10-67-2 | |

**Perform Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter (D-4052)**

**101-92L-1399**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, all necessary manuals and materials, upon receipt of petroleum products laboratory specialist is required to conduct testing procedures based on product specification and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the American Standard Test Method (ASTM) D-4052, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Prepare the apparatus.

WARNING: UNPLUG THE METER FROM THE WALL OUTLET PRIOR TO PERFORMING ANY ELECTRICAL SERVICE ON IT. FAILURE TO DO SO COULD RESULT IN ELECTRIC SHOCK AND OR FIRE DAMAGES.

   a. Calculating Density Analyzer Setup.
      (1) Remove four (4) screws and the rear panel to gain access to the three oscillation tube locking screws used for transportation. Remove the three (3) oscillation tube locking screws and retain screws for future use. Replace the rear panel and four (4) screws.
      (2) Turn on the power to the instrument. The instrument will momentarily display the software version then show 'Wait for Ready', which indicates the instrument cell is coming up to temperature. Allow the instrument to warm up for 20 minutes before calibrating or analyzing samples.
      (3) When the cell is up to temperature, it is ready for use. 'No calibration' will be displayed if the instrument has not been calibrated before or if the 'Memory clear' function has been performed. Perform the calibration procedure once per day or whenever a move has taken place. If calibration has been performed, 'Ready' will be displayed and analysis of samples can proceed.

2. Select and prepare reagents and materials.
   a. Water, re distilled, freshly boiled and cooled reagent water for use as a primary calibration standard.
   b. Acetone, for flushing and drying the sample tube.

WARNING: ACETONE IS EXTREMELY FLAMMABLE, DO NOT USE NEAR OPEN FLAME OR HEAT SOURCE.

   c. Dry Air, for blowing the oscillator tube.

3. Perform the test procedures.
   a. Press 'Method' key. The list of methods (0-9) will be displayed.
   b. Select method 1 (one) for JP-8 fuel analysis or method 2 (two) for diesel analysis. See measuring parameters setup for method parameters.
   c. Fill 10 mL syringe with sample.
   d. Insert the syringe tip into the sample outlet fitting. This fitting is the lower of the two cell fittings. The upper is the cell outlet.
   e. Place the end of the outlet tube into a waste beaker.
   f. Fill the measuring cell by discharging approximately 3 mL of sample from the syringe. Be careful not to allow any air to be discharged into the measurement cell while filling. Leave the syringe attached to the inlet.
   g. Press the 'Measure' key. The display will flash showing 'Measuring'.
   h. Read the result from the display when the audio alarm sounds.

**Performance Steps**

4. Report the test result shown on the display to your supervisor.

5. Perform PMCS.

NOTE: PMCS consist of checking to make sure the analyzer is without any physical or mechanical defects, cleaning the sample cell, and preparing the instrument for the next sample or for storage.

a. To clean the cell in preparation for another test or shutdown, do the following:
   (1) Draw the sample out of the cell using the syringe still attached to the cell inlet and then remove the syringe.
   (2) Fill a 10 mL syringe with 6 mL of acetone, attach it to the inlet of the sample cell, and discharge the contents through the cell.
   (3) Empty the cell by drawing the acetone out of the cell using the syringe.
   (4) Connect the dry air tube from the dry air outlet to the inlet (lower fitting) of the sample cell.
   (5) Press and hold the 'Pump' key for approximately 2 seconds.
   (6) Observe 'Purge Checking' displayed on the screen. the cell is being purged with dry air and will automatically shutoff when the cell is dry.
   (7) Observe 'Ready' displayed when the pump is dry. Pump shutoff, an alarm sound and 'Ready' will be displayed.

NOTE: Before transporting the meter, remove the four (4) screws and rear panel, install and tighten the three (3) oscillation tube locking screws, and replace the rear panel and four (4) screws.

b. To calibrate, use the following procedures:
   (1) Fill a 10 mL syringe with 6 mL of acetone and connect it to the cell inlet (lower fitting).
   (2) Discharge the acetone through the cell, then draw the solvent back into the syringe to empty the cell.
   (3) Connect the dry air tube from the dry air outlet to the inlet (lower fitting) of the sample cell.
   (4) Press and hold the pump key for 2 (two) seconds until the 'Purge Checking' display is shown.
   (5) Release the 'Pump' key and allow the instrument to dry the sample cell.
   (6) After the alarm Press 'Method' key and select '0', then the 'Enter' key.
   (7) Press 'Measure. Para' and set stability and limit to zero (0). Also set the sequence to 'Off'. Press the 'Reset' key.
   (8) Press the 'Calib.' key.
   (9) When the display key show 'Press Enter Key' and 'Purge OK?' press 'Enter'.
   (10) The display will show 'Calibrating'.
   (11) Wait for alarm 'Set Water and Press Enter Key' will sequence on the screen.
   (12) Fill a syringe with 6 mL reagent grade water and attach it to the inlet side of the sample cell.
   (13) Inject 2 mL of the water into the cell, wait 10 (ten) seconds, and inject another 2 mL through the cell. Do not remove the syringe from the cell inlet until calibration is complete.
   (14) Press 'Enter', the instrument will now perform the water adjustment and will display 'Calibrating'
   (15) At the end of the water adjustment, the display will show 'Calibration OK' and the calibration factor will be shown on the right side of the screen.
   (16) Draw the water back through the syringe to empty the cell then remove the syringe form the inlet fitting.
   (17) Repeat steps 1 (one) through 5 (five) above to clean and dry the cell.
   (18) Press the 'Reset' key . The instrument is now ready for the next sample analysis.

c. Complete "Measuring Parameters Setup".
   (1) Press 'Method' key. The list of methods (0-9) will be displayed.
   (2) Select the method number you want to setup then press 'Enter'.
   (3) Press 'Meas. Para.'. The measurement parameter screen will be displayed and the method name will be highlighted.
   (4) Press the 'Clear' key twice to clear the method name.

NOTE: The display key acts as a toggle, switching between functions.

   (5) Enter the method name by using the alpha/numeric keypad.

**Performance Steps**

(6) Press 'Enter' when the method name is correctly displayed as follows:
Method Number 0 = CAL
Method Number 1 = JP-8
Method Number 2 = DIESEL
(7) Set 'Measurement Temp.' to 15.00 degrees Celsius for all methods.
(8) Set 'Stability' to '0' for all methods.
(9) Set 'Time Limit' to '0' seconds for alls methods.
(10) Set 'Sequence' to 'Off' for all methods.
(11) Set 'Calib.' to 'Air & Water' for all methods.
(12) Enter all measurement parameters, highlight 'Exit:', then Execute on the second screen and press the 'Enter' key.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Prepared the apparatus by calculating density analyzer setup. | ____ | ____ |
| 2. Selected and prepared reagents and materials. | ____ | ____ |
| 3. Performed the test methods. | ____ | ____ |
| 4. Reported the test result shown on the display to your supervisor. | ____ | ____ |
| 5. Performed PMCS. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 3-100.4 |
| | MIL-STD-3004A |

**Perform Standard Test Method for Calculated Cetane Index by Four Variable Equations (D-4737)**

**101-92L-1400**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given an operational petroleum laboratory and all necessary manuals and materials, upon receipt of petroleum sample you the laboratory specialist is required to conduct testing procedures on petroleum products based on product specification and special instructions

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the American Standard Test Method (ASTM D-4737), performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the material.
    a. Programmable calculator or computer.
    b. Nomograph.

2. Calculate or Interpret the results.

NOTE: These calculations and/or interpretation, requires knowledge of the results of ASTM D-86 and ASTM D-1298 performed on the same product and same sample source.

    a. Compute the calculated cetane index by four variable using the equation found in ASTM D-4737, Section 3.
    b. Interpret the CCI from the Nomograph similar to those shown in ASTM D-4737, Figures 1, 2, and 3.

NOTE: These procedures are not applicable to fuels containing additives for raising the cetane number, pure hydrocarbons, nor to non-petroleum fuels derived from coal. Errors may occur if applied to residual fuels or crude oils.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared material. | ____ | ____ |
| 2. Calculated or interpreted the results. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 3-100.4 |

**Perform Standard Test Method for Lead and Sulfur in Fuels by X-Ray Spectroscopy**

**101-92L-1401**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given an operational petroleum laboratory and all necessary equipment, manuals and materials; upon receipt of petroleum products, you are required to conduct testing procedures based on product specification and special instructions.

**Standards:** Soldier performs all steps needed to analyze a gasoline sample and determine the amount of lead present in the fuel in accordance with equipment manual and American Standard Test Method (ASTM) D-5059, and performs preventive maintenance checks and services (PMCS) on all equipment.

**Performance Steps**

1. Prepare the apparatus.
    a. Power up the X-Ray Spectrometer.
    b. Wait a minimum of 30 minutes after spectrometer power-up.

2. Check the calibration.

NOTE: This procedure must be performed after every power-up of the X-Ray spectrometer.

    a. Press 'Select Mode'.
    b. Enter the corresponding number representing sulfur and press enter.
    c. Press the 'Sample ID' and enter the 'Sulfur standard' by using the 'Shift Lock' key and the letters of the keyboard then press enter.

NOTE: Position the standard so that the permanent marker line face to the front of the instrument and in line with the screw holding the window film at the '6:00 o'clock' position.

    d. Place the appropriate solid standard in the instrument for analysis.
    e. Press 'Count time' and enter 100, then press enter.
    f. Press 'Analyze'.
    g. Compare the analysis results obtained in step (f) with the allowable range posted on the top of the instrument.

NOTE: The analysis result must be within the posted range to be correctly calibrated. If the analysis is not within these limits, the instrument must be curve-corrected using the STDZ curve correction procedure before samples can be analyzed.

    h. Repeat steps a through g, substituting the number for lead in step b and 'Lead std' in step c to check the lead curve.

3. Analyze the fuel sample.
    a. Fill an X-Ray sample cup 1/2 to 2/3 full with the sample to be analyzed.
    b. Tear off a two inch piece of Mylar film and place it over the open end of the sample cup containing the sample.

NOTE: Minimize wrinkling of the film when securing it to the sample cup.

    c. Place the sample cup locking ring over the mouth of the sample cup and press down securing the film to the cup.
    d. Place the sample cup over the X-Ray window of the spectrometer with the film side down.
    e. Press 'Select Mode'.
    f. Enter the number corresponding to the type of fuel being analyzed and press enter.
    g. Press 'Count Time' and enter 100.
    h. Press 'Enter' followed by 'Sample ID'.
    i. Enter the sample ID, using the keypad.
    j. Press 'Enter', followed by 'Analyze'.

NOTE: The instrument will analyze the sample and print the result.

    k. Annotate the result and report to supervisor.

**Performance Steps**

4. STDZ Curve Correction Procedure.

NOTE: Perform this step when regular calibration yield results outside tolerable range, as well as after movement or initial receipt of instrument.

a. Press 'Count Time'.
b. Enter the appropriate number for sulfurs, or lead curve correction, and press 'Enter'.
c. Press 'Count Time'.
d. Key in 240 and press 'Enter'.
e. Press STDZ.
f. At the prompt position solid standard (sulfur or lead) and press 'Analyze'.

NOTE: the instrument will now analyze the standard and correct the curve.

g. Repeat checking the calibration (2); [steps (a) through (g)] to verify that the curve has been successfully corrected.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Prepared the apparatus. | ____ | ____ |
| 2. Checked the calibration. | ____ | ____ |
| 3. Analyzed the fuel sample. | ____ | ____ |
| 4. Performed STDZ Curve Correction Procedure. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 3-100.4 |

**Perform Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method) (D-5972)**

**101-92L-1402**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given a petroleum laboratory and all necessary materials and manuals, upon receipt of petroleum products you are required to conduct testing procedures based on product specification and special instructions.

**Standards:** Soldier performs all necessary steps to determine the freezing point of an aviation fuel sample in accordance with American Standard Test Method (ASTM) D-5972 and product specification and performs preventive maintenance checks and services (PMCS) without causing harm to personnel, equipment, and the environment.

**Performance Steps**

1. Prepare the apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of the fire extinguishers is readily available and keep all exits clear. Perform only one test at a time. Follow the procedures as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Power up the Freeze Point analyzer.

NOTE: The instrument will go through a self-test mode. Do not interrupt the self-test.

   b. At the prompt 'Press FINISH to continue', press finish.
   c. Unlock the test chamber.
      (1) Move the locking lever to the right.
      (2) Open the chamber.
   d. Clean the test chamber.
      (1) Transfer a 150 uL sample, using the 150 uL pipette to the test chamber.

CAUTION: DO NOT ALLOW THE PIPETTE TIP TO CONTACT THE BOTTOM OF THE TEST CHAMBER. THIS COULD SCRATCH THE CHAMBER WINDOW.

      (2) Mop the test chamber with a cotton swab and lightly rub the chamber to hasten the drying process. Repeat once.

2. Perform sample analysis.

NOTE: When transferring the sample, remove the fuel adhering to the outside of the pipette by wiping with a tissue prior to discharge into the test chamber.

   a. Transfer a 150 ul sample for analysis, using the pipette, to the test chamber.

CAUTION: AIR BUBBLES WILL INTERFERE WITH THE FREEZE POINT DETECTION. REMOVE ANY AIR BUBBLES WHICH MAY BE PRESENT IN THE SAMPLE CHAMBER; 'POP' THE PIPETTE, WHILE BEING CAREFUL NOT TO TOUCH THE CHAMBER WINDOW.

   b. Gently close the chamber lid and lock it in place by moving the locking lever to the left.
   c. Verify that the 'preheat value is 'OFF', and the 'Temp.Unit' value is 'C'. Refer to setup procedure if the values are not displayed.
   d. Press 'Run' to begin the analysis
   e. Read the results from the display after the alarm sounds.

CAUTION: DO NOT OPEN THE TEST CHAMBER UNTIL THE ALARM STOPS. THIS SIGNIFIES THE TEST CHAMBER IS AT AMBIENT TEMPERATURE. IF THE CHAMBER IS OPENED BEFORE IT HAS REACHED AMBIENT TEMPERATURE, THE RESULTING MOISTURE CONDENSATION CAN CAUSE INTERFERENCE IN SUBSEQUENCE ANALYSES.

3. Clean the test chamber.
   a. Unlock the test chamber.
   b. Remove the sample residue by repeating step 1d(2) above.

NOTE: Moisten a cotton swab with heptane and clean the test chamber and window if preparing the instrument for transport or storage.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Prepared the apparatus. | ____ | ____ |
| 2. Performed the sample analysis. | ____ | ____ |
| 3. Cleaned the test chamber. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2<br>FM 3-100.4<br>MIL-STD-3004A |

**Perform Standard Test Method for Kinematic Viscosity (D-445/D-446)**

**101-92L-1404**

**Conditions:** As a petroleum specialist given an operational petroleum laboratory in a field or garrison environment, materials and manuals needed, sample for testing, product specification, American Standard Test Method (ASTM) D-445, D-446, and D-7042, a hazardous materials spill kit, and a maintained file of material safety data sheet (MSDS) for all hazardous materials present in the workplace. Soldier receives petroleum products and conducts testing procedures based on product specification and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performs preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of the fire extinguishers is readily available and keep all exits clear. Perform only one test at a time. Follow the procedures as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

   a. Viscometers - use only fully annealed borosilicate calibrated glass capillary type viscometers, capable of measuring kinematic viscosity within limits of precision given in the ASTM. Select appropriate viscometers by product specification and kinematic viscosity range listed in ASTM D-446, Figure A1-1.
   b. Viscometer holders - enables viscometers that have the upper meniscus directly above the lower meniscus to be suspended vertically within 1 degree in all directions
   c. Temperature controlled bath - use a transparent liquid bath of sufficient depth.
   d. Temperature measuring device in the range of 0 to 100 degrees C.
   e. Timing device - use any timing device that can take readings with a discrimination of 0.1 second or better.

2. Select and prepare reagents.
   a. Sample solvent - completely miscible with the sample. Filter before use.
   b. Drying solvent - acetone is suitable
   c. For residual fuels, a prewash with an aromatic solvent such as toluene or xylene may be used
   d. Water - deionized or distilled and conforming to ASTM D-1193. Filter before use.

3. Perform the test procedure for transparent and opaque liquids.
   a. Select a calibrated viscometer of known viscometer constant.
   b. Mount viscometers in the bath and determine the flow times of the oil in accordance with ASTM D-445. Repeat the procedure again to obtain a second flow time.

4. Calculate the viscosity in accordance with ASTM D-446.

NOTE: Calculate the kinematic viscosity (v), from the measure flow time (t), and the viscometer constant (C) by means of the following equation.

$v = C(t)$

Where:
v = kinematic viscosity
C = calibration constant of the viscometer, and
t = mean flow time, s.

**Performance Steps**

5. Report the test results. Report the kinematic viscosity to four significant figures, together with the temperature.

6. Perform all cleaning and drying procedures in accordance with test standards.

CAUTION: MAKE SURE VISCOSITY UNIT IS DRY PRIOR TO USE.

7. Select and prepare apparatus for automatic ASTM D-7042.

NOTE: Set up Julabo F12-MC Chiller for operation of the SMV 3000.

a. Turn on SVM 3000 and let it go through the self test and initialization procedure. Turn on DMA 4500 and let it go through the self-test and initialization procedure. This will take approximately 10 to 15 minutes. ("Attemperating" is displayed during this process.
b. The SVM 3000 is ready for measurement after the start up procedure show the "measuring window".
c. The DMA 4500, when attemperating is finished, perform a density check measurement using TOLUENE once a week. Select MENU (soft key under Menu) Arrow down to ADJUSTMENT and press left turn key. Arrow down to DENSITY CHECK and press left turn key, arrow down to DENSITY CHECK SETTING press left turn key. Enter the recommended settings for TOLUENE.
d. Select check density and press left turn key. Using a 10mL disposable syringe, draw 1-2 mLs of TOLUENE into the syringe. Expel TOLUENE into the appropriate waste container.
e. Fill the 10mL disposable syringe with TOLUENE; remove bubbles and connect the syringe to the sample filing port on the SVM 3000, fill the cell without excessive pressure. Watch for the TOLUENE to exit the SVM 3000 and enter the DMA 4500 and exit into the waste container.

NOTE: The temperature of the SVM 3000 must be 20 degrees Celsius or higher. Leave the syringe in the sample port in order to prevent leakage.

f. Check measuring cell for bubbles. Select CHECK DENSITY to start and follow steps on display screen. If measured density is within permitted range, the display will show "density check OK". If NOT OK is displayed, perform the cleaning the cells process.

NOTE: The density check must be performed once a week.

g. Once the results are OK, Press soft key under SAVE. Press NO if screen ask to print results.

8. Fill a clean syringe for ACETONE and expel into sample port. Place pump hose form DMA 4500 in sample port on SVM 3000 and press PUMP on DMA 4500. At the top left corner of the screen, the Pump icon will flash when the pump is in use. Let pump run for 2 minutes. Pump will automatically shut off and cell will be dry and ready for use.

9. Using the DMA 4500, activate the FUEL OIL method by pressing the soft key under METHOD and using the up and down arrows to select FUEL OIL and then press left turn key.

10. Set the temperature on SMV 3000 by the fuel that you are testing.

a. JP-8, JetA, JetA-1, JP 5-20 degrees Celsius. Fill a syringe with acetone and expel into the sample port SMV 3000. Remove syringe, place the air pump hose from the DMA 4500 into the sample port and press PUMP on the DMA 4500. Pump will run for 2 minutes.
b. Remove the stopper from the connection for filling the external rinse. Fill the syringe with acetone and expel into the connection for filling the external rinse. Remove syringe. Place the air pump from the DMA 4500 into the connection for filling the external rinse and press PUMP on the DMA 4500. Allow pump to run for 2 minutes. Remove the air hose and replace the stopper.
c. Diesel: 40 and 100 degrees Celsius. From the "measuring window" press the SET key to change to the "various settings" menu. Press the right arrow one time or until the menu displays SET TEMPERTURE and press ENTER to change the temperature. Use the up and down arrows to change the number and the left and right arrows to move to the next digit. Press ENTER.

**Performance Steps**

11. Refresh the measuring window by pressing ESC. Allow the instrument to come to the set temperature. Viscosity is now ready to make determination of the desired temperature.

NOTE: If there are drastic temperature changes, repeat steps for setting temperatures prior to running a viscosity measurement.

NOTE: If the display on the svm 3000 is 'asleep' press the ESC button one time to get the measuring window. If the display on the DMA 4500 is 'asleep' press the Light button once.

12. Locate a 10mL disposable syringe. Draw 1-2 mLs of sample into the syringe. Expel fuel into a waste fuel container.

13. Fill the 10mL disposable syringe of a test sample. Remove bubbles if necessary. Connect the syringe to the sample filling port (top right hole on port), fill the cell without pressure until you see sample exit the SVM 3000 and enter DMA 4500 and exit into the waste container. Leave syringe connected to the port and PRESS start for about 10 seconds. This improves the prewetting of the measuring cell with the sample.

14. Press START to stop the motor. Slowly push another 1-2 mLs into the cell. Make sure there are no bubbles in the cell and press START to begin measurement. Press the soft key under START on the DMA 4500 to start the density measurement.

15. Once measurements are completed the SMV 3000 will have diamonds blinking next to result valid. Ensure the results "ny" line transmits to the computer. DMA 4500 will beep and the result will flash on the screen.

NOTE: If there are no more samples to be run at -20°C, set the temperature of the SMV to at least 20° C. Always complete the drying process in step 10 prior to setting the temperature of the SVM 3000 to -20° C.

16. Cleaning the cells at the end of the day.
    a. Using an empty syringe, pull plunger back filling with air, connect syringe to the sample port, and expel air smoothly through the cell until there isn't anymore sample in the waste hose. OR connect the air hose from the DMA 4500 to the filling port on the SVM and press PUMP to push out the sample. Press PUMP to turn the pump off.
    b. Fill a clean empty syringe with toluene and attach to the sample port. Expel toluene into the cell. Fill a clean syringe with acetone and attach to the sample port. Expel acetone into the cell.
    c. Connect the air hose to the filling port and press PUMP to push out the acetone and dry the cell. Press PUMP to turn off the pump after approximately 2 minutes. The air hose can remain on the filling port of the SVM until the next viscosity measurement.

17. Perform PMCS on applicable equipment. Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared reagents. | ____ | ____ |
| 3. Performed the test procedure for transparent and opaque liquids. | ____ | ____ |
| 4. Calculated the viscosity in accordance with ASTM D-446. | ____ | ____ |
| 5. Reported the test results. Reported the kinematic viscosity to four significant figures, together with the temperature. | ____ | ____ |
| 6. Performed all cleaning and drying procedures in accordance with test standards. | ____ | ____ |
| 7. Selected and prepared apparatus for automatic ASTM D-7042. | ____ | ____ |
| 8. Filled a clean syringe for ACETONE and expelled into sample port. Placed pump hose form DMA 4500 in sample port on SVM 3000 and pressed PUMP on DMA 4500. | ____ | ____ |
| 9. Using the DMA 4500, activated the FUEL OIL method by pressing the soft key under METHOD and using the up and down arrows to select FUEL OIL and then pressed left turn key. | ____ | ____ |
| 10. Set the temperature on SMV 3000 by the fuel that you are testing. | ____ | ____ |
| 11. Refreshed the measuring window by pressing ESC. Allowed the instrument to come to the set temperature. | ____ | ____ |
| 12. Located a 10mL disposable syringe. Drew 1-2 mL of sample into the syringe. Expelled fuel into a waste fuel container. | ____ | ____ |
| 13. Filled the 10mL disposable syringe of a test sample. Removed bubbles if necessary. Connected the syringe to the sample filling port (top right hole on port), filled the cell without pressure until you saw sample exit the SVM 3000 and entered DMA 4500 and exited into the waste container. Left syringe connected to the port and PRESSED start for about 10 seconds. | ____ | ____ |
| 14. Pressed START to stop the motor. Slowly pushed another 1-2 mL into the cell. Made sure there were no bubbles in the cell and pressed START to begin measurement. Pressed the soft key under START on the DMA 4500 to start the density measurement. | ____ | ____ |
| 15. Ensured the results "NY" line transmits to the computer. | ____ | ____ |
| 16. Cleaned the cells at the end of the day. | ____ | ____ |
| 17. Performed PMCS on applicable equipment. Cleaned up all spills immediately. Disposed of hazardous materials and hazardous waste in accordance with laboratory SOP. Reported all hazardous materials and hazardous waste spills immediately. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

**Required**
ASTM STANDARDS
FM 10-67-2

**Related**
MIL-STD-3004A

**Perform Standard Test Method for Distillation and Cetane Index of Petroleum Products**

**101-92L-1405**

**Conditions:** As a laboratory specialist in a field, or garrison environment, you are given all necessary materials and MIL-STD-3004A, and ASTM D-86, D-976. Upon receipt of a petroleum product sample, a laboratory specialist will conduct testing procedures based on product specification or special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, calculates and records test results in accordance with American Standard Test Method (ASTM D-86, D-976), and performs preventive maintenance checks and services (PMCS) on applicable equipment, and give the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the apparatus for the version of the test (manual or automatic) to be performed.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of the fire extinguishers is readily available and keep all exits clear. Perform only one test at a time. Follow the procedures as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

a. Select and prepare the test apparatus for the manual procedure according to the references in the ASTM D-86. Ensure the temperature of the equipment is as prescribed. Remove any residual liquid in the condenser tube by swabbing with a piece of soft, lint-free cloth attached to a cloth.
b. Verify that the temperature of the cooling bath and the graduate will be maintained at their respective temperature.
c. Measure 100 mL of sample in the graduate and transfer the contents as completely as practical to the distillation flask, ensuring that none of the liquid flows into the vapor tube.
d. Fit the temperature sensor, provided with a snug-fitting, well-rolled cork or silicon-rubber stopper, tightly into the neck of the flask. Ensure the bulb of the thermometer is centered in the neck and the lower end of the capillary is level with the highest point on the bottom of the inner wall of the vapor tube.
e. Fit the flask vapor tube, provided with a snug-fitting, well-rolled cork or silicone rubber stopper, tightly into the condenser tube for a distance of 25 to 50 mm (1 to 2 inches). Raise and adjust the flask board to fit snugly against the bottom of the flask.
f. Place the graduate that was used to measure the specimen, without drying the inside of the cylinder, into its temperature-controlled bath under the lower end of the condenser tube. The tube should be centered in the graduate cylinder. Cover the cylinder loosely with a piece of blotting paper or similar material to prevent vapors from escaping. Record the room temperature and prevailing barometric pressure.
g. Select and prepare the apparatus for the automatic distillation applicable the PQAS.
h. The PMD 100 Micro-Distillation Unit.
    (1) Power up the PMD 100 distillation unit.
    (2) At the prompt, press any key to continue.

NOTE: The Sample ID and the operator will be blank when the instrument is first powered-up. Do not enter a sample ID or operator. These will be entered via the computer.

    (3) Enter the product to be tested, if necessary, and press 'OK'.

**Performance Steps**

2. Perform the test procedures for manual and automatic distillation.

NOTE: Protect the environment in accordance with FM 3-100.4. Minimize waste, clean up spills immediately, report spills to your supervisor and/or designated spill response personnel, dispose of hazardous waste in accordance with laboratory standing operating procedure (SOP) and ISCCP. Always consult MSDS and ensure they are prominently posted in your work area.

a. Apply heat to the distillation flask and contents.
b. Observe and record the initial boiling point. Immediately move the graduate so that the tip of the condenser touches its inner wall.
c. Regulate the heating so that the time from initial boiling point to 5 or 10 percent recovered is as indicated in Table 5 of the ASTM. Continue to regulate the heating so that a uniform average rate of condensation from 5 or 10 percent recovered to 5 mL residue in the flask is 4- to 5-mL per minute.
d. Observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved in the intervals between the initial boiling point and the end of the distillation.
e. Adjust the heat. When the residual liquid in the flask is approximately 5 mL, make a final adjustment of the heat so that the time from the 5 mL of liquid residue in the flask to the end point (final boiling point) is within the limits prescribed in Table 5 of the ASTM.
f. Observe and record the end point (final boiling point) or dry point as required.
g. Pour the contents into a 5 mL graduate cylinder, after the flask has cooled, and allow the flask to drain until no appreciable increase in the volume of liquid in the 5 mL graduate is observed.
h. Perform Automatic distillation as follows:
    (1) Position a clean distillation flask containing 3 to 5 pumice stones in the flask stand.
    (2) Use a 10 mL automatic pipette to add 10 mL of the product to be tested to the flask.
        (a) Place an unused pipette tip on the pipette body.
        (b) Depress the pipette plunger to the first stop, place the tip in the product, and allow the plunger to come up.
        (c) Remove the pipette from the sample surface.
        (d) Discharge the pipette back into the sample container by depressing the plunger to the first stop, wait 1 second, then depress the plunger to the second stop which blows the last of the product out of the tip.
        (e) Repeat procedure (b) and (c).

NOTE: Do not allow the product to be introduced into the sidearm of the flask when transferring the sample to the distillation flask.

        (f) Discharge the second 10 mL sample into the distillation flask using the technique found in procedure (d).

CAUTION: THE STAINLESS STEEL FIXED ARM OF THE PRESSURE/VAPOR MEASURING HEAD MUST BE ALIGNED WITH THE SIDEARM OF THE FLASK. THE HEAD SLIDE GUIDE ASSURES THIS ALIGNMENT.

    (3) Insert the pressure/vapor measuring head into the neck of the flask.
    (4) Position the flask/measuring head into the instrument using the following procedure:
        (a) Depress the heater coil using the rubber grommet of the discharge tube.
        (b) Place the sidearm of the flask into the rubber grommet of the discharge tube.
        (c) Push the sidearm into the discharge tube until the stainless steel fixed arm of the pressure/vapor measuring head contact its receiver.
        (d) Continue pushing the sidearm into the discharge tube and the stainless steel fixed arm into its receiver until the stainless steel fixed arm 'snaps' into position.
        (e) Slowly release the heating coil button and allow the heating coil to raise and cradle the bottom of the flask.

NOTE: The instrument will not allow the analysis to proceed if the guard is not in place.

**Performance Steps**

(f) Lower the heating chamber Plexiglas shield
(g) Position the waste container under the outlet of the discharge tube.

NOTE: The waste container outlet is located on the left side of the instrument and the water container must be in position before the instrument will allow the analysis to proceed.

(5) Press the 'Start now' button to begin the analysis.
(6) Press the 'Alarm stop' key, then the 'Acquit' key when the alarm sounds to indicate the analysis is complete.
(7) Remove the flask when it has cooled by following these steps.
  (a) Remove the waste container under the outlet of the discharge tube.
  (b) Raise the heating chamber Plexiglas shield.
  c) Slowly depress the heating coil button .
  (d) Pull the sidearm from the discharge tube, until the stainless steel fixed arm of the pressure/vapor measuring head 'unsnaps' from its receiver.
  (e) Release the heater coil using the button located on the right front of the heating chamber.
(8) Clean the flask.
  (a) Empty the used pumice into a waste container.
  (b) Rinse the flask three times with 3 mL of acetone.
(9) Turn the cleaned flask upside down in the flask rack allowing it to dry before re-using.

3. Report the test results for the manual distillation.
   a. Report all percentages to the nearest 0.5 or 0.1 and all thermometer readings to the nearest 0.5 degrees C (1 degree F) or 0.1 degree C (0.2 degree F) . Report the barometric pressure to the nearest 0.1 kPa (1-mm Hg).
   b. Correct thermometer readings to 101.3 kPa (760 mm Hg) pressure.
   c. State whether the corrections have or have not been applied.
   d. For the automatic distillation, read the result from the LCD, print if necessary.

4. Calculate cetane index using the following equations:

   calculated cetane index = -420.34 + 0.016 G2 + G log M + 65.01 (log M)2-0.0001809 M2
   or
   calculated cetane index = 454.74 - 1641.416 D + 774.74 D2 - 0.554 B + 97.803 (log B)2

   Where:

   G = API gravity, determined by ASTM D-287 or D-1298,
   M = mid-boiling temperature, degrees F., determined by ASTM D-86 and corrected to standard barometric pressure,
   D = density at 15 degrees C, g/mL, determined by ASTM D-1298, and
   B = mid-boiling temperature, degrees C, determined by ASTM D-86, and corrected to standard barometric pressure. Calculate cetane.

5. Calculate cetane index values for distillate fuels by means of the alignment chart found in Section 4.2 of ASTM D-976.

6. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDSs for all hazardous materials present in the workplace

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Performed the test procedure. | ____ | ____ |
| 3. Reported the test results. | ____ | ____ |
| 4. Calculated cetane index using the equations. | ____ | ____ |
| 5. Calculated cetane index values for distillate fuels by means of alignment chart found in Section 4 of ASTM D-976. | ____ | ____ |
| 6. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | DOD 4140.25-M |
| MIL-STD-3004A | |

**Operate Mobile Laboratory and 60 KW Generator Set**

**101-92L-1407**

**Conditions:** As a petroleum laboratory specialist, quality surveillance specialist in a field or garrison environment, you are given a Mobile Petroleum Laboratory and 60 KW DED Generator set, TM 5-6115-545-12, and TM 5-6640-212-14, and you are required to operate the Mobile laboratory along with the 60 KW DED Generator set in order to perform petroleum laboratory testing.

**Standards:** Soldier operates and maintains the mobile petroleum laboratory and DED 60 KW generator set in accordance with TM 5-6115-545-12 and TM 5-6640-212-14, while adhering to all safety guidelines and environmental stewardship principles.

**Performance Steps**

1. Select a suitable site. Choose a site that provides:
    a. Ample space for maneuvering and assembling.
    b. Level well-drained terrain and relatively free from surface rocks and large stones.
    c. Accessible to tactical vehicles.
    d. Downstream from personnel assemble areas.

2. Set up the mobile laboratory.
    a. If applicable, install the boarding ladder and rear platform.
        (1) Lower the rear platform into position.
        (2) Remove the three boarding ladders from their storage racks.
        (3) Place the ladders at the entrance/exit doors, making sure they are secure.
    b. If applicable, raise the ECU platform.
        (1) Remove center keys and retaining pins.
        (2) Lift platform to operating position.
        (3) Reattach cable with pins and center key.
    c. Level the laboratory for the mobile laboratory.
        (1) Use the crank operated landing gear legs, and the screw operated jacks to level the laboratory.
        (2) Check the level at the front, middle, and rear of the lab. With the carpenter's leveler.
    d. Connect the drain hoses.
        (1) Connect drain hoses to the sink deck drain located adjacent to curb-side storage box and to the forward deck drain located on the roadside beneath the mechanical room.
        (2) Dig a drainage ditch or sump and place the ends of the drainage hoses in it.
    e. Ground the laboratory.

WARNING: DO NOT CONNECT THE MAIN POWER CABLE TO THE LABORATORY BEFORE GROUNDING THE LABORATORY PROPERLY. FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

(1) Remove grounding rod, driver/puller, and grounding cable from their storage location.
(2) Select an area as close as possible to the laboratory.
(3) Attach the first grounding rod and coupling to the driver/puller.

NOTE: Before driving grounding rod into the ground, ensure that the driver/puller and rod are fully threaded into the coupling. Be sure the collar is hand tight against the coupling.

(4) Drive the grounding rod into the ground for approximately 30 inches.

CAUTION: DO NOT ALLOW THE GROUNDING ROD TO ROTATE WHEN DISCONNECTING THE DRIVER/PULLER FROM IT. THE GROUNDING SECTIONS MUST REMAIN SCREWED TOGETHER TO ENSURE A GOOD ELECTRICAL GROUND.

(5) Remove the driver/puller assembly from the first grounding rod.
(6) Repeat steps 3 and 4 for the second and third grounding rod and drive the third grounding rod into the ground until only 12 inches (30.5 cm) of it remains above the ground.

**Performance Steps**

(7) Remove the driver/puller assembly from the third grounding rod and return it to storage location.
(8) Secure one end of the grounding cable to the grounding rod with the clamp and screw.
(9) Attach the other end of the grounding cable to the grounding lug on the laboratory.

3. Perform before-operations PMCS on the laboratory in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P.

4. Perform before-operations PMCS in accordance with TM 9-6115-464-24P.

WARNING: ADHERED TO THE FOLLOWING SAFETY PRECAUTIONS WHEN PERFORMING ALL THE STEPS ASSOCIATED WITH THIS TASK. REMOVE ALL JEWELRY. OPERATE THE EQUIPMENT IN ADEQUATELY VENTILATED AREA. SMOKING, SPARKS, AND OPEN FLAMES, ARE NOT PERMITTED WITHIN 50 FEET OF GENERATOR SETS WHICH ARE UNDERGOING FUEL SYSTEM MAINTENANCE OR REFUELING OPERATIONS. USE CARE WHEN HANDLING THE FAN AND RADIATOR, AS SHARP EDGES CAN CAUSE INJURY. DRY-CLEANING SOLVENTS ARE FLAMMABLE AND SHOULD NOT BE USED IN THE VICINITY OF SPARKS OR OPEN FLAMES. WEAR EYE SHIELDS WHEN USING COMPRESSED AIR. OPEN RADIATOR AND SURGE TANKS ONLY AFTER ENGINE IS COOL. WEAR RUBBER GLOVES AND GOGGLES WHILE WORKING ON BATTERY SYSTEMS. BEFORE WORKING ON EXHAUST SYSTEMS, MAKE SURE IT IS COOL. ALWAYS DISCONNECT BATTERY CABLES WHEN PERFORMING MAINTENANCE ON ELECTRICAL SYSTEMS OR WHEN PERFORMING PMCS IN THE VICINITY, EXCEPT WHEN IT IS NECESSARY TO HAVE ELECTRICITY PRESENT, USE SPECIAL CARE. WEAR HEARING PROTECTION WHEN THE ENGINE IS OPERATING. FOR REMOVING OR REPLACING COMPONENTS WEIGHING OVER 75 POUNDS USE MORE THAN ONE PERSON. ONLY OPERATE THE GENERATOR SET IF IT IS PROPERLY GROUNDED. DO NOT INHALE ETHER. THE FOLLOWING SHOULD NOT BE ATTEMPTED WHILE THE GENERATOR SET IS OPERATING. ADJUST THE VOLTAGE RECONNECTION BOARD AND CONNECT OR DISCONNECT LOADS, EXCEPT BY MEANS OF THE AC CIRCUIT BREAKER.

a. Perform before-operations PMCS in accordance with TM 9-6115-464-24P.
b. Perform weekly as well as before-operations PMCS if operating for the first time.
(1) Classify leaks as follows:
(2) Report all Class III leaks to your supervisor.
(3) Record all deficiencies on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) and give the form to your supervisor.

CAUTION: WHEN THE LABORATORY AND SUPPORTING EQUIPMENT ARE BEING SETUP, THE GENERATOR SET SHOULD NOT BE POSITIONED NEAR THE ECU'S. EXHAUST FROM THE GENERATOR WILL ACCUMULATE INSIDE THE LABORATORY, WHICH CAN CAUSE ADVERSE EFFECT ON PERSONNEL INSIDE.

5. Set the controls.
a. Check to ensure the voltage re connection board is set for 416/208, 3 phase volts.
b. Ensure the generator is properly grounded.
c. Position the fuel selector valve according to the fuel source.
d. Make sure shutters on the radiator end of the generator open and close freely when actuated by the shutter manual control.
e. Close all access doors except for the air vent and the control cubicle.
f. Position BATTLE-SHORT and START-RUN-STOP switches in the ON and RUN position respectively, check fuel level by reading the fuel gauge.
g. Return both switches in 'e' to OFF and STOP respectively.
h. Ensure the DC circuit breaker switch is closed.
i. Depress the fault location indicator TEST OR RESET switch and check that all fault indicator lights illuminate.

**Performance Steps**

6. Start the generator set.
    a. Place the START-RUN-STOP switch in the start position.

NOTE: Use start aid assembly, when necessary (ambient temperature below 50 degrees F).

    (1) Crank the generator set engine.
    (2) Inject a 'shot' of ether into the air cleaner assembly by placing the engine primer switch in the ON position and then releasing.

CAUTION: DO NOT CRANK FOR MORE THAN 15 SECONDS AT A TIME. ALLOW 15 SECONDS TO ELAPSE BETWEEN CRANKING. IF THE ENGINE FAILS TO START AFTER INJECTING THREE 'SHOTS' OF ETHER, CEASE OPERATIONS AND NOTIFY SUPERVISOR.

    b. Continue to hold the START-RUN-STOP switch in the start position until the engine oil pressure gauge reads at least 20 psi and the AC voltmeter indicates 208/416 volts.
    c. Release the START-RUN-STOP switch.
    d. Position the voltage rheostat as required to obtain the proper voltage output.
    e. Adjust the manual throttle control to obtain 60 Hz on frequency meter.
    f. Allow engine to warm up to normal operating temperature (100 to 150 degrees F) with no load applied.
    g. Check for faults by pressing the test or reset switch. If fault indicator lights are extinguished after releasing the switch, proceed to step (h).

CAUTION: IF ANY OF THE INDICATOR LIGHTS REMAIN ILLUMINATED AFTER ACTUATING THE TEST/RESET SWITCH, STOP THE GENERATOR SET AND CORRECT THE INDICATED FAULT BEFORE PROCEEDING.

    h. Hold the circuit breaker switch in the CLOSE position until the circuit breaker indicator illuminates.

7. Operate the generator set.
    a. Rotate the VOLTS-AMPS transfer switch to each phase position while observing the AC AMMETER. If more than rated load is indicated an any phase, report the situation to supervisor immediately.
    b. Make any necessary adjustments to generator voltage and frequency.
    c. Enhance tactical operation by closing control panel doors or covering the lights on the panel.

8. Start the laboratory.
    a. Unlatch and open the purge and exhaust doors and ensure the laboratory entrance/exit doors are closed.
    b. Roll up and secure the ECU canvas covers.
    c. Attach the main power leads from the generator.

CAUTION: BE SURE THE MAIN POWER CABLE LEADS ARE PROPERLY ATTACHED TO THE GENERATOR PRIOR TO ATTACHING THEM TO THE LABORATORY.

    d. Start the generator set and apply power to the laboratory in accordance with TM 5-6115-545-12 and TM 9-6115-464-24P.

WARNING: DO NOT ENTER THE LABORATORY UNTIL AUTOMATIC PURGE CYCLE IS COMPLETE. DANGEROUS COMBUSTIBLE GAS OR VAPOR MAY BE PRESENT WHICH COULD IGNITE CAUSING DEATH OR SERIOUS INJURY.

    e. Wait about 5 minutes for purge cycle to complete, unlock and open laboratory doors.
    f. Remove over-pack boxes, if necessary.

CAUTION: ENSURE THAT ALL TEST EQUIPMENT ARE EITHER TURNED OFF OR UNPLUGGED BEFORE APPLYING POWER TO THE LABORATORY SYSTEMS.

**Performance Steps**

9. Operate the laboratory systems.
    a. Electrical system.
        (1) Close the main circuit breaker, followed by all secondary circuit breakers.
        (2) Operate the light switches.
            (a) Blackout lights.
            (b) Emergency lights.
            (c) Normal operating lights.
        (3) Apply power to laboratory equipment and systems.
        (4) Turn on ECU and set desired temperature.
    b. Water system. Operate the water system in accordance with TM 10-6640-12-216-13&P and TM 10-6640-215-13.

NOTE: The water system can be operated from both pressurized and non-pressurized sources.

    c. Air pressure system. Operate the air pressure system in accordance with TM 10-6640-215-13 and TM10-6640-216-13&P.

10. Perform petroleum analysis testing in accordance with acceptable ASTM and MIL-STD-3004A.

11. Perform during-operations PMCS on the laboratory in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P.

12. Perform during operations PMCS on the generator in accordance with TM 5-6115-545-12 and TM 9-6115-464-24P.
    a. Monitor gauges and indicator lights.
    b. Monitor fluid lines and levels.
    c. Refuel and add oil to the generator as required.
    d. Log all actions/deficiencies on DA Form 2404.
    e. Give form to supervisor at the end of each shift.

13. Shut down laboratory.
    a. Close and cap all chemical containers and place them in their designated storage areas.
    b. Turn off power to all equipment.
    c. Secure and cover all balances and other appropriate equipment.
    d. Turn off the ECU power.
    e. Turn off all lights.
    f. Turn off power to all systems.

NOTE: The electrical system must be turned off last to prevent damages to other systems as well as the electrical systems.

    g. Store any additional items in the laboratory.
    h. Turn off the main power by opening the main circuit breaker and exit the laboratory.
    i. Close and secure the laboratory doors.
    j. Shut down the power generator set in accordance with generator operators manual.

14. Perform after-operation PMCS on the laboratory (exterior).

15. Perform after-operations PMCS in accordance with TM5-6115-545-12 and TM 9-6115-464-24P.
    a. Disconnect the negative battery cable, if it will be moved prior to next start, or if dormancy is expected for 72 hours or more.
    b. Inspect generator set.
    c. Check fluid levels; refuel and add fluids as necessary.
    d. Log all actions/deficiencies on DA Form 2404.
    e. Give completed form to supervisor at the end of each shift.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Selected a suitable site. | ____ | ____ |
| 2. Set up the mobile laboratory | ____ | ____ |
| 3. Performed before-operations PMCS on the laboratory in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P. | ____ | ____ |
| 4. Performed before-operations PMCS in accordance with TM 9-6115-464-24P. | ____ | ____ |
| 5. Set the controls. | ____ | ____ |
| 6. Started the generator set. | ____ | ____ |
| 7. Operated the generator set. | ____ | ____ |
| 8. Started the laboratory. | ____ | ____ |
| 9. Operated the laboratory systems. | ____ | ____ |
| 10. Performed petroleum analysis testing in accordance with acceptable ASTM and MIL-STD-3004A. | ____ | ____ |
| 11. Performed during-operations PMCS on the laboratory in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P. | ____ | ____ |
| 12. Performed during operations PMCS on the generator in accordance with TM 5-6115-545-12 and TM 9-6115-464-24P. | ____ | ____ |
| 13. Shut down laboratory. | ____ | ____ |
| 14. Performed after-operation PMCS on the laboratory (exterior). | ____ | ____ |
| 15. Performed after-operations PMCS in accordance with TM5-6115-545-12 and TM 9-6115-464-24P. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| DA FORM 2404 | FM 10-67-2 |
| MIL-STD-3004A | FM 3-100.4 |
| TM 5-6115-545-12 | |
| TM 5-6640-212-14 | |

**Perform Standard Test Method for Flash Points of Petroleum Products**

**101-92L-1408**

**Conditions:** As a petroleum laboratory specialist in a field or garrison environment, you are given an operational petroleum laboratory, flash point testing apparatus , American Standard Test Method (ASTM D-93, D-6450), a sample of petroleum product, and all safety and environmental protection equipment, as well as personal safety gear. Upon receipt of a petroleum sample, you are told directly or indirectly to perform procedures to establish the flash point of the product.

**Standards:** Soldier safely and accurately performs test procedures to accurately determine the flash point of the petroleum product in accordance with ASTM D-93 or ASTM D-6450. Give the result to his supervisor.

**Performance Steps**

1. Prepare the apparatus for ASTM D-6450.

NOTE: Wear proper safety gear: goggles, rubber gloves, aprons. Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheet (MSDS).

   a. Power-up the mini-flash unit.
   b. From 'Measure', press 'Task'.

2. Analyze the standards.

NOTE: Analysis of standards is to be performed daily or whenever a move has taken place.

   a. Select '1' for Dodecane at the measurement screen, then press 'RUN'.
   b. Transfer 1 mL of Dodecane to the sample cup and insert it into the instrument.
   c. Press 'RUN'.

NOTE: The sample will automatically rise into position and the analysis will begin.

   d. After the alarm, press 'STOP', and wait for the apparatus to cool.

NOTE: When the instrument has cooled, the sample cup will be lowered for removal, clean up, and reuse.

   e. Clean the sample cup with acetone and laboratory tissues.
   f. Press 'STOP' again to return to the measurement screen.
   g. Compare the obtained flash point to the established value for the particular standard used.

NOTE: If there value is within acceptable instrument precision range, proceed to sample analysis. If the value is outside the acceptable instrument precision range of + or - 2 degrees C, rerun the standards to verify correct instrument operation.

3. Analyze the sample.

   a. Select the appropriate number associated with the type of fuel to be sampled from the 'Measure' parameter screen.
   b. Transfer 1 mL of the sample to the sample cup and insert it into the instrument.
   c. Press 'RUN'.

NOTE: The sample cup will automatically rise into position and the analysis will begin.

   d. After the alarm, press 'STOP', and wait for the apparatus to cool.

NOTE: When the instrument has cooled, the sample cup will be lowered for removal, clean up, and reuse.

   e. Press 'STOP' again to return to the measurement screen.
   f. Read the result from the screen and record it as the Flash Point.

NOTE: The result will be displayed as degrees Celsius.

4. Perform preventive maintenance checks and services.

   a. Clean the sample cup with acetone and laboratory tissues.
   b. Store the clean sample cup in the apparatus in the raised position.

**Performance Steps**

c. Move the cursor to directional arrows and 'TASK'.

NOTE: The bare next to the arrows shows the position lift.

d. Turn off the instrument.

5. Select and prepare test apparatus for ASTM D-93.
   a. Select the test thermometer according to the ASTM.
   b. Ensure Pensky-Martens Closed Flash Tester meets criteria according to specifications in Annex A1 of the ASTM.

6. Prepare the sample.
   a. Avoid the loss of volatile material. Do not open containers unnecessarily. Do not use samples from leaky containers.
   b. Dehydrate the samples that contain dissolved or free water with calcium chloride or by filtering through a qualitative filter paper.

WARNING: NEVER DISPOSE OF CHEMICALS OR PETROLEUM PRODUCTS IN DRAINAGE SYSTEMS. ALWAYS DISPOSE OF USED MATERIALS IN APPROPRIATE MARKED CONTAINERS.

7. Perform test procedures.
   a. Thoroughly clean and dry all parts of the test cup and its accessories.
   b. Fill the test cup with the sample to be tested to the level indicated by the filling mark. Place the lid on the cup and set the latter in the stove. Be sure to have the locking device properly engaged. Insert the thermometer. Bring the material to be tested and the tester to a temperature of at least 18 degrees C, or 32 degrees F lower than estimated flash point.
   c. Light the test flame and adjust it to a 3.2 to 4.8 mm diameter. Supply the heat at such a rate that the temperature indicated by the thermometer increases 5 to 6 degrees C (9 to 11 degrees F) per minute. Turn the stirrer 90 to 120 RPM, stirring in a downward direction.

CAUTION: THE OPERATOR MUST EXERCISE AND TAKE APPROPRIATE SAFETY PRECAUTIONS DURING THE INITIAL APPLICATION OF THE TEST FLAME. SAMPLES CONTAINING LOW FLASH MATERIAL CAN GIVE AN ABNORMALLY STRONG FLASH WHEN THE TEST FLAME IS FIRST APPLIED.

   d. If the sample has a known flash point of 110 degrees C (230 degrees F) or below, apply the test flame when the temperature of the sample is 23 degrees C or 41 degrees F below the expected flash point and each time thereafter at a temperature reading that is a multiple of 1 degree C (2 degree F). Apply the test flame by operating the mechanism on the cover which controls the shutter and the test flame burner so the flame is lowered into the vapor space of the cup in 0.5 seconds, left in its lowered position for 1 second and quickly raised to its high position. Do not stir the sample while applying the test flame.
   e. If the sample has a known flash point above 110 degrees C (230 degrees F) apply the test flame in the ignition source in the same manner as described above at each temperature that is a multiple of 2 degree C (5 degrees F).
   f. Record as the observed flash point the temperature read on the thermometer a the time the test flame application cause a distinct flash in the interior of the cup. Do not confuse the true flash point with the bluish halo that sometimes surrounds the test flame at applications preceding the one that cause the actual flash. The sample is deemed to have a flashed when a large flame appears and instantaneously propagates itself over the entire surface of the test specimen.

8. Calculate and report the test results.
   a. Observe and record the ambient barometric pressure at the time of the test. When the pressure differs from 101.3 kPa (760 mmHg), correct the flash point in accordance with test procedure.
   b. Record and report the corrected flash point to the nearest 0.5 degree C (1 degree F).

WARNING: NEVER DISPOSE OF CHEMICALS OR PETROLEUM PRODUCTS IN DRAINAGE SYSTEM. ALWAYS DISPOSE OF USED MATERIALS IN APPROPRIATE MARKED CONTAINERS.

9. Perform PMCS on applicable equipment.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Prepared the apparatus for ASTM D-6450. | ____ | ____ |
| 2. Analyzed the standards. | ____ | ____ |
| 3. Analyzed the sample. | ____ | ____ |
| 4. Performed preventive maintenance checks and services. | ____ | ____ |
| 5. Selected and prepared the test apparatus for ASTM D-93. | ____ | ____ |
| 6. Prepared the sample. | ____ | ____ |
| 7. Performed the test procedure. | ____ | ____ |
| 8. Calculated and reported the test results. | ____ | ____ |
| 9. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | AR 200-1 |
| | DA FORM 2077 |
| | FM 10-67-2 |
| | FM 3-100.4 |
| | MIL-STD-3004A |

Subject Area 3: Quality Surveillance

**Perform Standard Test Method for Electrical Conductivity of Aviation and Distillate Fuels Containing a Static Dissipator Additive (D-2624)**

**101-92L-1359**

**Conditions:** As a petroleum laboratory specialist in a field environment or garrison, you are given conductivity meter and American Standard Test Method (ASTM) standards and all necessary equipment and materials. Upon receipt of a petroleum product a petroleum laboratory specialist will conduct laboratory test based on product specifications and special instructions.

**Standards:** Soldier selects and prepares the required test apparatus, performs the test procedures, records the test results in accordance with the ASTM, performed preventive maintenance checks and services (PMCS) on applicable equipment, and gives the recorded test results to his/her immediate supervisor.

**Performance Steps**

1. Select and prepare the test apparatus.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheets (MSDS).

   a. Conductivity cell and current measuring apparatus.
   b. Thermometer; having a suitable range for measuring fuel temperature in the field.
   c. Measuring vessel; any suitable cylindrical vessel capable of holding sufficient fuel to cover the electrodes of the conductivity cell.

2. Select and prepare the reagents and materials.
   a. Cleaning solvent.
   b. Isopropyl alcohol; used instead of cleaning solvent when water is suspected.

WARNING: CLEANING SOLVENT AND ISOPROPYL ALCOHOL ARE FLAMMABLE. KEEP AWAY FROM FLAME SOURCES.

   c. Toluene.

WARNING: TOLUENE IS FLAMMABLE AND VAPOR HARMFUL.

   d. A mixture of 50 percent volume analytical grade iso-propanol and 50 percent volume analytical grade heptane may be substituted for toluene.

WARNING: ANALYTICAL GRADE ISO-PROPANOL AND ANALYTICAL GRADE HEPTANE ARE FLAMMABLE AND A VAPOR HAZARD.

3. Calibrated the test equipment. Calibration procedure will depend on the type of conductivity apparatus used.

4. Perform the test procedure.

NOTE: Conductivity measurements should be made as soon as possible after sampling and preferably within 24 hours.

5. Report the test results.
   a. Report the electrical conductivity of the fuel and the fuel temperature at which measurement was made.
   b. Report less than 1pS/M, if the electrical conductivity reads zero on the meter.

**Performance Steps**

6. Perform PMCS on applicable equipment.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Selected and prepared the test apparatus. | ____ | ____ |
| 2. Selected and prepared the reagents and materials. | ____ | ____ |
| 3. Calibrated the test equipment. | ____ | ____ |
| 4. Performed the test procedure. | ____ | ____ |
| 5. Reported the test results. | ____ | ____ |
| 6. Performed PMCS on applicable equipment. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| | FM 3-100.4 |

**Perform Standard Practice for Manual Sampling of Petroleum Products (D-4057)**

**101-92L-1367**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given all necessary equipment and materials; sampling and gaging kit, samplers, and American Standard Test Method (ASTM) D-4057. Upon receipt of a petroleum product, a laboratory specialist will conduct test procedures based on product specification and special instructions.

**Standards:** Soldier performs preventive maintenance checks and services (PMCS), prepares equipment and manually obtains various types of samples of specified petroleum products in accordance with ASTM D-4057 while preserving the condition of the product without causing damage to personnel and the environment.

**Performance Steps**

NOTE: This method covers procedures for manually obtaining representative samples of petroleum products of a liquid, semi-liquid, or solid state whose vapor pressure at ambient conditions is below 101 kPa (14.7 PSA).

1. Determine the appropriate type of sample container for a given application.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheets (MSDS).

2. Determine the type of sample to be obtained.

3. Obtain a sample for specific tests following special instructions in ASTM D-4057.
    a. Obtain a sample for distillation of petroleum products.
    b. Obtain a sample for products that are to be tested for oxidation stability.

4. Obtain a sample for specific applications following special instructions in ASTM D-4057.
    a. Sample marine cargoes of crude oils.
    b. Sample crude oil gathered by truck.
    c. Sample tank cars.

WARNING: WHEN TAKING SAMPLES FROM TANKS SUSPECTED OF CONTAINING FLAMMABLE ATMOSPHERES, PRECAUTIONS SHOULD BE TAKEN TO GUARD AGAINST IGNITIONS FROM STATIC ELECTRICITY.

    d. Sample package lots (cans, drums, barrels, or boxes).

5. Perform general sample procedures.

6. Tag each sample container immediately after sampling.

NOTE: Clean up all spills immediately. Dispose of hazardous materials and hazardous waste in accordance with laboratory SOP. Report all hazardous materials and hazardous waste spills immediately. Be familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Determined the appropriate type of sample container for a given application. | ____ | ____ |
| 2. Determined the type of sample to be obtained. | ____ | ____ |
| 3. Obtained a sample for specific tests following special instructions in ASTM D-4057. | ____ | ____ |
| 4. Obtained a sample for specific applications following special instructions in ASTM D-4057. | ____ | ____ |
| 5. Performed general sample procedures. | ____ | ____ |
| 6. Tagged each sample container immediately after sampling. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2<br>FM 3-100.4<br>MIL-STD-3004A |

**Operate Petroleum Test Kits**

**101-92L-1393**

**Conditions:** As a petroleum laboratory specialist, in a field or garrison environment, you are given sampling/gauging kit and SC 6680-95-N01, TM 10-6630-230-13&P, TM 10-6630-247-13&P, TM 10-6640-221-13&P, TM 5-6630-218-10. Upon receipt of instructions you the petroleum laboratory specialist are required to operate and maintain petroleum test kits.

**Standards:** Soldier performs all steps in sequence that are required to operate and maintain a specified petroleum test kit in accordance with the operator's manual and petroleum facility standing operating procedure (SOP).

**Performance Steps**

1. Operate and maintain the aviation fuel contamination test kit.

NOTE 1: The aviation fuel contamination test kit is a one-person, portable kit consisting of components and testing equipment capable of determining the particulate contaminant level, API gravity and temperature, and free water content in aviation fuel samples.

NOTE 2: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one task at a time. Follow the procedure as outlined in the task, the operator's manual, and the petroleum facility SOP. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheets (MSDS).

a. Determine the particulate contaminant level in an aviation fuel sample.
   (1) Install the quick-release valve.

NOTE 3: The pressure in the system should not exceed 100 psi.

   (2) Select the correct monitor according to the type of method used as follows:
      (a) Contamination monitors; blue and red protective plugs.
      (b) Remove the plugs from the monitor in the correct order.
      (c) Unscrew the sampler cover from the sampler base and insert the monitor spoke-side down into the base.
   (3) Insert the monitor into sample valve hose assembly.
   (4) Assemble the sampler valve hose assembly.
      (a) Insert the sampler base (with monitor in place) into the sampler cover and screw the two pieces together to a snug hand-tightness.

NOTE 4: Do not over-tighten, this may damage the monitor or membrane.

      (b) Connect the bypass hose, from the three-way valve, to either bypass port located on the sides of the base. Press the hose down firmly into the port for a tight fit.
   (5) Attach the remote sampling assemble to the sampler valve hose assembly.
      (a) Screw the remote sampling assembly onto the sampler base.
      (b) Force the nylon plug into the open port on the side of the sampler base tightly plugging the port hole to prevent leakage.
   (6) Connect the sampler valve hose assembly to the quick-release valve.
      (a) Ensure that the three-way valve must be in the OFF position before attaching the sampler to the remote assembly.

NOTE 5: The valve is closed or off when the valve arm is positioned approximately 45 degrees from the base of the valve.

      (b) Remove the protective cap and plug from the quick-release valve, inlet hose nipple, and sample valve.

**Performance Steps**

(c) Insert the sampler hose nipple into the quick-release valve collar and retract the valve collar and insert the nipple firmly into the valve. Release the collar when the nipple is sealed.

(d) Attach ground wire by placing one end of the ground wire on the assembly and the other end on grounded metal (such as a vehicle bumper).

(7) Flush the inlet hose.

(a) Turn the three-way valve to the FLUSH position: the valve arm is horizontal to the base of the valve.

b) Pass at least two volumes, about twice the containment of the assembly system, 3 or more liters (3.2 quarts), into the 5-gallon receptacle.

NOTE 6: This should remove contaminants from the inlet valve, hose and three-way valve.

(8) Take a sample.

(a) Hold the sampler in an upright (vertical) position and turn the three-way valve to the TEST position.

NOTE 7: The test position is when the valve arm is positioned at a right angle to the base of the valve (vertical).

(b) Allow no more than 1 liter (3.7 gallons) to flow through the monitor. Record the sample volume for reporting.

(c) When collection is completed, turn the three-way valve to the OFF position before turning off the system pump.

NOTE 8: Some pumping system such as Aircraft Refuelers may develop a vacuum when closed, this can cause product back-flow which may rupture the monitor. If this happens, the test is invalid.

(d) Retract the quick-release valve collar and remove the sampler nipple from the valve. Replace the protective cap and plug.

(e) Disconnect the bypass hose from the side of the sampler and unscrew the sampler base. Hold the sampler in an upright position and remove the monitor.

(9) Pump the monitor dry.

(a) Securely fit the bottom or spoke-side of the monitor onto the syringe valve and pump the syringe arm.

(b) Point the syringe away from you and pump the arm, holding the extended arm for 5 seconds before releasing each time. Pump the arm two or three times or until the filter inside the monitor appears dry of fuel.

NOTE 9: Drain excess fuel into approved container only.

(c) Remove the monitor from the syringe.

(10) Assess the monitor for particulate contamination.

(a) Using the back of the tweezers, carefully pry off the top of the monitor.

(b) Use the aviation turbine fuel contamination standards with color comparator method.

(c) To use the gravimetric method; replace the monitor's protective plugs (top and bottom), label the monitor, wrap it well in bubble paper or whatever protective covering is available, and ship to a designated laboratory for analysis.

b. Determine the API gravity and temperature of an aviation fuel sample.

NOTE 10: Testing for specific gravity or API gravity and relative density is necessary to control the quality and volume levels of fuel. The measurement of fuel temperature is also required to minimize volume correction errors.

(1) Install the quick-release valve.

(2) Assemble the sampler valve hose assembly. Follow procedures as described in 1a(2), (3) above.

(3) Attach the PVC sample bottle to the remote sampling assembly. Screw the PVC sample bottle mouth onto the remote sampling assembly.

**Performance Steps**

(4) Connect the sampler valve hose assembly to the quick-release valve. Follow procedures as described in 1a(4) above.

WARNING: THE SAMPLER VALVE HOSE ASSEMBLY MUST BE PROPERLY GROUNDED TO AVOID POSSIBLE FIRE OR EXPLOSION FROM STATIC ELECTRICAL CHARGES. AN ELECTRICAL CONTINUITY TEST OF THE GROUND HOOKUP SHOULD BE PERFORMED PRIOR TO THE TEST TO ASSURE CONDUCTANCE OF ELECTRICAL CHARGES FROM SYSTEM TO GROUND.

(5) Flush the Inlet Hose.

NOTE 11: If one or all test procedures are performed at the same time (within the same hour), reflushing the lines in not required. Do not use the PVC bottle to contain the flushed sample.

(6) Take a sample.

(a) Hold the sampler upright and turn the three-way valve to the TEST position.

(b) Collect enough fuel to fill the PVC sample bottle - no more than 1 liter (1 quart ).

(c) When collection is completed, turn the three-way valve to the OFF position before turning off the system pump.

(d) Retract the quick-release valve collar; remove the sampler nipple from the valve and replace the protective cap and plug.

(e) Carefully remove the PVC sample bottle from the sampler.

(7) Determine the API gravity and temperature.

(a) Fill the clear plastic cylinder half-full with fuel.

NOTE 12: Pour the fuel at an angle to minimize air entrapment.

(b) Select a hydrometer that allows the scale to fall within the fuel cap.

(c) Place the hydrometer into the cylinder giving it a slight twist as you release it into the fuel.

(d) Let the hydrometer settle. Allow approximately 5 minutes for the temperature of the hydrometer to equilibrate with the temperature of the fuel sample.

(e) With the hydrometer in the cylinder, read the degrees API to the nearest 0.1 at the meniscus cut point.

(f) Remove the hydrometer from the cylinder and take a temperature reading. Record the readings.

(8) Find the corrected API gravity, temperature, and relative density.

(a) Using the gravity calculator attached to the test kit placard, determine the corrected API.

(b) Select the appropriate type of fuel being tested and turn the computer slide to match the recorded API gravity with the recorded temperature.

(c) Read and record the corrected gravity, temperature, and relative density indicated at the 60 degree mark on the computer scale. Refer to the example shown on the gravity calculator as well.

(d) Compare the readings to the established site standards and record the test results. Determine if the fuel sample satisfies specified site standards.

NOTE 13: Testing for undissolved (free) water is necessary to control the growth of microorganisms and the subsequent corrosion caused by such microorganisms in aircraft tanks. It is also essential to prevent filters from icing in the fuel system.

c. Test for undissolved water in an aviation fuel sample.

(1) Calibrate the aqua-glo water detector.

NOTE 14: To ensure accurate undissolved water detection, calibrate the Aqua-Glo water detector before each daily use and after every hour of use.

(a) Turn on the water detector, setting the indicator switch to the appropriate power source; set to either AC (power cord), internal, or external battery.

(b) Remove the calibration pad stored in the kit. The pad is covered with a clear plastic shielding and has a coding standard written on side. Note the "Set" code in the center of the pad.

(c) Insert the calibration pad in the test area window located in the bottom of the water detector.

**Performance Steps**

(d) Lift the cover's curved metal tab and place the pad (text facing you) in the depressed circular area or "window" located in the center of the test area.
(e) Close the test area cover and stand the water detector upright.
(f) Position the light-modulator lever located on the side of the water detector (moving the lever left or right) until the lever is directly above the number on the scale which corresponds to the set number shown on the calibration pad.
(g) Depress the switch button on the instrument pack and read the calibration meter.

NOTE 15: If the meter reads "0" the water detector calibration procedure is complete. If the meter reads any increment other than "0" you must adjust the internal calibration screws until the water detector is "zeroed-out" (the meter lever shaft reads "0").

(h) Using the jeweler's screwdriver, remove the outer screw on the side of the calibration meter housing.
(i) Insert the tip of the jeweler's screwdriver into the housing and turn the internal adjustment screw (either a right or left direction), depress the switch button on the instrument pack as you turn the screw until the meter levels reads "0".
(j) Replace the outer screw, the calibration of the water detector is now complete.

(2) Install the quick-release valve.
(3) Prepare the Stainless Steel Monitor.
(a) Pry open the top of the stainless steel monitor using the back end of the tweezers.
(b) Carefully remove a free-water test pad from its sealing package using a clean dry tweezers.

NOTE 16: Do not remove the test pad from its sealed package until you are ready to place it into the monitor. Do not allow any discrete water droplets to come into contact with the pad. Do not expose the pad to humidity or the atmosphere. Take care not to touch the pad with your fingers. Contact with these elements may affect the accuracy of the test results.

(c) Insert the pad (orange-side up) towards the inlet of the monitor (the orange side should be facing upstream of the fuel flow).
(d) Reassemble (snap the top on) the monitor.

(4) Insert the stainless steel monitor into the sampler assembly.
(a) Unscrew the sampler cover and insert the stainless steel monitor containing the free-water test pad (inlet side facing upstream).
(b) Screw the sampler case into the sampler cover (to a snug hand-tightness).
(c) Connect the bypass hose from the three-way valve to either bypass port located on the sides of the base. Press the hose down firmly into the port for a tight fit.

(5) Attach the remote sampling cap and bypass hose.
(a) Thread the remote sampling cap and bypass hose into the base of the sampler.
(b) Force the nylon plug into the port located on the side of the sampler.

(6) Connect the sampler to the quick-release valve.
(a) Remove the protective cap and plug from the quick-release valve, inlet hose nipple, and sampler valve.

NOTE 17: The three-way valve must be in the OFF position before attaching the sampler to the remote assembly; the valve is closed or off when the valve arm is positioned approximately 45 degrees from the base of the valve.

(b) Insert the sampler hose nipple into the quick-release valve collar; retract the valve collar and insert the nipple firmly into the valve. Release the collar when the nipple is seated.
(c) Attach the ground wire.

(7) Flush the Inlet Hose. Follow procedures as described in step 1a (6) above.

**Performance Steps**

(8) Take a Sample.

(a) Hold the sampler in an upright (vertical) position, turn the three-way valve to the TEST position.

(b) Allow 500 milliliters (17.0 ounces) or less of fuel to pass through the assembly and free-water test pad.

NOTE 18: If the calibration reading was off (higher than normal), the sample volumes may be reduced to as low as 100 milliliters (3.4 ounces), then multiplying the reading number by 5 to obtain the parts per millions.

(c) When collection is completed, turn the three-way valve to the OFF position.

(d) Retract the quick-release valve collar and remove the sampler nipple from the valve. Replace the protective cap and plug.

(e) Disconnect the bypass hose from the side of the sampler and unscrew the sample base. Hold the sampler in an upright position and remove the stainless steel monitor.

(9) Remove the free-water test pad for undissolved water testing.

NOTE 19: To maximize the accuracy of the reading, the free-water test pad should be read within 3 minutes of initiating the sampling.

(a) Disassemble the stainless steel monitor (pry off the top with the back end of the tweezers) and using the tweezers tips, gently remove the free-water pad.

(b) Place the pad between two dry, clean paper towels. Using the heel of your hand, press the layers firmly (with approximately 5 pounds of pressure) three or four times to blot excess fluids.

NOTE 20: A pad that is not properly blotted will result in a low reading because the excess fuel will absorb part of the ultraviolet light and decrease fluorescence.

(c) Open the test area cover located on the bottom side of the water detector. Place the free-water pad (orange side down) in the test area window. Close the cover and turn the water detector upright.

(d) Turn the power setting knob to the appropriate power source.

(e) Depress the switch button on the instrument pack and adjust the light-modulator lever until the meter reads "0".

(f) Read the undissolved water level where the lever crosses the scale.

(10) Record the reading to the nearest whole number as ppm by volume of undissolved water in the fuel: Free water, ppm = (meter reading, ppm) (500)/(sample volume, mL).

d. Maintain the Aviation Fuel Contamination Test Kit.

(1) Kit maintenance.

(a) Completely dissemble all fuel line parts and components, (including tubings and connectors) that come in contact with fuel.

(b) Remove all O-rings and gaskets from their seats (if necessary, use flat-blade unserrated forceps to pry O-rings out of their grooves).

(c) Inspect all O-rings and gaskets for embedded dirt and remove any dirt with a gentle scraping.

(d) Replace the O-ring or gasket if grit particles are deeply embedded, rather than to excavate the grits which can cause damage to the seal.

(e) Carefully examine O-rings and gaskets for cracks and deep or large abrasions (discard and replace the part if its integrity is compromised, refer to TM 5-6630-218-10 for a list of replacement parts).

(2) Kit cleaning.

(a) Flush all parts/components with hot, flowing tap water to remove loose dirt particles. Wash each piece separately with hot water and nonabrasive soap solution scrubbing gently until any dirt or film is removed.

(b) Vigorously scrub smooth metal surfaces with a sponge or soft cloth.

NOTE 21: Do not scrub filter support screen.

(c) Use a stiff bristle brush on the threaded parts, to remove matter sticking to the bottoms of the threads.

**Performance Steps**

(d) Use cotton-tip swabs to clean O-rings grooves by rubbing systematically along entire length of the groove.
(e) Wash all O-rings and gaskets in the same soapy water solution being careful not to scratch their surfaces.
(f) After cleaning, thoroughly rinse all components in hot flowing water then rinse again with cold water (in hard water areas, distilled or deoinezed water may be needed for final rinse).
(g) Reinspect O-rings and gaskets for cracks or other damages. Replace if damaged.

(3) Dry and store the kit.
(a) Completely dry all components with a clean, soft absorbent cloth, or use a blast of compressed air, that is entirely free of oil droplets and dirt particles.
(b) Reassemble the equipment and store in its appropriate slot in the kit's foam insert.

(4) Clean and maintain hydrometer.
(a) Wipe excess fuel off the glass hydrometer (s) with clean, soft absorbent cloth.
(b) Wipe the glass hydrometer (s) with a second cloth that has been dampened with the specified cleaning solvent for the type of fuel tested, allow solvent to dry.
(c) Place the completely dried hydrometer(s) inside the protective container.

2. Test for undissolved water in an aviation fuel sample using Gammon Aqua Glow Series III Water Detector.

a. Calibration.

(1) Assemble the light unit and comparator by sliding the comparator into the light unit, after removal from carrying case.
(2) Attach the AC power cord and apply power to the unit.
(3) Remove encapsulated pad labeled 'Calibration Standard' from its envelope using tweezers.
(4) Turn the assembled unit upside-down to gain access to the test pad window.

NOTE 22: This calibration standard is supplied with each unit.

(5) Make a note of the certified value of the calibration standard and place the standard into the test pad window compartment using tweezers.
(6) Turn the instrument right-side up and turn on the ultraviolet lamp by depressing the button on the comparator unit.
(7) Adjust the light-modulating lever on the light until the red pointer is steady at zero.

NOTE 23: Always move the light modulating lever in the same direction when zeroing the photocell comparator and/or taking sample readings to eliminate errors due to play in the mechanical linkage.

(8) Read the light modulating lever and compare this value to the certified value of the calibration standard.
(9) Move the light-modulating lever to the certified value of the calibration standard.

NOTE 24: If the values are not in agreement, proceed to the next steps below. However if the values are in agreement, the instrument is calibrated and ready for use.

(10) Remove the comparator adjustment access screw located on the lower right side of the comparator.
(11) Depress the ultraviolet light button and using the supplied screwdriver, turn the adjustment screw to obtain a zero reading.
(12) Perform a reading of the calibration standard as in steps d.5, and d. 6. This value should be the same as the certified value.

NOTE 25: The instrument needs to be calibrated at the start of each day and after every hour of use.

(13) Remove the certified standard from the light unit using tweezers and store in the plastic bag provided.

b. Sample Preparation.

(1) Remove detector pad housing from the Aqua-Glo carrying case.
(2) Attach the outlet of the detector pad housing to the first vacuum flask of the filtration setup using the stopper with tubing attached.
(3) Transfer approximately 200 mL of sample to the graduate bottle supplied with the kit.

**Performance Steps**

(4) Flush the housing by placing the inlet tube into the sample, turning on the vacuum pump, and allowing the 200 mL sample to be drawn through the detector pad housing.
(5) Turn off the vacuum pump and unscrew the two halves of the housing.

NOTE 26: Make certain the orange colored side of the pad faces the inlet of the housing.

c. Procedure.
(1) Remove a new detector pad from the individually sealed packets and place in detector pad housing using tweezers, making certain the orange colored side of the pad faces the inlet of the housing.
(2) Transfer 500 mL of sample to graduated bottle.
(3) Place the inlet tube of the detector pad housing into the sample, turn on the vacuum pump, and allow the full 500 mL sample to be drawn through the detector housing and pad.
(4) Turn off the vacuum pump and disconnect the detector pad housing from the vacuum flask.
(5) Analyze the detector pad by removing it from the housing using tweezers and placing the pad on a lint-free absorbent towel and blot dry 3 to 4 times, each times moving the pad to a dry area.
(6) Using tweezers, place the detector pad into the test pad window, turn on the lamp and press photocell.
(7) Adjust the light-modulating lever to obtain a zero reading which is stable for 10 to 15 seconds.
(8) Read the light-modulating lever to obtain the amount of water (ppm) in the sample.

3. Operate and maintain Sampling and Gauging Kit.
a. Inspect and prepare the kit.
(1) Clean the innage tape with cheesecloth. Ensure the equipment is clean, dry, free of dirt, and serviceable.
(2) Check the mercury columns in the hydrometer and the cup-case thermometer. If the mercury is separated or the glass is cracked, replace the instrument.
b. Operate the kit.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Operated and maintained the Aviation Fuel Contamination Test Kit. | ____ | ____ |
| 2. Operated and maintained the Aqua-Glo Series III, Water Detector Kit. | ____ | ____ |
| 3. Operated and maintained Sampling and Gauging Kit. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| SC 6680-95-N01 | FM 10-67-2 |
| TM 10-6630-230-13&P | |
| TM 10-6630-247-13&P | |
| TM 10-6640-221-13&P | |
| TM 5-6630-218-10 | |

**Perform Sampling and Gauging Procedures on Petroleum Products**

**101-92L-1394**

**Conditions:** As a petroleum specialist in a field or garrison environment, you are given necessary equipment and manuals; petroleum vehicles, or pipelines with petroleum product, packaged product, sampling and gauging kit, 1-gallon sample cans or 1-quart bottles, fuel-handlers gloves, and rags; American Standard Test Method (ASTM) D-4057, Tables 5A through 6B API/ASTM/-IP Petroleum Measurement Tables, DA Form 1804 (Petroleum Sample), DA Form 3853-1 (Innage Gage Sheet (Using Innage Tape and Bob)), and related safety and environment protection equipment. You are tasked to obtained sample(s) of petroleum products.

**Standards:** Soldier chooses the appropriate sampling apparatus, safely collects sample(s), completes DA Form 1804, and gauges petroleum products in a variety of vessels, or vehicles without causing damage to the environment.

**Performance Steps**

1. Determine the appropriate sampling apparatus in accordance with ASTM D-4057.

NOTE 1: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult material safety data sheets (MSDSs).

   a. Weighted bottle or beaker samplers are applicable for sampling liquids of 16 psi (110 kPa) RVP or less in tank cars, tank trucks, shore tanks, ship tanks and barge tanks.
   b. Tap samplers are applicable for sampling of 26 psi (179 kPa) RVP or less in tanks that are equipped with suitable sampling taps or lines.
   c. Sampling probes are used to withdraw portions from a flowing stream that will represent the entire stream.
   d. Dipper samplers are applicable for sampling liquid of 2 psi (13.8 Kpa) or less and semi-liquids where free or open-discharge stream exists.
   e. Tube samplers are applicable for sampling liquids of 2 psi (13.8 kPa) or less and semi-liquids in drums, barrels, and cans. Sometimes referred to as "Drum Thief".
   f. Thief samplers are applicable for obtaining bottom samples or of semi-liquids in tank cars and storage tanks. Samples can be obtained within 1/2 inch of the bottom of the car or tank.
      (1) Bacon Bomb.
      (2) Core Thief.
   g. Extended-tube samplers are used for obtaining bottom water samples primarily on ships and barges. Samples can be obtained within 1/2 inch of the bottom of the tank.

2. Prepare sample containers.
   a. Use sample containers that are clear or brown glass bottles or cans. The only cans permissible are those with the seams soldered on the exterior surface with a flux of rosin in a suitable solvent.
   b. Use plastic bottles made of suitable unpigmented linear polyethylene for handling and storage of gas oil, diesel oil, fuel oil, and lubricating oil. They should not be used for gasoline, aviation jet fuel, kerosine, crude oil, white spirit, medicinal white oil, and special boiling point products unless testing indicates there is no problem with solubility, contamination, or loss of light ends.
   c. Never use rubber stoppers. Cork or glass stoppers, or screw caps of plastic or metal, may be used for glass bottles; screw caps only shall be used for cans to provide a vapor tight closure seal.

**Performance Steps**

d. Clean containers.
   (1) Wash containers with a strong soap solution, rinse it thoroughly with tap water, and then distilled water.
   (2) Dry either by passing a current of clean, warm air through the container or by placing it in a hot dust-free cabinet at 40 degrees C (104 degrees F) or higher.
   (3) When dry, stopper or cap the container immediately.
e. Rinse sample container with product to be sample before collecting sample, except for when collecting sediment (millipore) samples.

3. Follow all safety precaution when sampling petroleum products.
   a. Always ground your body by touching the steel stair rail, platform, or tank shell when approaching the top of a tank.
   b. When gloves are worn in cold weather, it is recommended that a metal button be inserted in the palm of the glove so that contact can be made between the hand and the steel tank.
   c. Open the gauging hatch with the wind at your back.
   d. Use the buddy system when sampling storage tanks.

4. Obtain a sample using a weighted bottle or beaker (tank cars, tank trucks, shore tanks, ship tanks and barge tanks).
   a. All level sample (one-way).
      (1) Lower the weighted, stoppered bottle, or beaker as near as possible to the draw-off level.
      (2) Pull out the stopper with a sharp jerk of the line.
      (3) Raise the bottle at a uniform rate so that it is about three-fourths full as it emerges from the liquid.
   b. Running sample (two-way).
      (1) Lower the unstoppered bottle or beaker as near as possible to the level of the bottom of the outlet connection or swing line.
      (2) Raise the bottle or beaker to the top of the liquid at a uniform rate of speed such that it is about three-fourths full when withdrawn.
   c. Top, upper, middle, lower an outlet samples.
      (1) Lower the weighted stoppered bottle or beaker to the proper top upper, middle, lower, and outlet depths.
      (2) At the selected level, pull out the stopper with a sharp jerk of the line and allow the bottle or beaker to fill completely.
      (3) When full, raise the bottle or beaker, pour off a small amount, and stopper immediately.
      (4) Stopper sample immediately after taking them.
      (5) Label sample container, complete DA Form 1804, and deliver to the laboratory in the original sampling bottles.

NOTE 2: Use bottles instead of the weighted beaker, when possible, to sample volatile products. The loss of light ends is likely to occur when transferring volatile products from a weighted beaker to another container.

5. Obtain a sample using a tube sampler (drum thief).
   a. Drums and Barrels.
      (1) Place the drum or barrel on its side with the bung up. If the drum does not have a side bung, stand it up and sample from the top.
      (2) If detection of water, rust, or other insoluble contaminants is desired, once the barrel or drum is on its side, let it remain in this position long enough to permit the contaminants to settle.
      (3) Remove the bung and place it beside the bung hole with the oily side up.
      (4) Close the upper end of a clean, dry sampling tube (drum thief) with the thumb and lower the tube into the oil for a depth of about 1 foot (0.3 meters).
      (5) Remove the thumb, allowing oil to flow into the tube.
      (6) Again close the upper end with the thumb and withdraw the tube.

**Performance Steps**

(7) Rinse the tube with the oil by holding it nearly horizontal and turning it so that the oil comes in contact with that part of the inside surface that will be immersed when the sample is taken.
(8) Avoid handling any part of the tube that will be immersed in the oil during the sampling operation.
(9) Discard the rinse oil and allow the tube to drain.

NOTE 3: Discard waste in approved containers only.

(10) Insert the tube into the oil again, holding the thumb against the upper end.

NOTE 4: If an all-level sample is desired, insert the tube with the upper end open.

(11) When the tube reaches the bottom, remove the thumb and allow the tube to fill.
(12) Replace the thumb, withdraw the tube quickly, and transfer the contents to the sample container.

CAUTION: DO NOT ALLOW THE HANDS TO COME IN CONTACT WITH ANY PART OF THE SAMPLE.

(13) Close the sample container; replace and tighten the bung in the drum or barrel.

b. Cans.
(1) For cans of 5-gallon (19-L) capacity or larger.
(a) Obtain sample in the same manner as from drums and barrels.
(b) Use a tube of proportionately smaller dimensions.
(2) For cans of less than 5-gallon (19-L) capacity.
(a) Use the entire contents as the sample.
(b) Select cans at random in accordance with Table 3, ASTM D-4057.
(3) Close and label sample containers.

6. Obtain a sample using a bomb thief sampler.
a. Lower the clean, dry thief through the dome of a tank car or tank hatch until it strikes the bottom.
b. When the thief is full, remove it and transfer the contents to the sample container.
c. Close and label the container immediately.

7. Complete DA Form 1804. Annotate information in applicable block/column and attach sample tag to container immediately after collecting sample.
a. PRODUCT - enter product nomenclature.
b. FROM (INSTALLATION) - installation/activity submitting sample.
c. SAMPLE NO. - sample identification number.
d. LABORATORY NO. - assigned by laboratory personnel after sample is submitted.
e. SPECIFICATION NO. - applicable specification of product.
f. AMOUNT PRODUCT SAMPLE REPRESENTS - gallon of product within the container (for example, storage tank and tank truck) represented by the sample.
g. MANUFACTURE/SUPPLIER - company that supplied the product, if know.
h. SOURCE OF SAMPLE - tank number, truck number, tank car #, cans, or drums.
i. SAMPLE BY - person that obtained sample.
j. ARMED SERVICES PROCUREMENT NO. - applicable contract number. If not required or known, enter N/A.
k. STOCK NO. - applicable stock number.
l. DATE SAMPLED - date sample was taken.
m. QUALIFICATION NO. - applicable qualification number (applies to certain type lubricants only). If not required, enter N/A.
n. BATCH NO. - applicable batch number. If not required, enter N/A.
o. FILL DATE - date container was filled with product (applies only to cases, cans, pails, and drums). If not required, enter N/A.
p. SHIPMENT DELIVERY DATE - date delivery of shipment was made.
q. CONTRACT BULLETIN NO. - applicable DESC contract bulletin number. If not required, enter N/A.

**Performance Steps**

r. ITEM NO. - applicable DESC bulletin item number. If not required, enter N/A.
s. PROGRAM - place an "X" in the applicable box.
t. TYPE SAMPLE - place an "X" in the applicable box. When "X" is entered in the box titled "Other", specify type of sample taken (for example, all levels).
u. REVERSE SIDE - enter any remarks pertinent to expedite the analysis/review of the sample being tested (for example, weather condition and visual analysis of product). Annotate name, address, and telephone number of person to contact for sample information.

NOTE 5: Any special samples submitted for immediate analysis should have the sample tags outlined in red for immediate processing by the laboratory.

8. Gauge petroleum product.

NOTE 6: Gauging is used to determine the amount of product on hand and the amount of water in storage tanks. It is also used to detect leaks or unauthorized withdrawals and to determine tank ullage for receiving shipments.

a. Determine the type of gauge equipment that is needed.
   (1) Tape and bob. Used to measure petroleum products in fixed storage tanks.
      (a) Outage gauge - the distance from the reference point to the surface of the liquid in a tank. Use to gauge liquids in conventional fixed-roof tanks, ship and barge tanks and tanks equipped with a pressure lock.
      (b) Innage gauge - the depth of liquid in a tank, measured from the surface of the liquid to the tank bottom or to a fixed datum plate.
   (2) Petroleum gauge stick - used to determine the Innage of a tank vehicle or a non pressurized tank car with more than 1 foot of shell outage. Measurement is in inches.
   (3) Tank vehicle gauge stick - used to determine the amount of product in tank vehicles. Measurements are in gallons.
   (4) Yardstick - used as a field expedient measure to determine the approximate number of gallons in a 55-gallon drum.
   (5) Tank car gauge stick - used to determine dome Innage and shell outage in non pressurized rail tank cars that have shell outages of 1 foot or less.
b. Obtain an Innage gauge of petroleum product in a storage tank using an Innage tape and bob.
   (1) Ensure all safety measures are observed.
   (2) Prepare the gauging tape by placing product-indicating paste on the tape where product cut is expected.

NOTE 7: Apply indicating paste in a thin layer to ensure measurements can be read after gauging. Grease or light lubricating oil may be used instead of the paste.

   (3) Place the unmarked side of the tape against the metal rim of the gauging hatch reference point.
   (4) Lower the tape and bob into the tank until the bob is a short distance from the bottom. To determine this point, compare the length of the unwound tape with the reference height of the tank.
   (5) Unwind the tape slowly until the tip of the bob touches the tank bottom or datum plate. To ensure an accurate gauge, compare the tape reading at the reference point with the reference height of the tank.
      (a) Make sure the bob does not rest on a rivet or other obstruction.
      (b) Make sure the tape is not lowered so far into the tank that the bob tilts and causes an incorrect gauge.
   (6) Withdraw the tape quickly, and observe the product cut.
   (7) Record the cut as the Innage gauge.
   (8) Repeat the gauging procedure until 2 identical readings are recorded.
c. Obtain an outage gauge of petroleum product in a storage tank using an Innage tape and bob.
   (1) Place the unmarked side of the tape against the metal rim of the gauging hatch at the reference point.
   (2) Lower the tape and bob into the tank until the bob touches the surface of the product.
   (3) Wait until the bob stops moving. Lower the tape slowly until the bottom of the bob is 2 to 3 inches below the surface of the product.

**Performance Steps**

(4) Record the reading on the tape at the reference point as the tape reading.
(5) Withdraw the tape quickly, and record the product cut on the bob as the bob reading. If the cut is hard to read, put product-indicating paste on the bob and gauge the tank again.
(6) Determine the outage.
(a) Subtract the bob reading from the tape reading.
(b) To convert the outage gauge to Innage gauge, subtract the outage gauge from the reference height of the tank.

d. Obtain an outage gauge of petroleum product using an outage tape and bob.
(1) Hold the unmarked side of the tape against the metal rim of the gauging hatch at the reference point.
(2) Lower the tape and bob into the tank until the bob touches the surface of the product.
(3) Wait until the bob stops moving. Lower the tape slowly until the bottom of the bob is 2 to 3 inches below the surface of the product.
(4) Record the reading on the tape at the reference point as the tape reading.
(5) Withdraw the tape quickly, and record the product cut on the bob reading. If product cut is hard to read, put product-indicating paste on the bob and gauge the tank again.
(6) Add the bob reading to the tape reading to get the outage gauge.

e. Gauge bottom sediment and water in storage tank.

NOTE 8: Storage tanks must be measured for sediment and water each time they are gauged to find the actual product amount.

(1) Place a thin even layer of water-indicating paste on the part of the bob where the water and product are expected to meet.
(2) Hold the side of the tape against the metal rim of the gauging hatch at the reference point.
(3) Lower the tape and bob into the tank until the bob is a short distance from the bottom. Determine this by comparing the length of the unwound tape with the reference height of the tank.
(4) Unwind the tape slowly until the tip of the bob touches the tank bottom or datum plate.
(a) Make sure the bob does not rest on a rivet or other obstructions.
(b) Make sure the tape is not lowered so far into the tank that the bob will tilt and cause an incorrect reading.
(5) Keep the tape and bob in the gauging position 5 to 10 seconds for kerosene, gasoline, and other light products. Keep it in position for 15 to 30 seconds for heavier products.
(6) Remove the tape and bob from the tank. There should be no paste left on the portion of the bob that was in the water or the paste should be discolored.
(7) Record the water cut as a water Innage or outage.

f. Measure the temperature of petroleum product using the cup-case thermometer.

NOTE 9: The temperature of gauged product is necessary to correct the measured quantity to quantity at the standard temperature of 60 degrees F. Temperature should be taken during gauging operations.

(1) Examine the mercury column of the cup-case thermometer for separation. Replace the thermometer if the column is faulty.
(2) Determine the minimum number of temperature reading for various depths of liquid.
(3) Attach the thermometer to the end of a gauge tape, brass-coated chain, or cord. If a cord is used, tie knots in the cord so that they will show when the thermometer reaches the required level.
(4) Lower the thermometer to the required level. Allow the thermometer to remain in place for the length of time.
(5) Withdraw the thermometer (with the cup full of product) and immediately read the thermometer with the cup sheltered below the edge of the hatch.

NOTE 10: Shelter the cup to minimize change of reading which may be caused by wind or atmospheric temperature.

(6) Immediately record the temperature to the nearest degree Fahrenheit.
(7) Add the readings together when temperatures are taken at more than one level. Divide the sum by the number of readings to get the true average temperature of the product.

**Performance Steps**

9. Determine net quantity of petroleum product.

NOTE 11: Volume correction of quantities less than 3,500 gallons is optional. Measured volumes that equal or exceed 3,500 gallon must be corrected.

   a. Find the total measured quantity on the tank strapping chart (strapping charts are specific for individual tanks). Convert the linear measurements to volumetric measurements.
   b. Find the amount of bottom sediment and water measured on the tank strapping chart. Convert the linear measurements to volumetric measurements.
   c. Find the net quantity of product, uncorrected. Subtract the bottom sediment and water quantity from the total measured quantity.
   d. Measure the API Gravity of the product in accordance with ASTM D-1298.
   e. Convert the observed API Gravity reading to API Gravity @ 60 degrees F using Table 5B, API/ASTM-IP Petroleum Measurement Table.
   f. Determine volume conversion factor using Table 6B, API/ASTM-IP Petroleum Measurement Table.
   g. Multiply volume conversion factor by the net quantity of product to find the quantity of fuel @ 60 degrees F.
   h. Record corrected volume of product on DA Form 3853-1.

10. Perform PMCS on equipment in accordance with technical manual or manufacture's instructions.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Determined the appropriate sampling apparatus in accordance with ASTM D-4057. | ____ | ____ |
| 2. Prepared sample containers. | ____ | ____ |
| 3. Followed all safety precautions when sampling petroleum products. | ____ | ____ |
| 4. Obtained a sample using a weighted bottle or beaker. | ____ | ____ |
| 5. Obtained a sample using a tube sampler (drum thief). | ____ | ____ |
| 6. Obtained a sample using a bomb thief sampler. | ____ | ____ |
| 7. Completed DA Form 1804. | ____ | ____ |
| 8. Gauged petroleum products. | ____ | ____ |
| 9. Determined net quantity of petroleum products. | ____ | ____ |
| 10. Performed PMCS in accordance with equipment technical manual or manufacturer's instruction. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | FM 4-20.13 |
| DA FORM 1804 | |
| DA FORM 3853-1 | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

Skill Level 2

Subject Area 4: Supervising Laboratory Operations

**Supervise Laboratory Testing**

**101-92L-2300**

**Conditions:** As a petroleum laboratory sergeant in a field environment or garrison, given a petroleum testing facility and petroleum laboratory specialist under your supervision performing test procedures on petroleum products; all safety related materials and petroleum ongoing petroleum testing technicians. Materials and manuals needed: Applicable American Standard Test Method (ASTM) and/or Federal Test Method, DA Form 2077 (Petroleum Products Laboratory Analysis Report), and MIL-STD-3004A.

**Standards:** Soldier verifies that the glassware and apparatus being used are in accordance with specified ASTM and verified that the testing procedures were being followed. The calculations were performed in accordance with the ASTM and reviewed the significance of the test with technicians.

**Performance Steps**

1. Compare the test being performed with the petroleum specification requirements to verify that the correct ASTM is being performed.
2. Verify the glassware being used is required in the ASTM.
3. Verify that all safety precautions are observed and followed.
4. Verify that the testing apparatus assembly conforms to the ASTM.
5. Verify that the techniques used by the operators are the same as those given in the ASTM.
6. Identify the errors in calculations by performing independent calculations.
7. Verify that the reported test results conform to the ASTM standards.
8. Provide technicians with assistance while performing the ASTM if they are having difficulties.
9. Explain the significance of test methods to the technician when necessary.

**Evaluation Preparation:** See condition and standard statements. Have all materials ready.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Compared the test being performed with the petroleum specification requirements. | ____ | ____ |
| 2. Verified that the glassware used was required in the ASTM. | ____ | ____ |
| 3. Verified that all safety precautions were observed and followed. | ____ | ____ |
| 4. Verified that the testing apparatus assembly conformed to the ASTM. | ____ | ____ |
| 5. Verified that the techniques used by the operators were the same as those given in the ASTM. | ____ | ____ |
| 6. Identified the errors in calculations by performing independent calculations. | ____ | ____ |
| 7. Verified that the reported test results conformed to the ASTM standards. | ____ | ____ |
| 8. Provided technicians with assistance while performing the ASTM if they had difficulties. | ____ | ____ |
| 9. Explained the significance of test methods to the technician when necessary. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | FM 10-67-2 |
| DA FORM 2077 | |
| MIL-STD-3004A | |

**Review Laboratory Reports**

**101-92L-2301**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison environment, you are given the responsibility to review petroleum analysis tests reports. Materials and manuals needed: applicable American Standard Test Method (ASTM) and/or Federal Test Method, applicable product specification, MIL-STD-3004A, and DA Form 2077 (Petroleum Products Laboratory Analysis Report), petroleum laboratory specialist, under your supervision has completed DA Form 2077.

**Standards:** Soldier verifies that the test method, glassware, and apparatus used were correct, the technique used and calculations are those given in the test method, the reporting method is accurate, and the results of the test procedures are correctly analyzed.

**Performance Steps**

1. Identify errors in the administrative entries of DA Form 2077.
    a. Verify data entered from DA Form 1804 (Petroleum Sample) and laboratory sample logbook are entered correctly on the DA Form 2077.
        (1) Product name and type.
        (2) Laboratory sample number.
        (3) Sample number assigned by user.
        (4) Specification number for specific product.
        (5) Verify that the dates the test was started and completed are entered.
    b. Verify that specification requirements for specified product are entered correctly.

2. Examine the repeatability statistic for specific test, if applicable.

NOTE: Repeatability is the difference between successive test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material.

    a. Maintain a historical log for technicians.
    b. Maintain a historical log for testing equipment.

3. Review the recorded results.
    a. Perform independent calculation of reported results.
    b. Verify that results are report in accordance with the ASTM reporting procedures.

4. Review the remark section of DA Form 2077 to ensure OG, SFU, or NSFU has been annotated, if applicable.
    a. Verify that technician has annotated all deterioration limits from MIL-STD-3004A if product is SFU.
    b. Verify that all tests that failed to meet specification limit and deterioration limit are annotated.

WARNING: PETROLEUM LABORATORIES ARE INHERENTLY DANGEROUS. CHEMICALS, SOLUTIONS, AND FUMES CAN POSSIBILY INJURE SOLDIERS AND DAMAGE EQUIPMENT. PREGNANT SOLDIERS SHOULD TAKE EXTRA PRECAUTIONS.

**Evaluation Preparation:** See condition and standard statements. Have all materials ready.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Identified errors in the administrative entries on DA Form 2077. | ____ | ____ |
| 2. Examined the repeatability statistic for specific test, if applicable. | ____ | ____ |
| 3. Reviewed the recorded results. | ____ | ____ |
| 4. Reviewed the remark section of DA Form 2077 to ensure OG, SFU or NSFU was annotated, if applicable. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| ASTM STANDARDS | |
| DA FORM 2077 | |
| MIL-STD-3004A | |

**Supervise Preparation of Chemical Solutions**

**101-92L-2302**

**Conditions:** As a petroleum laboratory sergeant in a field, or garrison environment, you are given an operational petroleum laboratory and FM 10-67-2, you are required to supervise laboratory specialist while they prepare chemical solutions.

**Standards:** Soldier supervises the preparation and standardization of chemical solution by titration to within +/- 0.0005N accuracy.

**Performance Steps**

1. Verify that glassware is cleaned and prepared properly.
    a. If chemical cleaning is necessary, monitor process to ensure all safety measures are adhered to.
    b. Verify that used solutions are disposed of in an appropriate container.
2. Verify the amount of solute needed to prepare a solution.
    a. Check to ensure correct calculations were used to determine the amount of solid needed.
    b. Check to ensure correct calculations were used to determine the volume of liquid needed.
3. Verify that the correct balance is used to weigh substances.
4. Verify that an appropriate standard is selected.
5. Check the calculation used to determine the weight of the primary standard.

CAUTION: ENSURE ALL HAZARDOUS WASTE IS DISPOSED OF IN APPROVED MARKED CONTAINERS.

6. Verify the preparation of the solution.
7. Verify the standardization of the primary standard.
    a. Check the amount of solution used to reach the end point.
    b. Check the calculation used to determine the normality of the solution.
    c. Verify that the results have been recorded to the fourth decimal place.
8. Verify that the standardized solution is properly labeled.

NOTE: Ensure that all spills are cleaned up immediately and hazardous materials and hazardous waste are disposed of in accordance with laboratory sop. Report all hazardous material and hazardous waste spills immediately. Laboratory personnel are familiar with and know the location of MSDS for all hazardous materials present in the workplace.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Verified that glassware was cleaned and prepared properly. | ____ | ____ |
| 2. Verified the amount of solute needed to prepare a solution. | ____ | ____ |
| 3. Verified that the correct balance was used to weigh substances. | ____ | ____ |
| 4. Verified that an appropriate standard was selected. | ____ | ____ |
| 5. Checked the calculation used to determine the weight of the primary standard. | ____ | ____ |
| 6. Verified the preparation of the solution. | ____ | ____ |
| 7. Verified the standardization of the primary standard. | ____ | ____ |
| 8. Verified that the standardized solution was properly labeled. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

**Required**
FM 10-67-2

**Related**
ASTM STANDARDS
MIL-STD-3004A

**Supervise Fire Prevention and Safety Measures**

**101-92L-2303**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison environment, you are given fire-fighting equipment and FM 10-67-2, newly arrived and current petroleum laboratory specialists who are required to perform petroleum laboratory specialist related duties in a petroleum laboratory or other fuel facility.

**Standards:** Soldier conducts safety inspections and provides safety training in accordance with laboratory standing operating procedure (SOP) and FM 10-67-2.

**Performance Steps**

1. Verify that laboratory technicians follow fire and safety measures in accordance with Task 101-92L-1387.
2. Inspect the fire-fighting equipment.
   a. Check fire extinguishers to make sure they have not been damaged or tampered with.
   b. Check that fire extinguisher hose nozzles are not clogged.
   c. Make inspections at least monthly to ensure extinguishers are in their designated places and seals are intact.
   d. Check the extinguishers inspection tags to make sure that:
      (1) CO2 extinguishers are hydrostatically tested.
      (2) Dry chemical extinguishers are tested.
   e. Make sure an operator is assigned to each fire extinguisher.
   f. Place extinguishers in areas where there is a high probability of fire.
3. Inspect the fire blankets.
   a. Check that fire blankets open and draw without difficulty.
   b. Check that fire blankets are firmly attached to their supports.
   c. Check that the bottoms of the fire blankets are as close to the floor as the case design permits.
   d. Check that fire blankets have no holes or weak areas.
4. Inspect the emergency showers and eye washes for serviceability.
   a. Check that no objects on which a person could trip are stored in or near the showers.
   b. Check that an EMERGENCY SHOWER or EYEWASH sign is prominently displayed.
   c. Inspect water valves for easy operation and to ensure there is no accumulated rust in the service pipes.
5. Identify and supervise the correction of any fire safety violations.
   a. Inspect the laboratory for fire hazards such as:
      (1) Piles of flammable debris such as paper and rags.
      (2) Leaking gas piping or tubing.
      (3) Flammable liquids stored near a heat source.
   b. Supervise the removal of fire hazards or correct them.
6. Train Soldiers in use of fire-fighting equipment.
   a. Instruct the laboratory technicians thoroughly in areas of fire prevention and the proper response to the sighting of a fire.
   b. Train laboratory technicians on the safe and proper use of portable fire extinguishers.
7. Verify that all safety precautions are observed.
   a. Observe the handling of chemicals.
   b. Make sure the laboratory is properly ventilated at all times.
   c. Perform the gas alarm system test as specified in the laboratory SOP.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment, SOP, and training aides.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Verified that laboratory technicians followed fire and safety measures in accordance with Task 101-92L-1387. | ____ | ____ |
| 2. Inspected the fire-fighting equipment. | ____ | ____ |
| 3. Inspected the fire blankets. | ____ | ____ |
| 4. Inspected the emergency showers and eye washes for serviceability. | ____ | ____ |
| 5. Identified and supervised the correction of any fire safety violations. | ____ | ____ |
| 6. Trained Soldiers in use of fire-fighting equipment. | ____ | ____ |
| 7. Verified that all safety precautions are observed. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| FM 10-67-2 | AR 200-1 |
| | FM 5-415 |

**Supervise Environmental Stewardship Measures**

**101-92L-2304**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison given the responsibility to supervise the handling and disposal of any hazardous waste material or other waste material that might generate hazardous waste. Materials needed: material to clean up hazardous spills and a maintained file of material safety data sheets (MSDSs) for all hazardous materials in the workplace, and newly assigned and current petroleum laboratory specialist in a petroleum related facility performing assigned duties upon being assigned to a petroleum laboratory or petroleum storage and or distribution facility.

**Standards:** Soldier supervises: the activities at his assigned location to prevent damage to the environment, and report spills in accordance with established SOP if necessary, the disposal of all hazardous waste in a manner that has no detrimental effect on the environment and in accordance with local standing operating procedure (SOP), ensure that all environmental laws are obeyed, and trains subordinate on good environmental stewardship procedures in accordance with AR 200-1, FM 3-100.4, and other related laws.

**Performance Steps**

1. Verify that MSDS are maintained and available to laboratory personnel.
   a. Place copies of the appropriate MSDS in the laboratory.
   b. Brief laboratory personnel on the location of the MSDS.
   c. Review MSDS to verify applicability.
   d. Update MSDS as required.
2. Verify that unit hazardous waste and hazardous material management policy is incorporated in all laboratory operations.
   a. Verify that laboratory personnel are able to extract information from MSDS.
   b. Strictly enforce safety precautions.
3. Supervise storage of hazardous waste materials.

WARNING: NEVER PLACE HAZARDOUS MATERIAL OR HAZARDOUS WASTE IN UNAUTHORIZED CONTAINER (FOR EXAMPLE, DUMPSTERS). THIS IS AN ILLEGAL DISPOSAL.

4. Observe testing and other operations to ensure work areas are clean and safe.
5. Verify that all required safety equipment is on-hand and serviceable.
6. Verify that procedures for spill response are followed in accordance with established SOPs.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Verified that MSDS were maintained and available to laboratory personnel. | ____ | ____ |
| 2. Verified that unit hazardous waste and hazardous material management policy was incorporated in all laboratory operations. | ____ | ____ |
| 3. Supervised storage of hazardous waste materials. | ____ | ____ |
| 4. Observed testing and other operations to ensure work areas were clean and safe. | ____ | ____ |
| 5. Verified that all required safety equipment was on-hand and serviceable. | ____ | ____ |
| 6. Verified that procedures for spill response were followed in accordance with established SOP. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| AR 200-1 | FM 10-67-2 |
| AR 700-141 | |
| FM 3-100.4 | |

**Supervise Operation and Maintenance of Mobile Laboratory and 60 KW DED Generator Sets**

**101-92L-2314**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison environment, given generator set, diesel engine, laboratory, petroleum, semitrailer and FM 10-67-2, TM 10-6640-215-13, TM 6115-545-12, and petroleum laboratory specialist are required to operate and maintain the mobile laboratory and the 60 KW DED generator set.

**Standards:** Soldier supervises mobile laboratory and DED generator operations and maintenance procedures in accordance with applicable TM while adhering to all safety and environmental stewardship principles in accordance with TM 5-6115-545-12, TM 10-6640-215-13, FM 10-67-2, MIL-STD 3004A, and American Standard Test Method (ASTM) volumes.

**Performance Steps**

1. Supervise site selection.
    a. Direct the selection of a site that conforms to:
        (1) Ample space for maneuvering and assembling.
        (2) Level well-drained terrain and relatively free from surface rocks and large stones.
        (3) Accessible to tactical vehicles.
        (4) Downstream from personnel assembly areas.

2. Supervise the setup process.
    a. Reinforce all safety precaution measures.
    b. Direct the positioning and leveling of the laboratory.
    c. Ensure all drain hoses are properly connected.
    d. Supervise the grounding process.

3. Monitor before-operations PMCS on the laboratory.
    a. Provide feedback to Soldiers.
    b. Ensure deficiencies found are directed to the appropriate maintenance level for corrective actions.
    c. Enforce related safety procedures when necessary.

4. Monitor starting procedures.
    a. Verify Soldiers comply with all applicable safety guidelines.
    b. Ensure all pre-starting tasks are completed.
        (1) Entry doors closed.
        (2) Purge doors closed.
        (3) Power connection is correct.
        (4) Verify ground connection in accordance with applicable TM.
        (5) Ensure start aid is used when necessary.
        (6) Verify steps are performed in sequence.
    c. Supervise the supply of power to the laboratory.

5. Supervise the operation of the laboratory system and verify the system components operate in accordance with applicable TM.

NOTE: The purge cycle must be completed prior to entering the laboratory.

    a. Electrical system lights and switches.
    b. Water system's water lines and fittings.
    c. Air and vacuum systems operate in accordance with applicable TM.

6. Supervise petroleum analysis testing.
    a. Ensure Soldiers use the proper ASTM and or test guidelines.
    b. Verify that all required gear is being worn.

**Performance Steps**

c. Provide guidance and mentorship to Soldiers.
d. Enforce safety and environmental stewardship measures in accordance with laboratory SOP and applicable publications.

7. Monitor the during-operations PMCS in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P.

8. Supervise the shut down process.
   a. Verify that all chemicals are secured and stored properly.
   b. Verify power to all equipment is turned off.
   c. Verify all equipment are secured and stored properly.
   d. Verify the ECU power and all lights are turned off.
   e. Verify power to all systems is turned off.
   f. Ensure that the electrical system is turned off only after all other systems are turned off.
   g. Verify the main circuit breaker is opened and the door closed.
   h. Ensure the power generator is powered down in accordance with generator operations manual.

9. Monitor the after-operations PMCS on laboratory (exterior).

10. Supervise before-operations PMCS on generator sets.
    a. Ensure Soldiers use the correct manual.
    b. Ensure Soldiers have and wear appropriate safety gear.
    c. Verify leaks are properly classified.
    d. Verify deficiencies are correctly annotated on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).

11. Verify controls are properly set in accordance with operators manual.
    a. Verify generator set is properly grounded.
    b. Verify all pre-starting steps are completed.
       (1) Ensure all switches are set in accordance with operators manual.
       (2) Radiator shutter operates freely.
       (3) Fault indicator lights illuminate.

12. Monitor starting of the generator set.
    a. Verify steps are performed in sequence.
    b. Ensure start aid is used when necessary.
    c. Verify generator set is not cranked for more than 15 seconds at a time.
    d. Verify engine reach proper operating temperature prior to applying any load.
    e. Verify frequency and voltage adjustments are made in accordance with operators manual.
    f. Ensure Soldiers check for faults and correct them if necessary, prior to closing circuit breaker.

13. Supervise operation of the generator set.
    a. Observe Soldier making adjustments to generator voltage and frequency if needed.
    b. Ensure the AC ammeter indicates balanced load per phase.
    c. Direct Soldier to close and or open doors/panels when needed.

14. Monitor Soldier performing during-operations PMCS on generator set in accordance with operators manual.

15. Supervise shutdown of the generator set by observing Soldier and providing feedback if needed.
    a. Ensure Soldier opens main AC contactor.
    b. Ensure Soldier places the Start-Run-Stop switch to STOP position after allowing the appropriate time interval.
    c. Ensure Soldier removes DC power after engine has stopped.

16. Monitor after-operations PMCS in accordance with operators manual.

**Evaluation Preparation:** See condition and standard statements. Verify all manuals and safety equipment are present, and personnel are available to perform the tasks.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Supervised site selection and directed the selection of a site. | ____ | ____ |
| 2. Supervised the setup process. | ____ | ____ |
| 3. Monitored before-operations PMCS on the laboratory. | ____ | ____ |
| 4. Monitored starting procedures. | ____ | ____ |
| 5. Supervised the operation of the laboratory system and verified the system components operated in accordance with applicable TM. | ____ | ____ |
| 6. Supervised petroleum analysis testing. | ____ | ____ |
| 7. Monitored the during-operations PMCS in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P. | ____ | ____ |
| 8. Supervised the shut down process. | ____ | ____ |
| 9. Monitored the after-operations PMCS on laboratory (exterior). | ____ | ____ |
| 10. Supervised before-operations PMCS on generator sets. | ____ | ____ |
| 11. Verified controls were properly set in accordance with operators manual. | ____ | ____ |
| 12. Monitored starting of the generator set. | ____ | ____ |
| 13. Supervised operation of the generator set. | ____ | ____ |
| 14. Monitored Soldier whom performed during-operations PMCS on generator set in accordance with operators manual. | ____ | ____ |
| 15. Supervised shutdown of the generator set by observing Soldier and providing feedback if needed. | ____ | ____ |
| 16. Monitored after-operations PMCS in accordance with operators manual. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| FM 10-67-2 | DA PAM 200-1 |
| MIL-STD-3004A | FM 3-100.4 |
| TM 10-6640-215-13 | |
| TM 5-6115-545-12 | |

Subject Area 5: Supervising Operation and Maintenance of Laboratory Facilities

**Supervise Installation and Adjustment of Laboratory Equipment**

**101-92L-2305**

**Conditions:** As a petroleum laboratory sergeant in a field environment or garrison, you are given an operational laboratory, laboratory equipment (oven, manometer, baths, and so on), and FM 10-67-2, petroleum laboratory specialist who are required to install and or adjust petroleum laboratory equipment.

**Standards:** Soldier supervises the installation and adjustment of laboratory equipment in accordance with laboratory standing operating procedure (SOP) and the manufacturer's manual.

**Performance Steps**

1. Verify that mercury-to-mercury regulator has been installed properly.

CAUTION: NEVER HANDLE MERCURY WITH BARE HANDS. IF SPILL OCCURS, ENSURE ADEQUATE VENTILATION IS EFFECTED. COVER SPILL WITH SULFUR. CLEAN UP THE MERCURY AND SULFUR TOGETHER AND PUT THEM IN A SUITABLY LABELED CONTAINER.

   a. Ensure Soldier inspect the regulator for the presence of gas bubbles.
   b. Supervise Soldier in the heating or handling of mercury.

2. Supervise the setup of a wire-to-mercury thermoregulator.
   a. Verify the temperature setting of the bath.
   b. Ensure proper placement of the regulator.
   c. Ensure the steps are performed in correct sequence.
   d. Reinforce precautions for handling mercury.

3. Verify that the laboratory oven temperatures have been adjusted properly.
   a. Observe Soldier adjust the rheostat clockwise to desired setting.
   b. Monitor the stabilization process.
   c. Verify that Soldier uses correct procedure to perform calibration.

**Evaluation Preparation:** See condition and standard statements. Have all materials and equipment ready.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Verified that mercury to mercury regulator was installed properly. | ____ | ____ |
| 2. Supervised the setup of a wire-to-mercury thermoregulator. | ____ | ____ |
| 3. Verified that the laboratory oven temperatures were adjusted properly. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| FM 10-67-2 | |

**Supervise PQAS Operations**

**101-92L-2311**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison environment, given an operational Petroleum Quality Analysis System (PQAS) and MIL-STD-3004, petroleum laboratory specialists who are required to perform PQAS related tasks.

**Standards:** Soldier supervises Soldiers that operate the PQAS in accordance with TM 10-8340-243-13&P.

**Performance Steps**

1. Supervise site selection and direct the selection of a site that conforms to the following:
   a. Provide ample maneuvering space.
   b. Level well-drained terrain relatively free from rocks and large stones.
   c. Accessible to tactical vehicles.
   d. Sheltered from high winds.
   e. Downstream from personnel assembly areas.
2. Supervise the setup process.
   a. Reinforce all safety guidelines.
   b. Direct positioning of the PQAS.
   c. Monitor the grounding process and provide adequate feedback.
   d. Inspect the results of all connections and assemblies.
3. Direct the PQAS bootwall and MCPS tent assembly process.
   a. Monitor the inventory of the tent components.
   b. Observe the performance of all steps in accordance with TM 10-8340-243-13&P.
   c. Emphasize the adherence of all safety measures.
4. Monitor starting procedures.
   a. Verify all safety procedures have been followed.
      (1) The lab is properly ground.
      (2) Appropriate power sources have been selected.
      (3) Shelter port plug screwed in.
   b. Verify Soldier perform all steps in sequence.
5. Supervise petroleum analysis testing in accordance with MIL-STD-3004A and ASTM.
6. Monitor during-operations PMCS of the PQAS and tent assembly.
7. Direct the shutdown process.
   a. Verify all safety procedures have been followed.
   b. Verify all steps are performed in sequence.
8. Monitor after-operations PMCS of PQAS and tent assembly in accordance with applicable TM.

**Evaluation Preparation:** See condition and standard statements. Verify all manuals and safety equipment is present, and personnel are available to perform the tasks.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Supervised site selection. | ____ | ____ |
| 2. Supervised the setup process. | ____ | ____ |
| 3. Directed the PQAS bootwall and MCPS tent assembly process. | ____ | ____ |
| 4. Monitored the starting process. | ____ | ____ |
| 5. Supervised petroleum analysis testing in accordance with MIL-STD-3004A and ASTM. | ____ | ____ |
| 6. Monitored during-operations PMCS. | ____ | ____ |
| 7. Directed the shutdown process. | ____ | ____ |
| 8. Monitored after-operations PMCS. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| MIL-STD-3004A | CF634D03 |
| TM 10-8340-243-13&P | TB 11-5825-291-10-2 |

Subject Area 6: Supervising Quality Surveillance

**Supervise Operation and Maintenance of Petroleum Test Kits**

**101-92L-2309**

**Conditions:** As a petroleum laboratory sergeant in a field or garrison environment, you are given a sampling and gauging kit, petroleum and FM 10-67-2, SC 6680-95-N01, TM 10-6630-230-13&P, TM 10-6640-221-13&P, TM 5-6630-218-10, petroleum laboratory specialist who are required to operate and maintain petroleum test kits.

**Standards:** Soldier supervise the operation and the maintenance of petroleum test kits in accordance with TM 5-6630-218-10, TM 10-6640-221-13&P, and TM 10-6630-230-13&P.

**Performance Steps**

1. Supervise the operation and maintenance of the Aviation Fuel Contamination Test.
    a. Direct inventory of the kit and ensure shortages are recorded and corrected.
    b. Monitor the setup of subassembly and provide guidance as needed.
    c. Ensure the correct monitor is used and direct corrective actions if needed.
    d. Monitor attention to details process.
        (1) Pressure in the system not exceeding 100 psi.
        (2) Do not allow of sampler base and cover.
        (3) The valve is closed or off when the valve arm is approximately 45 degrees from the base of the valve.
        (4) The three-way valve in correct positions.
    e. Monitor safety procedures being incorporated and provide guidance as needed.
    f. Monitor environmental stewardship measures being incorporated and provide guidance as needed.
    g. Monitor sampling procedure and provide guidance as needed.
    h. Direct PMCS activities.
        (1) Oversee disassembly and reassemble of parts and components.
        (2) Monitor the cleaning of parts and components.
        (3) Monitor storage and replacement processes of components.

2. Supervise the operation and maintenance of the Sampling and Gauging Kit.
    a. Direct inventory of the kit and ensure shortages are recorded and corrected.
    b. Monitor the setup of subassembly and provide guidance as needed.
        (1) Observe the mercury columns in the hygrometers and cup-case thermometers.
        (2) Direct cleaning process if needed.
    c. Monitor safety procedures being incorporated and provide guidance as needed.
        (1) Proper safety gear is worn.
        (2) Equipment properly grounded.
    d. Monitor environmental stewardship measures being incorporated and provide guidance as needed.
        (1) Spill prevention methods being taken.
        (2) Demonstrated knowledge of Spill Prevention Control and Countermeasures (SPCC) procedures.
        (3) Waste management procedures.
    e. Monitor sampling procedure and provide guidance as needed.
    f. Direct PMCS activities (as in 1h above).

**Performance Steps**

3. Supervise the operation and maintenance of the Aqua-Glo, Series III, Water Detector Kit.
   a. Monitor the calibration process and provide guidance as needed.
   b. Monitor the setup of subassembly and provide guidance as needed.
   c. Monitor attention to details process (as in 1d above).
   d. Monitor safety procedures being incorporated and provide guidance as needed (as in 2c above).
   e. Monitor environmental stewardship measures being incorporated and provide guidance as needed (as in 2d above).
   f. Direct PMCS activities (as in 2f above).

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment, environmental stewardship control materials, and manuals.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Supervised the operation and maintenance of the Aviation Fuel Contamination Test Kit. | ____ | ____ |
| 2. Supervised the operation and maintenance of the Sampling and Gauging Kit. | ____ | ____ |
| 3. Supervised the operation and maintenance of the Aqua-Glo, Series III, Water Detector Kit. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| FM 10-67-2 | FM 3-100.4 |
| SC 6680-95-N01 | |
| TM 10-6630-230-13&P | |
| TM 10-6640-221-13&P | |
| TM 5-6630-218-10 | |

Skill Level 3

Subject Area 7: Directing Operation and Maintenance of Laboratory Facilities

**Direct Laboratory Procedures**

**101-92L-3400**

**Conditions:** As a petroleum laboratory supervisor, or petroleum surveillance noncommissioned officer (NCO) in a field or garrison environment, you are given an operational petroleum laboratory, American Standard Test Method (ASTM) standards, DA Pamphlet 710-2-1, FM 10-426, FM 10-67-2, MIL-STD-3004A, petroleum laboratory procedures that are required to be periodically reviewed, or required update due to changes in Army doctrine, operations, or command directives.

**Standards:** Soldier directs laboratory operations to include evaluating laboratory testing procedures, making recommendation to customers on petroleum products quality preservation, and in developing or revising a supply program and a laboratory standing operating procedure (SOP).

**Performance Steps**

1. Evaluate testing procedures used by individual laboratory technician.
   a. Verify that the correct ASTM is selected in accordance with product specifications.
   b. Identify deficiencies in the ASTM procedures by comparing the technician's procedure with the ASTM.
   c. Review Petroleum Product Laboratory Analysis Report for completeness and accuracy.
   d. Instruct the technician in the correct procedure when deficiencies are observed.

2. Identify laboratory test results that indicate contamination or deterioration.
   a. Compare the laboratory report to previous reports for the same product, if available.
   b. Identify product properties that could indicate possible contamination or deterioration.
   c. Compare test results to determine if the failure is due to deterioration or contamination (FM 10-67-2, Table D-1).
   d. Examine the handling history of the product to pinpoint the source contamination or the probable cause of the deterioration.

3. Recommend the use of petroleum products that do not meet specification limits but meet deterioration limits.
   a. Review all possible uses for the products.
   b. Select and recommend the best use for the product.
   c. Record recommendations in the appropriate section block of the Petroleum Product Laboratory Analysis Report.

4. Recommend the disposition of petroleum products that fail to meet deterioration/contamination limits.
   a. Identify disposition alternatives, considering local capabilities.
   b. Review the best method of disposition using the following criteria:
      (1) The requirement for the specified product.
      (2) The degree and type of contamination or deterioration.
      (3) The value of the product as compared to its capability and the cost of reclaiming it.
   c. Identify types of reclamation techniques, considering factors that may affect the process.
   d. Determine a blending ratio or amount of additive needed when blending of off specification product is recommended.
   e. Record recommendations in the appropriate section block of the Petroleum Product Laboratory Analysis Report.

**Performance Steps**

5. Implement a laboratory correlation testing program.
    a. Verify that samples are received and properly logged as correlation samples.
    b. Verify that testing is being conducted in accordance with applicable ASTM.
    c. Review completed Petroleum Product Laboratory Analysis Report.
    d. Verify that results are forward to USAPC.
    e. Maintain historical file of comparison results.

6. Monitor a laboratory supply program.
    a. Verify that technicians are filling out the breakage list.
    b. Establish procedures to requisition supplies.
        (1) Complete DD Form 1348-6 (DOD Single Line Item Requisition System Document (Manual Long-Form) for request for single line items not listed in the FEDLOG in accordance with DA Pamphlet 710-2-1.
        (2) Complete DA Form 2765-1 (Request for Issue or Turn-In) for request for expendable, durable, or non-expendable single line items with national stock number (NSN) listed in the FEDLOG in accordance with DA Pamphlet 710-2-1.
        (3) Use the FEDLOG to verify equipment's NSN.
    c. Develop inventory schedule to generate a list of required supplies.
    d. Establish procedures for receiving and storing requested supplies.

7. Evaluate the preparation of chemical solutions.
    a. Verify the preparation of chemical solutions.
    b. Evaluate the chemical solution formula use by laboratory technicians for accuracy.
    c. Monitor standardization procedures, ensuring that chemical solutions are standardized at the required interval.

8. Develop a laboratory SOP. Verify that the SOP includes the following at a minimum:

NOTE: An example to an SOP format can be found in FM 10-426, Appendix B.

    a. Sampling receiving and in-processing procedures.
        (1) Review procedures for DA Form 1804 (Petroleum Sample).
        (2) Acceptable condition for samples and sample containers.
    b. Procedures for recording and reporting test results.
    c. Laboratory safety and fire prevention to include, but not limited to:
        (1) Emergency telephone numbers.
        (2) Procedures for reporting emergencies.
        (3) Handling and storage procedures for chemical and other hazardous materials.
        (4) Safety inspection checklist.
        (5) Spill response plan.
    d. Calibration and maintenance procedures.
    e. Environmental stewardship procedures.
        (1) Installation Spill Contingency Plan (ISCP).
        (2) Handling and storage procedures for chemical and other hazardous materials.
        (3) Local environmental laws.
        (4) SOP for compliance with Host Nation environmental stewardship procedures and laws.
    f. Procedures for ordering and rotating supplies.
    g. General cleaning procedures for glassware and other equipment not specifically covered in applicable ASTM.
    h. Preventive maintenance checks and services schedules.

**Evaluation Preparation:** See condition and standard statements. Ensure all equipment, manuals, and Soldiers are available.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Evaluated testing procedures used by individual laboratory technician. | ____ | ____ |
| 2. Identified laboratory test results that indicated contamination or deterioration. | ____ | ____ |
| 3. Recommended the use of petroleum products that did not meet specification limits but met deterioration limits. | ____ | ____ |
| 4. Recommended the disposition of petroleum products that failed to meet deterioration/contamination limits. | ____ | ____ |
| 5. Implemented a laboratory correlation testing program. | ____ | ____ |
| 6. Developed a laboratory supply program. | ____ | ____ |
| 7. Evaluated the preparation of chemical solutions. | ____ | ____ |
| 8. Developed a laboratory SOP. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| ASTM STANDARDS | AR 200-1 |
| DA FORM 2765-1 | DA PAM 200-1 |
| DA PAM 710-2-1 | FM 7-0 |
| DD FORM 1348-6 | |
| FM 10-426 | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

**Direct Mobile Laboratory Operations**

**101-92L-3404**

**Conditions:** As a petroleum laboratory supervisor, or petroleum surveillance NCO in a field or garrison environment, you are given generator set, mobile petroleum laboratory, FM 10-426, TM 10-6640-215-13, TM 11-5825-291-13, TM 38-250, and petroleum laboratory specialist that are required to setup the laboratory and operate in a designated area.

**Standards:** Soldier directs the operations of the mobile laboratory: deployment, setup and operation in a manner that allows for accomplishment of the mission, while minimizing danger to Soldiers or damage to the environment and equipment.

**Performance Steps**

1. Implement site selection and movement criteria during pre-deployment.
    a. Select an appropriate site.
        (1) Select a site that has ample space for maneuvering the laboratory and all support equipment.
        (2) Verify that the site is firm, has well drained terrain, and is relatively free of surface rocks and large stones.
        (3) Avoid ground that is excessively sloped. Excessive sloping could hamper leveling of the laboratory.
    b. Use GPS to coordinate movement to selected site in accordance with TM 11-5825-291-13.
2. Verify that PMCS has been performed on the laboratory and all related equipment.
3. Check that all basic laboratory systems are operational.
4. Inspect the mobile laboratories to verify that they are packed and secured in accordance with TM 10-6640-215-13 and TM 10-6640-216-13&P.
5. Review all DD Forms 1387-2 (Special Handling Data/Certification) to verify that a form is completed and on-hand for each hazardous chemical in the laboratory and completed in accordance with TM 38-250.
6. Review all MSDS to ensure they are up to date and that one is on hand for each hazardous chemical in the laboratory.
7. Develop a mobile laboratory operations SOP, to include at a minimum:

NOTE: An example of a SOP format can be found in FM 10-426, Appendix B.

    a. Preventive maintenance procedures.
    b. Setup, power-up, and shut down procedures.
    c. Supply replacement procedures.
    d. Storage procedures.
    e. Placarding procedures.
    f. Mobile laboratory environmental stewardship procedures.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and other materials available.

| Performance Measures | GO | NO-GO |
|---|---|---|
| 1. Implemented site selection and movement criteria during pre-deployment. | ____ | ____ |
| 2. Verified that PMCS had been performed on the laboratory and all related equipment. | ____ | ____ |
| 3. Verified that all basic laboratory systems are operational. | ____ | ____ |
| 4. Inspected the mobile laboratory to verify that it was packed and secured in accordance with TM 10-6640-215-13. | ____ | ____ |
| 5. Reviewed all DD Forms 1387-2 to verify that a form was completed and on-hand for each hazardous chemical in the laboratory and completed in accordance with TM 38-250. | ____ | ____ |
| 6. Reviewed all MSDS to ensure they were up to date and that one was on hand for each hazardous chemical in the laboratory. | ____ | ____ |
| 7. Developed a mobile laboratory operations SOP. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| Required | Related |
|---|---|
| DD FORM 1387-2 | FM 10-67-2 |
| FM 10-426 | FM 7-0 |
| TM 10-6640-215-13 | |
| TM 11-5825-291-13 | |
| TM 38-250 | |

Subject Area 8: Directing Quality Surveillance

**Perform Quality Surveillance at Petroleum Facilities**

**101-92L-3406**

**Conditions:** As a petroleum laboratory supervisor, petroleum surveillance NCO in a field or garrison environment, you are given all materials and manuals such as AR 710-2, DA Pamphlet 710-2-2, MIL-STD-3004A, petroleum facilities that are required to be inspected, and show evidence of meeting established Quality Surveillance demands, or petroleum laboratories wherever located. Upon notification/orders you will conduct petroleum quality surveillance procedures to determine quality of product and storage, handling and distribution techniques being employed.

**Standards:** Soldier evaluates petroleum product quality in accordance with MIL-STD-3004A and the facility's quality surveillance SOP.

**Performance Steps**

1. Identify potential sources of contamination for aviation fuel.

NOTE: Wear proper safety gear (goggles, rubber gloves, and aprons). Clear the area of ignition sources and open flames. Close all unused gas lines. Ensure that the appropriate type of fire extinguisher is readily available and keep all exits clear. Perform only one test at a time. Follow the procedure as outlined in the ASTM. Re-stopper bottles and other containers immediately after use, check labels, keep bases away from acids, never pour water into acid, and always consult MSDS.

a. Contamination with other products.
b. Contamination with water, solids, and microbiological growth.
   (1) Water; water in fuel may be either fresh or salt and may be present either as dissolved or free water.

NOTE: Free water can cause icing in an aircraft fuel system, malfunctioning of fuel quantity probes, and corrosion of fuel system components. Saltwater will promote corrosion much more rapidly than fresh water.

   (2) Sediment; sediment appears as dust, powder, flakes, granular, or fibrous materials.

NOTE: Sediment or solid contamination will be either coarse or fine. Coarse sediment is ordinarily 10 microns in size or larger. It easily settles out of the fuel or can be removed by adequate filtration. Fine sediment is smaller than 10 micron and to a limited degree can be removed by settling, filtration, and centrifuging.

   (3) Microbiological Growth; microbiological growth consists of living organisms that grow at the fuel water interface.

NOTE: If water is absent, microbiological growth cannot occur.

2. Identify potential sources of contamination for ground mobility fuel.
   a. Contamination with Other Fuels.
      (1) Contamination of diesel fuel with gasoline or JP-8 turbine fuel will lower the flash point of the diesel and create a safety hazard.
      (2) Contamination of motor gasoline with diesel fuel will reduce the antiknock index (average of research and motor octane number) and will cause increased engine deposits, as well as decrease storage stability.
      (3) Contamination of unleaded gasoline with leaded gasoline will result in damaging the catalytic converter in the using vehicles equipped with the emission control systems.
   b. Water: Water in fuel may be either fresh or salt water and may be either dissolved or free.
      (1) Dissolved water is water that has been solubilized in the fuel and is invisible.
      (2) Free water may be in the form of an emulsion, fine droplets in suspension, or in large quantities, separates at bottoms of tank or containers. Free water in ground fuel can cause stalling, injection fouling, and other engine malfunctions as well as being a cause of corrosion. In cold weather it may cause blockage of fuel lines from freezing.

**Performance Steps**

c. Sediment.

NOTE: Sediment includes both organic and inorganic matter. If the fuel container or tank has a water bottom, some or all of the sediment may be present at the fuel and water interface. Sediment may be in the form of dust, powder flakes, granular material, fibrous material, agglomerates, sludge, or slime.

(1) Inorganic Sediment; inorganic sediment includes metallic and rust particles, siliceous material, and mineral fibers such as fiberglass. Coarse sediment (greater than 10 microns) may clog fuel lines and damage fuel injector pumps and other engine components.

(2) Organic Sediment; organic sediment consists primarily of deterioration of products of fuel and of microbiological debris.

3. Evaluate the QCP at a bulk storage facility. Ensure the responsible agency establishes and maintains an acceptable program for the control of quality of petroleum products.
   a. Verify that the responsible agency has a satisfactory written description of their inspection procedure used prior to receipt or delivery of product.
   b. Verify that the responsible agency complies with the established quality control program for the following operations:
      (1) Addition of approved blending components when necessary.
      (2) Sampling petroleum products received or stored.
      (3) Verification of the adequacy of the testing laboratory, to include calibration program.
      (4) Control of terminal pipelines, manifold connections, or valves used to convey product to the final customer.
      (5) Inspection of containers for cleanliness and suitability to receive product prior to filling or loading.
      (6) Adequacy of procedure for sealing containers and recording of serial numbers on records and shipping documents, when applicable.
      (7) Loading and discharging of tankers, rail cars, and barges.
      (8) Determination of quantities.
      (9) Completion and submission of required forms and reports.
   c. Verify inventories and losses.
      (1) Verify inventory process for all petroleum products.
         (a) Certify the accuracy of the inventory date.
         (b) Determine sources of loss or gain.
      (2) Witness inventory of foreign government and NATO held storage that is under Memorandum of Agreement or country-to-country agreements according to the terms of the memorandum or agreement.
      (3) Investigate losses of Government-owned product caused by accident or mishap that is in the custody of a contractor. Forward a detailed factual report to the accountable activity and the contracting officer.
   d. Inspect storage tanks and filtering devices.
      (1) Verify that tanks being used to store petroleum products are adequate for the intended purpose. Tanks will meet the following criteria:
         (a) Sound in structure.
         (b) Free of roof leaks.
         (c) Floating roof tanks will be equipped with roof drains that do not spill water into the product being stored.
         (d) Free of contaminants.
         (e) Have certified strapping charts available.
         (f) Have provisions for control of water bottoms, where permitted.
      (2) Verify that the agency maintain filtering devices in tank cars, tank trucks, and small container filling lines to guard against rust, scale, and sediment being carried over into shipping containers.

**Performance Steps**

e. Facilitate the preparation of SF 361, when Government-owned petroleum products are received in an improper condition.
   (1) Check shipments to determine the extent of the damage, shortage, and the cause, if possible.
   (2) Submit all pertinent information to the designated accountable activity.

4. Assess the adequacy of contractor's processes using IQUE. Verify that the contractor's processes consistently meet contractual requirements in storage and laboratory testing.

5. Assist in the reporting and investigation of customer complaints to DISC.

6. Evaluate QS procedures at an aviation unit refueling facility.
   a. Evaluate the unit's operational SOP to verify that procedures for maintaining the quality of petroleum product are established and make recommendations, when required.
   b. Monitor sampling and gauging procedures.
      (1) Verify annotation in sample log box.
      (2) Inspect sample submission procedures.
   c. Inspect logbooks/records to verify that required quality surveillance procedures are being performed.
      (1) Inspect product rotation history.
      (2) Review completed Petroleum Product Laboratory Analysis Report.
      (3) Review DA Form 4702-R (Monthly Bulk Petroleum Accounting Summary (LRA)) and other product accountability documents.
   d. Provide assistance in the investigation of aircraft crashes.

**Evaluation Preparation:** See condition and standard statements. Ensure all equipment, manuals, and Soldiers are available.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Identified potential sources of contamination for aviation fuel. | ____ | ____ |
| 2. Identified potential sources of contamination for ground mobility fuel. | ____ | ____ |
| 3. Evaluated the quality control program at a bulk storage facility. | ____ | ____ |
| 4. Assessed the adequacy of a contractor's processes using | ____ | ____ |
| 5. Assisted in the reporting and investigation of customer complaints to DESC. | ____ | ____ |
| 6. Evaluated QS procedures at an aviation unit refueling facility. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| AR 710-2 | DLAR 8200.12 |
| DA FORM 4702-R | FM 7-0 |
| DA PAM 710-2-1 | |
| DA PAM 710-2-2 | |
| FM 10-67-2 | |
| MIL-STD-3004A | |
| STP 10-92F15-SM-TG | |

**Perform Quality Surveillance on Petroleum Vessels and Vehicles**

**101-92L-3407**

**Conditions:** As a petroleum laboratory supervisor, or a petroleum surveillance NCO at a fuel transfer point, you are given all materials and manuals (AR 710-2, FM 10-67-2, and MIL-STD-3004A), petroleum vessels and vehicles that are required to be inspected to determine compliance with established quality surveillance protocols.

**Standards:** Soldier performs quality surveillance inspections for the loading and discharging of tankers/barges, tank car, tank truck shipment, and the movement of petroleum product through a pipeline system to ensure quality of petroleum products in accordance with MIL-STD-3004A, FM 10-67-2, DOD 4140.25-M, AR 710-2, local quality surveillance SOP, DD Form 250 (Materiel Inspection and Receiving Report), and DD Form 250-1 (Tanker/Barge Materiel Inspection and Receiving Report).

**Performance Steps**

1. Perform quality surveillance procedures for tankers and barges prior to loading.

NOTE: A barge is any vessel with less than 30,000 barrel capacity. Any vessel with 30,000 barrel capacity or more will be treated as a tanker.

a. Tankers.
   (1) Verify that tanks are prepared for loading in accordance with MIL-STD-3004A.
   (2) Physically enter and inspect each tank to verify suitability to load. A fresh air pack shall be on hand for use.

CAUTION: ENSURE EACH TANK HAS BEEN PROPERLY GAS-FREED, TESTED, AND CERTIFIED BY QUALIFIED PERSONNEL.

   (3) Review vessel loading plans to determine their suitability. Verify that all bulkheads are secure and the vessel has double valve separation or line blanks.
   (4) Verify that the tank is rust-free, request sample when considered necessary.
   (5) Inspect tankers scheduled for multiple port loading to determine their suitability for the scheduled products.

b. Barges.

NOTE: Apply inspection procedures for handling tanker to barges with the exception as stated in MIL-STD-3004A. Physical entry is not required.

2. Apply quality surveillance techniques to loading of tankers.
   a. Pre-loading Inspection Procedures.
      (1) Verify that sampling, testing, and approval of shore tank is completed prior to loading the vessel.
      (2) Check loading lines to determine they are properly isolated and contain no product detrimental to the cargo.
      (3) Verify that loading lines are full. Obtain opening and closing shore tank gauges (or meter readings where necessary).
      (4) Determine the position of the swing line in the shore tank (where applicable) and setting to prevent loading any free water or sludge from the tank bottom.
      (5) Verify that sea suction and overboard discharge valves are closed and sealed.

NOTE: In the case of split cargo, those valves essential to cargo isolation should be sealed with serially numbered seals and their numbers recorded on shipping documents.

      (6) Monitor and line samples analysis for quality of product moving to the vessel.
      (7) Verify that sampling and testing of vessel's cargo tanks during and after loading are done in accordance with Table IX, MIL-STD-3004A.
   b. Loading Inspection Procedure.
      (1) Verify that the line fill, approximately 2,000 to 5,000 barrels, is pumped into one cargo tank in the vessel.
      (2) Monitor switching between tanks when loading.

NOTE: If at anytime during loading there is an indication of contamination, the loading shall be stopped until the cause and extent of the contamination has been determined.

**Performance Steps**

(3) Verify that a sample is drawn from the first tank, after a 30 minute wait, and tests are performed to determine if the quality of the product being loaded is satisfactory.
(4) Verify aviation turbine fuel or kerosene is being loaded in accordance with established applicable publications and/or local SOP.
(a) Prior to loading, all water will be removed from the vessel pipeline and cargo tank.
(b) Verify that the initial loading rate does not exceed 3 feet per second (about 1,500 barrels per hour through a 12 inch line) through loading lines into the cargo tanks until the discharge outlet has been covered by at least 3 feet of the product.
(c) Verify that the loading rate of 3 feet per second is applied to the flow into each tank.
(d) Verify that ullages, water soundings, temperatures, and samples, including the sample are not taken from any cargo tank until at least 30 minutes after flow into the tank has ceased.

3. Apply quality surveillance techniques to the loading of barges.
a. Pre-loading inspection procedures. Use the precaution and procedures outlined in 1a above will be used for pre loading barges.
b. Loading inspection procedure.
(1) Verify that a sample is drawn from the tank, after a 30 minute wait, and that tests are performed to determine if the quality of the product being loaded is satisfactory.
(2) Verify that sample and test of the contents of vessel's cargo tanks during and after loading are performed in accordance with Table IX, MIL-STD-3004A.

4. Perform post loading quality surveillance on tankers and barges.
a. Witness sampling of vessel cargo tanks.
b. Monitor cargo tank gauging and temperature determination, and as time will permit, water cuts.

NOTE: If possible, water will be stripped ashore before the tanker is released.

c. Determine the quantity of fuel loaded. Use shore tank gauges to determine the quantity of product loaded or shipped.
(1) Witness shore tank gauging (opening and closing).
(2) Determine shore and vessel net quantities and ship/shore losses or gains.

NOTE: Tanker and barge quantities will be based upon shore tank gauges. Investigate and report any quantity discrepancy in excess of 0.5 percent prior to release of the vessel.

d. Verify that agency maintains the retain samples for the period designated in accordance with SOP or applicable publication.

5. Perform quality surveillance procedures on discharge of tankers and barges.
a. Verify numbers on seals used for spilt cargo isolations, seas suction valves, and discharge valves before and after discharge.
b. Verify that all-level samples are taken from each cargo tank.
(1) Perform a visual check on each sample.
(2) In the case of split cargo, different products in adjacent compartments will be tested as necessary to determine if commingling has occurred.
(3) Samples are combined to form composite samples and are required to be retained in accordance with SOP.
c. Verify that gauges, temperature, and water soundings have been taken and recorded.

NOTE: These figures will be used to compare with those obtained at the loading point for indications of quality deficiencies.

d. Maintain surveillance on products being moved from the vessel to the shore tanks.

CAUTION: DO NOT ALLOW RESIDUE TO DRAIN ON THE GROUND. USE AN APPROVED CONTAINER.

(1) Check the discharge line.
(2) Witness the opening and closing shore tank gauges.
e. Verify that quantities received are based on shore tank gauges.

**Performance Steps**

f. Verify that required inspection documents are available.
   (1) Completed DD Form 250-1.
   (2) Ullage or innage report.
   (3) Other documents that may be required.
g. Distribute inspection documents in accordance with SOP or local instructions.

6. Perform quality surveillance on tank cars and tank trucks prior to loading.
   a. Inspect tank car or truck for cleanliness. The interior, including domes, must be free from loose rust, scales, or dirt, and must be dry (water-free).
   b. Inspect tank car or truck suitability to receive product. Make sure the product last carried is the same as the product to be loaded. If the product is different, the tank car or truck should be processed in accordance with MIL-STD-3004A.
   c. Look for any foreign objects such as tools, bolts, or old seals that may have fallen into the tank. Objects should only be removed by authorized persons.
   d. Verify that outlet and safety valves are properly seated and in operable condition.
   e. Verify that dome covers and bottom outlet valves are opened and bottom outlet caps on tank cars are removed to allow residue from previous cargos to drain.

CAUTION: DO NOT ALLOW RESIDUE TO DRAIN ON THE GROUND. USE AN APPROVED CONTAINER.

   f. Inspect outlet valves.

NOTE: If valves are found defective, ensure they are replaced or repaired prior to loading.

7. Monitor loading procedures for tank cars and tank trucks.
   a. Verify that all outlet valves and caps are replaced prior to filling.
   b. Verify that all safety precautions are adhered to and observed during loading.
   c. Verify that preventive measures are taken at top-loading facilities to prevent free-falling or splash during loading operations.
      (1) Verify that discharge hoses or loading arm fill pipes are inserted so that they reach the bottom of the tank.
      (2) Verify that the fill rate is slow until the hose or fill pipe is covered by at least 6 inches of product.
   d. Verify that domes and/or unloading valves in the case of tank cars and all openings in the case of tank trucks are secured and sealed with serially numbered seals immediately after filling.

8. Inspect loaded tank cars and tank trucks.
   a. Verify that each tank car and tank truck is sampled and tested in accordance with MIL-STD-3004A upon completion of loading.
   b. Verify that all products, which can be visually examined, are checked for water and sediment.
   c. Verify that the agency maintains a record of test results.
   d. Verify the quantity of product loaded.
      (1) Determine quantities shipped by tank car in accordance with established provisions.
      (2) Determine quantities shipped by tank truck using the truck calibration table, the net weight of product loaded, or by the use of a properly calibrated meter.
   e. Verify that samples are maintained for the appropriate time in accordance with established procedure.

9. Inspect documents covering tank car and tank truck loading.
   a. Verify that the corrected API gravity, provided by the agency, is annotated on the loading documents.
   b. Inspect prepared documentation for accuracy and completeness.

**Performance Steps**

10. Perform quality surveillance procedures on pipeline movements.
    a. Verify the quality of product in pipeline receiving tankage after receipt of the tender or batch.
        (1) Check calculation of net quantity.
        (2) Investigate and report any quantity discrepancy in excess of established tolerance factor.
    b. Maintain familiarity with the procedures used by the carrier to protect or condition the pipeline interior.
    c. Verify that only approved corrosion inhibitors are added to military products.
    d. Evaluate transported mixtures, when required.
    e. Maintain liaison with activities receiving product by pipeline and render technical assistance as required.

**Evaluation Preparation:** See condition and standard statements. Have all safety equipment and MSDS.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Performed quality surveillance procedures for tankers and barges prior to loading. | ____ | ____ |
| 2. Applied quality surveillance techniques to loading of tankers. | ____ | ____ |
| 3. Applied quality surveillance techniques to the loading of barges. | ____ | ____ |
| 4. Performed post loading quality surveillance on tankers/barges. | ____ | ____ |
| 5. Performed quality surveillance procedures on discharge of tankers and barges. | ____ | ____ |
| 6. Performed quality surveillance on tank cars and trucks prior to loading. | ____ | ____ |
| 7. Monitored loading procedures for tank cars and trucks. | ____ | ____ |
| 8. Inspected loaded tank cars and tank trucks. | ____ | ____ |
| 9. Inspected documents covering tank car and tank truck loading. | ____ | ____ |
| 10. Performed quality surveillance procedures on pipeline movement. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| AR 710-2 | DA PAM 710-2-1 |
| DD FORM 250 | |
| DD FORM 250-1 | |
| DOD 4140.25-M | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

Skill Level 4

Subject Area 9: Managing Laboratory Operations

**Validate Laboratory Procedures**

**101-92L-4406**

**Conditions:** As a petroleum laboratory supervisor, or petroleum surveillance NCO in a field or garrison environment, you are given manuals, materials (AR 200-1, DA Form 1804 (Petroleum Sample), FM 3-100.4, MIL-STD-3004A, and TM 38-410) operational petroleum laboratory with laboratory specialist performing various laboratory procedures.

**Standards:** Soldier validates laboratory procedures in accordance with SOP and verified that all applicable laws and regulations are being adhered to, verifies that all necessary publications (FM 3-100.4, DLAM 4140, and ASTM) are available to the laboratory personnel, Validates the adequacy of the laboratory's safety and environmental stewardship programs and the laboratory is providing the appropriate level of services to customers, and that testing procedures comply with established SOP, and ASTM used.

**Performance Steps**

1. Develop plans for laboratory missions.
    a. Identify supply routes and sources.
    b. Coordinate movement preparation and execution.
        (1) HAZMAT containment.
        (2) Shipping method selection/preparation.
    c. Coordinate support.
        (1) Organizational maintenance.
        (2) TMDE support.
        (3) Personnel support.
    d. Coordinate customer support.
        (1) Establish customer base.
        (2) Determine forward and rear area support.

2. Develop environmental stewardship plan for petroleum laboratory facilities.
    a. Identify sources for guidelines on handling hazardous material.
    b. Develop environmental checklist to verify compliance.
    c. Coordinate requirement for compliance with HN or local environmental policies and procedures.
    d. Identify sources for proper guidelines on environmental protection in the areas of operation.
    e. Verify that petroleum products are rotated on a first in, first use basis.

3. Develop fire prevention and safety guidelines for petroleum testing facilities.
    a. Evaluate the laboratory fire prevention plan and provide feedback.
    b. Identify sources for fire prevention and safety equipment.
    c. Evaluate the laboratory chemical use safety plan.
    d. Identify sources for chemical safety equipment.
    e. Evaluate laboratory safety training plan.
    f. Coordinate training programs and resources for laboratory personnel.
    g. Determine the operational safety capacity of petroleum testing facilities relevant to activities performed there and provide feedback.

**Performance Steps**

4. Perform petroleum laboratory liaison functions.
   a. Develop quality surveillance plan for petroleum products supplied by host nation.
   b. Develop guidelines for petroleum laboratory services between host nation and US Army.
   c. Integrate environmental stewardship in petroleum handling and distribution activities.
   d. Coordinate host nation petroleum activities on behalf of US Army units.

**Evaluation Preparation:** See condition and standard statements. Verify all manuals and safety equipment is present and personnel are available to perform the tasks.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Reviewed laboratory SOP. | ____ | ____ |
| 2. Developed laboratory personnel training support systems. | ____ | ____ |
| 3. Developed fire prevention and safety guidelines for petroleum facilities. | ____ | ____ |
| 4. Performed petroleum laboratory liaison functions. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| AR 200-1 | DA FORM 2077 |
| DA FORM 1804 | DOD 4140.25-M |
| FM 3-100.4 | FM 10-67-2 |
| MIL-STD-3004A | |
| TM 38-410 | |

Subject Area 10: Managing Quality Surveillance

**Implement Quality Surveillance Programs for Petroleum Facilities**

**101-92L-4407**

**Conditions:** As a petroleum laboratory supervisor, petroleum surveillance NCO in a field or garrison environment, given all materials and manuals (DOD 4140.25-M, FM 10-67-2, and MIL-STD-3004A), petroleum facilities that are required to performing quality surveillance for petroleum products that are stored and distributed.

**Standards:** Soldier uses all available resources to implement a quality surveillance program for petroleum facilities in the area of operation in accordance with MIL-STD-3004A, DOD 4140.25-M, AR 200-1, and local SOP.

**Performance Steps**

1. Develop quality surveillance plan for petroleum laboratories.
    a. Coordinate customer support services to include:
        (1) Sample submission and receipt.
        (2) Set guidelines for sampling of petroleum products in accordance with MIL-STD-3004A.
        (3) Methods of notification used by the laboratory.
    b. Provide broad input to the laboratory SOP relevant to the theater of operation and the customer base.
    c. Establish guidelines for the rotation and use of chemicals and other hazardous materials.
    d. Coordinate training support for laboratory personnel.
    e. Conduct regular compliance oversight of laboratory operations and personnel compliance with establish SOP, local directives, and applicable publications.

2. Monitor quality surveillance procedures at petroleum storage and distribution facilities.
    a. Identify potential source of contamination.
    b. Inspect the facilities sampling procedures and provide feedback.
    c. Examine issue documents for completeness.
    d. Verify that petroleum vehicles are properly maintained and cleaned.
    e. Verify that the agency has a satisfactory written description of their inspection procedures and schedule.
    f. Verify that the agency complied with an approved quality surveillance program in accordance with DLAM 8200 when applicable.
        (1) Addition of approved blending components.
        (2) Timely sampling of batches or lots of petroleum products received or stored.
        (3) The adequacy of the procedure for sealing and recording of serial numbers on records and shipping documents.
        (4) Loading and discharging of tankers, barges, tank trucks, rail cars, and tank cars when applicable.
        (5) Notification procedures for receipt for all products received.
    g. Monitor the inspection procedure and frequency of storage tanks and filtering devices.
        (1) Verify that storage facilities are adequate for the stored product.
        (2) Verify that each storage unit is free of contaminants.
        (3) Check that water bottoms are appropriately managed in accordance with MIL-STD-3004A.
    h. Evaluate quality surveillance procedures at aviation unit refueling facility.
        (1) Evaluate the unit's SOP.
        (2) Verify that procedures for maintaining product quality are within established guidelines in accordance with MIL-STD-3004A.
        (3) Monitor sampling and gauging procedure and sampling frequency.

**Performance Steps**

(4) Inspect the sample submission procedure and provide feedback.
(5) Inspect product rotation history.
(6) Review relevant documentation such as DA Forms 4702-R, 1804, 3853-1, 3643, 3644, and Petroleum Products Laboratory Analysis Report.

i. Develop procedure for the performing accident investigation and provide assistance when required.

3. Monitor safety procedures at petroleum laboratories.
   a. Provide oversight of the application of the laboratory safety procedures.
   b. Coordinate training support for laboratory personnel.
   c. Encourage integration of improved and modernized safety techniques into daily activities.
   d. Enforce installation and local jurisdiction regulation on safety when applicable.
   e. Inspect physical structures to determine suitability for the intend use.
   f. Inspect and determine if the accident reporting procedures are in compliance with local policy.

4. Monitor safety procedures at petroleum storage and distribution facilities.
   a. Develop safety checklist for use in the verification of compliance with established safety guidelines.
   b. Monitor reporting procedures for each petroleum facilities and provide necessary feedback.
   c. Examine the training procedures for personnel and check training records when necessary.
   d. Determine the safety measures integrated into the operation of assigned equipment.
   e. Monitor licensing of operators and procedures used.
   f. Monitor the availability of safety equipment and their operational condition.
      (1) Check for the posting of applicable signs and markings.
      (2) Availability of personnel protection gears/equipment.

**Evaluation Preparation:** See condition and standard statements. Verify all manuals and safety equipment is present, and personnel are available to perform the tasks.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Developed quality surveillance plan for petroleum laboratories. | ____ | ____ |
| 2. Monitored quality surveillance procedures at petroleum storage and distribution facilities. | ____ | ____ |
| 3. Monitored safety procedures at petroleum laboratories. | ____ | ____ |
| 4. Monitored safety procedures at petroleum storage and distribution facilities. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| DOD 4140.25-M | |
| FM 10-67-2 | |
| MIL-STD-3004A | |

**Implement Quality Surveillance Programs for Petroleum Vessels and Pipeline**

**101-92L-4408**

**Conditions:** As a petroleum laboratory supervisor, petroleum surveillance NCO in a field or garrison environment, you are given all materials and manuals (AR 200-1, DOD 4140.25-M, and MIL-STD-3004A), petroleum vessels and pipelines are required to maintain the quality of petroleum products to acceptable levels.

**Standards:** Soldier uses all available resources to implement a quality surveillance program for petroleum vessels and pipelines in accordance with MIL-STD-3004A and local SOP.

**Performance Steps**

1. Evaluate unit/agency's quality control plan for petroleum vessels and pipelines.
    a. Monitor the unit/agency's maintenance program.
        (1) Check the cleaning procedures and frequency of cleaning.
        (2) Check product and vessel rotation plan.
        (3) Check contingency rotation and inspection plan.
    b. Monitor the unit/agency's record keeping procedure.
        (1) Conduct inspections to determine:
            (a) Correctness of shipping documents.
            (b) Completeness of issues and receipt documents.
            (c) Sampling schedules.
            (d) Sample testing schedules.
        (2) Coordinate training sessions for the unit/agency.
    c. Monitor the unit/agency's loading procedures.
        (1) Verify that all pre-loading procedures are followed.
        (2) Verify that all loading procedures conform to established guidelines in accordance with MIL-STD-3004A, DLAM 8200, and other directives or local instructions.
        (3) Verify that all sanctioned post-loading procedures are followed.
    d. Establish reporting and feedback procedures up and down the chain of command.

2. Develop quality surveillance procedures for petroleum vessels and pipelines.
    a. Establish a SOP for quality surveillance of petroleum products stored and/or transported.
    b. Conduct regular oversight functions to ensure compliance with established quality surveillance guidelines; including:
        (1) Rust prevention procedures.
        (2) Vessel/pipeline maintenance procedures.
        (3) Preventing or preventing pipeline leaks.
        (4) Sampling and gauging intervals and techniques used.
        (5) The testing frequencies of products, and appropriate responses to laboratory recommendations/feedback.
    c. Establish physical security procedures for petroleum vessels and pipelines.

3. Develop safety and fire prevention plan for petroleum vessels and pipelines.
    a. Develop a safety checklist for use in verification of compliance with established safety guidelines.
    b. Coordinate integration of improved/modernized safety techniques into daily activities.
    c. Develop reporting procedures up and down the chain of command and responsible outside agencies.

**Performance Steps**

4. Develop environmental stewardship procedures for petroleum vessels and pipelines.
   a. Implement hazardous material handling procedures.
   b. Implement spill prevention and control procedures.
   c. Establish appropriate reporting procedures.
   d. Enforce compliance with local and national environmental laws and procedures.
   e. Coordinate regular training for personnel.

**Evaluation Preparation:** See condition and standard statements. Verify all manuals and safety equipment is present and personnel are available to perform the tasks.

| **Performance Measures** | **GO** | **NO-GO** |
|---|---|---|
| 1. Evaluated units/agency's quality control plan for petroleum vessels and pipelines. | ____ | ____ |
| 2. Developed quality surveillance procedures for petroleum vessels and pipelines. | ____ | ____ |
| 3. Developed safety and fire prevention plan for petroleum vessels and pipelines. | ____ | ____ |
| 4. Developed environmental stewardship procedures for petroleum vessels and pipelines. | ____ | ____ |

**Evaluation Guidance:** Score the Soldier GO if all performance measures are passed. Score the Soldier NO-GO if any performance measures are failed. If the Soldier scores NO-GO, show what was done wrong and how to do it correctly.

**References**

| **Required** | **Related** |
|---|---|
| AR 200-1 | FM 10-67-2 |
| DOD 4140.25-M | TM 38-410 |
| MIL-STD-3004A | |

# CHAPTER 4

## Duty Position Tasks

### 92L-Petroleum Laboratory Specialist, CMF 92

*(SL1) MOSC 92L10* Soldiers receive samples and conduct physical property tests on petroleum products. Report findings in accordance with ASTM and FTM test methods. Evaluates test results with specification requirements and makes recommendations regarding product disposition. Apply fire prevention and safety control procedures in handling volatile POL products. Apply environmental stewardship measures to petroleum laboratory operations.

*(SL2) MOSC 92L20* Soldiers identify sources and types of contamination and deterioration and makes recommendations for reclamation and disposition. Provide required quality surveillance reports to higher headquarters. Supervise organization and preventive maintenance on laboratory equipment. Supervise the application of fire prevention and safety control procedures. Perform inspections of fire and safety equipment. Supervise environmental stewardship measures, and provide technical guidance and training to subordinate petroleum laboratory personnel.

*(SL3) MOSC 92L30* Soldiers perform duties shown in previous skill level (SL) when required and plan and organize petroleum laboratory activities. Establish files and technical references and specifications. Prepare and review administrative and technical reports. Direct all supply activities, coordinate activities with POL storage and distribution. Direct the establishment of quality surveillance programs. Monitor adherence to laboratory fire, safety and environmental stewardship procedures. Apply principles of occupational health and safety Act and EPA regulations. Enforce compliance with various environmental laws.

*(SL4) MOSC 92L40* Soldiers perform duties shown in previous SL when required. Perform staff and advisory duties. Manage the quality surveillance program, and assist the planning and implementing quality assurance programs. Make inspection of petroleum facilities to determine compliance with various aspects of the operation, and maintenance of the facilities. Manage laboratory correlation program. Coordinate special testing of POL products. Manage fire prevention, safety and environmental stewardship programs. And coordinate training for petroleum laboratory personnel and other interested personnel.

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# APPENDIX A

## HANDS-ON EVALUATION (DA FORM 5164-R) INSTRUCTIONS

This appendix provides a sample of DA Form 5164-R (see Figure A-1) for the tasks in this STP. The DA Form 5164-R allows the trainer to keep a record of the performance measures a Soldier passes or fails on each task. Trainers should use the following instructions when completing DA Form 5164-R.

***Prior to Evaluating the Soldier***

- Obtain a blank copy of DA Form 5164-R, which you may locally reproduce on 8 x 11-inch paper. The form also can be downloaded from the Army Publishing Directorate web site (www.apd.army.mil/forms).
- Enter the task title and 10-digit number for the task from the evaluation guide of the SM task summary.
- In column (a), enter the number of each performance measure from the evaluation guide.
- In column (b), enter the performance measure corresponding to the performance measure number in column (a). (You may abbreviate this information if necessary.)
- Enter the feedback statement from the evaluation guide just below the last performance measure.
- Locally reproduce the partially completed form if you are evaluating more than one Soldier on the task or the same Soldier on more than one task.

***During the Evaluation***

- Enter the date just before evaluating the Soldier's task performance.
- Enter the evaluator's name and the Soldier's name and unit.
- For each performance measure in column (b), enter a check in column (c) PASS or column (d) FAIL as appropriate.
- Compare the number of performance measures the Soldier passes (and if applicable, which ones) against the task standard shown in the feedback statement. If the standard is met or exceeded, check the GO block under STATUS; otherwise, check the NO-GO block.

**HANDS-ON EVALUATION**
For use of this form, see STP 11-25S14-SM-TG; the proponent agency is TRADOC

DATE: 1 July 2007

TASK TITLE: Install and Adjust Laboratory Equipment

TASK NUMBER: 101-92L-1389

| ITEM a | PERFORMANCE STEP TITLE b | SCORE (Check One) PASS c | FAIL d |
|---|---|---|---|
| 1. | Installed and adjusted a mercury-to-mercury regulator | [X] P | [ ] F |
| 2. | Setup a wire-to-mercury thermometer | [ ] P | [X] F |
| 3. | Setup the oven temperature | [X] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] P |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |
| | | [ ] P | [ ] F |

SAMPLE

EVALUATOR'S NAME: SSG KENNY HALL

UNIT:

SOLDIER'S NAME: PFC RON HOWARD

STATUS: [ ] GO [X] NO GO

DA FORM 5164-R, SEP 85 EDITION OF DEC 82 IS OBSOLETE APD V2.01

**Figure A-1. Sample of a Completed DA Form 5164-R**

# APPENDIX B

## FIELD EXPEDIENT SQUAD BOOK (DA FORM 5165-R) INSTRUCTIONS

This appendix provides a sample of DA Form 5165-R (see Figure B-1) for the tasks in this STP. The DA Form 5165-R allows the trainer to keep a record of task proficiency for a group of Soldiers. Trainers should use the following instructions when completing DA Form 5165-R.

***Prior to Evaluating the Soldier***

- Obtain a blank copy of DA Form 5165-R, which you may locally reproduce on 8 x 11 paper. The form also can be downloaded from the Army Publishing Directorate (www.apd.army.mil/forms).

- Enter the SM task number and abbreviated task title for the evaluated tasks in the appropriate column. Use additional sheets as necessary. Locally reproduce the partially completed form if you are evaluating more than nine Soldiers.

***During the Evaluation***

- Enter the names of the Soldiers you are evaluating, one name per column, at the top of the form. You may add the names of newly assigned Soldiers if there are blank columns.

- Under STATUS, record (*in pencil*) the date in the GO block if the Soldier demonstrated task proficiency to Soldier's manual standards. Keep this information current by always recording the most recent date on which the Soldier demonstrated task proficiency.

- Record the date in the NO-GO block if the Soldier failed to demonstrate task proficiency to Soldier's manual standards. Soldiers who failed to perform the task should be retrained and reevaluated until they can meet the standards. When that occurs, enter the date in the appropriate GO block and erase the previous entry from the NO-GO block.

***After the Evaluation***

- Read down each column (GO/NO-GO) to determine the training status of that individual. This will give you a quick indication on which tasks a Soldier needs training.

- Read across the rows for each task to determine the training status of all Soldiers. You can readily see on which tasks to focus training. Line through the training status column of any Soldier who departs from the unit.

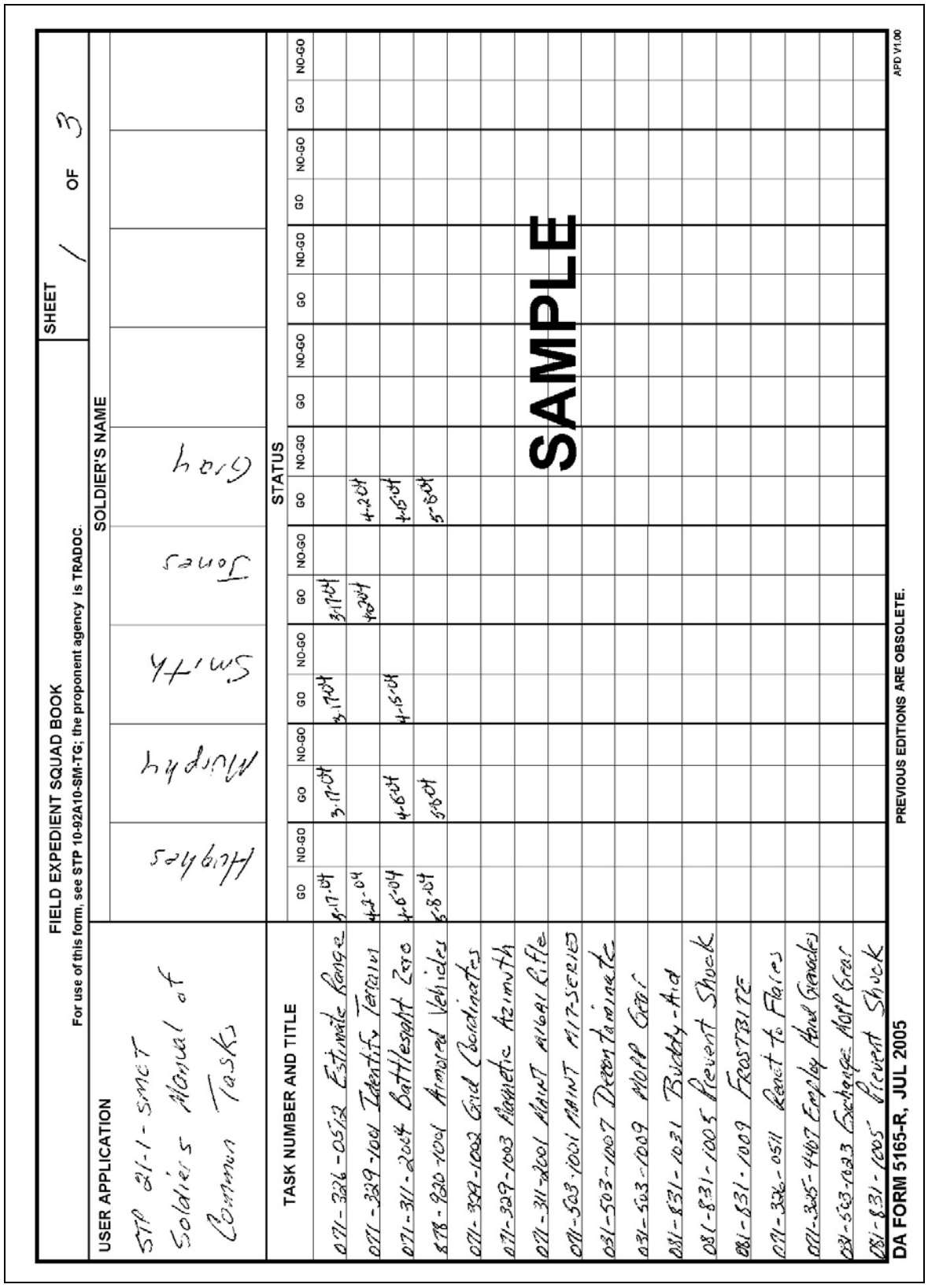


**Figure B-1. Sample of a Completed DA Form 5165-R**

## GLOSSARY

| | |
|---|---|
| **AC** | alternating current |
| **ACCP** | Army Correspondence Course Program |
| **ACS** | American Chemical Society |
| **AIPD** | Army Institute for Professional Development |
| **AIT** | Advanced Individual Training |
| **ANCOC** | Advanced NCO Course |
| **API** | American Petroleum Institute |
| **APD** | Army Publishing Directorate |
| **APU** | Auxiliary Power Unit |
| **AR** | Army regulation |
| **ARTEP** | Army Training and Evaluation Program |
| **ASTM** | American Standard Test Method |
| **ATTN** | attention |
| **AVGAS** | aviation gasoline |
| **BNCOC** | Basic NCO Course |
| **C** | Celsius |
| **cm** | centimeter(s) |
| **CO2** | carbon dioxide |
| **CTT** | common task test |
| **DA** | Department of the Army |
| **D.C.** | District of Columbia |
| **DC** | direct current |
| **DED** | Diesel Engine Driven |
| **DiEGME** | Diethylene Glycol Monomethyl Ether |
| **ECU** | Electrical Control Unit |
| **EPA** | Environmental Protection Agency |
| **F** | Fahrenheit |
| **FM** | field manual |
| **Freq** | frequency |
| **FTM** | Federal Test Method |
| **FTMS** | Federal Test Method Standard |
| **g** | gram(s) |
| **Hz** | hertz |
| **IP** | Institute of Petroleum |
| **ISCP** | Installation Spill Control Plan |
| **JFTOT** | Jet Fuel Thermal Oxidation Tester |
| **JP-5** | jet propulsion fuel, type 5 |
| **JP-8** | jet propulsion fuel, type 8 |
| **kPa** | kilopascal |
| **Kw** | Kilowatt |
| **L** | litre |
| **LED** | light emitting diode |
| **MCPS** | Modular Command Post System |
| **METL** | Mission Essential Task List |
| **MIL-STD** | military standard |
| **mg** | milligram(s) |
| **mL** | milliliter(s) |
| **mm** | millimeter(s) |
| **MO** | monthly |
| **MOS** | military occupational specialty |
| **MOSC** | Military Occupational Specialty Code |
| **MSCP** | Millipore Filter Color Rating |
| **MSDS** | material safety data sheet |
| **MSG** | Master Sergeant |

| | |
|---|---|
| **NA** | not applicable |
| **NCO** | noncommissioned officer |
| **NCOIC** | noncommissioned officer in charge |
| **NFPA** | National Fire Protection Association |
| **No.** | number |
| **NSFU** | not suitable for use |
| **NSN** | national stock number |
| **OG** | outgoing |
| **PAM** | pamphlet |
| **PGA** | Probe Gas Analyzer |
| **PMCS** | preventive maintenance checks and services |
| **POL** | petroleum, oil, lubricants |
| **PQAS** | Petroleum Quality Analysis System |
| **ppm** | parts per million |
| **psi** | pounds per square inch |
| **PSIA** | pound per square inch absolute |
| **PV1** | Private One |
| **PVC** | polyvinyl chloride |
| **QM** | Quartermaster |
| **QT** | quarterly |
| **rcf** | relative centrifugal force |
| **RPM** | revolutions per minute |
| **RVP** | Reid vapor pressure |
| **SA** | semiannually |
| **SC** | supply catalog |
| **SCCP** | Spill Control Contingency Plan |
| **SFC** | Sergeant First Class |
| **SFU** | suitable for use |
| **SGM** | Sergeant Major |
| **SGT** | Sergeant |
| **SL** | skill level |
| **SM** | Soldier's Manual |
| **SMCT** | Soldier's Manual of Common Tasks |
| **SOP** | standing operating procedure |
| **SPC** | Specialist |
| **SPCC** | Spill Prevention Control and Countermeasures |
| **SSG** | Staff Sergeant |
| **STP** | Soldier Training Publication |
| **TB** | technical bulletin |
| **TG** | Trainer's Guide |
| **TM** | technical manual |
| **Tng** | training |
| **µL** | microlitre |
| **UNIT** | Trained in the Unit |
| **US** | United States |
| **USATRADOC** | United States Army Training and Doctrine Command |
| **VAC** | volts alternating current |
| **VOM** | volt-ohm-millimeter |
| **WISM** | water index separometer, modified |
| **WK** | weekly |

# REFERENCES

## Army Regulations

| | |
|---|---|
| AR 200-1 | Environmental Protection and Enhancement, 13 December 2007 |
| AR 385-10 | The Army Safety Program, 23 August 2007 |
| AR 700-68 | Storage and Handling of Liquefied and Gaseous Compressed Gasses and Their Full and Empty Cylinders, 16 June 2000 |
| AR 700-141 | Hazardous Material Information System, 13 August 2007 |
| AR 710-2 | Supply Policy Below the National Level, 8 July 2005 |

## Department of Army Forms

DA forms are available from the APD website at https://myforms.us.army.mil/wps/myportal.

| | |
|---|---|
| DA FORM 1804 | Petroleum Sample |
| DA FORM 2028 | Recommended Changes to Publications and Blank Forms |
| DA FORM 2077 | Petroleum Products Laboratory Analysis Report |
| DA FORM 2404 | Equipment Inspection and Maintenance Worksheet |
| DA FORM 2765-1 | Request for Issue or Turn-In |
| DA FORM 3853-1 | Innage Gage Sheet (Using Innage Tape and Bob) |
| DA FORM 4702-R | Monthly Bulk Petroleum Accounting Summary (LRA) |
| DA FORM 5164-R | Hands-On Evaluation |
| DA FORM 5165-R | Field Expedient Squad Book |

## Department of Army Pamphlets

| | |
|---|---|
| DA PAM 710-2-1 | Using Unit Supply System (Manual Procedures), 31 December 1997 |
| DA PAM 710-2-2 | Supply Support Activity Supply System: Manual Procedures, 30 September 1998 |

## Department of Defense Forms

DD forms are available from the OSD website at
http://www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm

| | |
|---|---|
| DD FORM 250 | Materiel Inspection and Receiving Report |
| DD FORM 250-1 | Tanker/Barge Materiel Inspection and Receiving Report |
| DD FORM 1348-6 | DOD Single Line Item Requisition System Document (Manual Long-Form) |
| DD FORM 1387-2 | Special Handling Data/Certification |

## Department of Defense Publications

| | |
|---|---|
| DOD 4140.25-M | DOD Management of Bulk Petroleum Products, Natural Gas and Coal Volumes I – IV, 22 June 1994 |

## Field Manuals

| | |
|---|---|
| FM 3-100.4 | Environmental Considerations in Military Operations, 15 June 2000 |
| FM 7-0 | Training the Force, 22 October 2002 |
| FM 7-1 | Battle Focused Training, 15 September 2003 |
| FM 10-67-2 | Petroleum Laboratory Testing and Operations, 2 April 1997 |
| FM 10-426 | Petroleum Supply Units, 12 June 1997 |
| FM 25-4 | How to Conduct Training Exercises, 10 September 1984 |

**Other Product Types**

| | |
|---|---|
| ASTM | American Society for Testing and Materials (ASTM) Test Method Supplement to FM 10-92C1/2, December 1989 |
| ASTM STANDARDS | Annual Book of ASTM Standards, 1 January 2001 |
| ASTM/API/IP TABLE 5B | Generalized Products Correction of Observed API Gravity to API Gravity at 60 Degrees F |
| ASTM/API/IP TABLE 6B | Generalized Products Correction of Volume to 60 Degrees F Against API Gravity at 60 Degrees F |
| DLAR 8200.12 | DCMC Independent Lab Testing, 22 November 1991 |
| FTMS 791 | Federal Test Method System Method 5327.4 Test for Fuel System Icing Inhibitor in Fuels, September 1986. |
| MIL-STD-3004A | Quality Surveillance for Fuels, Lubricants, and Related Products, 5 November 2003 |
| SC 6680-95-N01 | Sets, Kits, & Outfits for Sampling and Gauging Kit Petroleum, 1 September 1999 |

**Soldier Training Publications**

| | |
|---|---|
| STP 10-92F15-SM-TG | Soldier's Manual and Trainer's Guide, MOS 92F, Petroleum Supply Specialist, Skill Levels 1, 2, 3, 4, and 5, 31 May 2006 |
| STP 21-1-SMCT | Soldier’s Manual of Common Tasks, Skill Level 1, 14 December 2007 |
| STP 21-24-SMCT | Soldier’s Manual of Common Tasks (SMCT) Warrior Leader, Skill Levels 2-4, 2 October 2006 |

**Technical Manuals**

| | |
|---|---|
| TM 5-301-2 | Army Facilities Components System--Planning (Tropical), 27 June 1986 |
| TM 5-6115-545-12 | Operator's and Organizational Maintenance Manual for Generator Set, Diesel Engine Driven, Tactical Skid Mtd., 60 Kw, 3 Phase, 4 Wire, 120/208 and 240/416 Volts, DOD Model MEP-006A, Utility Class, 50/60 Hz (NSN 6115-00-118-1243) DOD Model MEP-105A, Precise Class, 50/60 Hz (6115-00-118-1252) DOD Model MEP-115A, Precise Class, 400 Hz (6115-00-118-1253) Including Optional Kits, DOD Model MEP006AWF, Winterization Kit, Fuel Burning (6115-00-407-8314) DOD Model MEP006AWE, Winterization Kit, Electric (6115-00-455-7693) DOD Model MEP006ALM, Load Bank Kit (6115-00-407-8322) DOD Model MEP006AWM, Wheel Mounting Kit (6115-00-463-9092), 10 June 1973 |
| TM 5-6630-218-10 | Operator's Manual for Aviation Fuel Contaminant Test Kit, (NSN 6630-01-008-5524), 23 May 1990 |
| TM 5-6640-212-14 | Operator's, Organizational, Direct Support and General Support Maintenance Manual for Mobile Semitrailer- Mounted Petroleum Laboratory, 30 December 1980 |
| TM 5-6640-213-14 | Operator's, Organizational, Direct Support and General Support Maintenance Manual for Laboratory, Air Mobile Aviation Fuel (NSN 6640-00-902-9711), 24 June 1980 |
| TM 5-6640-214-14 | Operator's, Organizational, Direct Support and General Support Maintenance Manual for Petroleum Base Laboratory Assembly (NSN 6640-00-303-4940), 21 December 1981 |

| | |
|---|---|
| TM 9-2330-392-14&P | Operator's, Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Trailer, Cargo: 2040 Pounds, 2-Wheel M1101 (NSN 2330-01-387-5443), (EIC: CBC); Trailer, Cargo: 2840 Pounds, 2-Wheel M1102 (2330-01-387-5426), (EIC:CBB); Chassis, Trailer: 3072 Pounds, 2-Wheel (2330-01-387-5424), (EIC: CCL) , 1 October 1995 |
| TM 10-6630-230-13&P | Operator's, Unit and Direct Support Maintenance Manual (Including Repair Parts and Special Tools List) for Gammon Mini-Monitor Fuel Sampling Kit, 28 September 1990 |
| TM 10-6630-247-13&P | Operator's, Unit, & Direct Support Maintenance Manual Including Repair Parts & Special Tools Lists Ground Fuels Petroleum Test Kit Model PTK-200, (NSN 6630-00-310-8564) (EIC: FHN), 18 January 1994 |
| TM 10-6640-215-13 | Operator's, Unit, & Direct Support Maintenance Manual for Petroleum Laboratory, Semi-Trailer Mounted (NSN 6640-00-538-2736, 30 June 1993 |
| TM 10-6640-221-13&P | Operator's, Unit and Direct Support Maintenance Manual (Including Repair Parts and Special Tool List) for Aqua Glo Water Detector Model GTP-322 (NSN 6640-00-244-9478), 28 September 1990 |
| TM 11-5825-291-13 | Operations and Maintenance Manuals for Satellite Signals Navigation Sets AN/PSN-11 (NSN 5825-01-374-6643) and AN/PSN-11(V) 1 (5825-01-395-3513), 1 April 2001 |
| TM 38-250 | Preparing Hazardous Materials for Military Air Shipments, 12 October 2004 |
| TM 38-410 | Storage and Handling of Hazardous Materials, 13 January 1999 |

## Related Publications

Related publications are sources of additional information. They are not required in order to understand this publication.

### Army Correspondence Course Program Subcourses

| | |
|---|---|
| QM5076-5 | Complete DD Form 250-1, Tanker/Barge Material Inspection and Receiving Report |

### Department of Army Visual Information Production and Distribution Program

| | |
|---|---|
| TVT 10-63 | Mobile Petroleum Laboratory |
| TVT 10-65 | Petroleum Safety Hazards |
| TVT 10-69 | API Gravity of Petroleum Products |
| TVT 77L JOIN | 77L JOIN Television Tape |

### Field Manuals

| | |
|---|---|
| FM 5-415 | Fire-Fighting Operations, 9 February 1999 |
| FM 10-67-1 | Concepts and Equipment of Petroleum Operations, 2 April 1998 |

**Other Product Types**

**Technical Bulletins**

| | |
|---|---|
| TB 11-5825-291-10-2 | Soldiers Guide for Precision Lightweight GPS Receiver (PLGR) AN/PSN-11 (NSN 5825-01-374-6643) and AN/PSN-11(V) (5825-01-395-3513), 1 December 1996 |

**Training Support Packages**

| | |
|---|---|
| CF634D03 | Global Positioning System (GPS), 1 October 2002 |

**STP 10-92L14-SM-TG**
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