EO 45-5A-2C

ROYAL CANADIAN AIR FORCE

AVIATION FUELS

HANDLING

(This EO replaces EO 45-5A-2C dated 10 May 57)

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

29 JAN 60

LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO

FOREWORD

This Engineering Order has been prepared for the guidance of unit personnel handling aviation fuels. More complete information on various aspects of fuel handling can be found in the orders referenced below:-

CROSS REFERENCED ORDERS

EO 00-80-4/6	Safety Precautions - Refuelling of Aircraft
EO 45-1-2	Specified Alternate Grade Fuel and Oil for Aircraft Engine Combinations
EO 45-1-4	RCAF Petroleum and Associated Products with US and British Equivalents
EO 45-5A-2	RCAF Fuel Specifications, Use and Disposition
EO 45-5A-2D	Fuel Handling - General Safety Precautions
EO 45-5A-7	Inspection and Cleaning of Filters and Strainers in Bulk Fuel Storage and Dispensing Systems
EO 80-D-2	Handbook Operation and Service Instructions With Part List, Fuel Handling Equipment.
EO 80-D-7C	Daily Inspection-Trucks Fueller
CAP 16, Vol. 1 Chapter 18	Aviation, ME Fuels and Oils

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

PART 1

AVIATION FUELS USED IN THE RCAF

DEFINITION

1 The aircraft engine fuel to be handled as described in this EO may be either high octane gasoline or turbo-jet fuel.

IDENTIFICATION

2 Standard specifications are laid down for all fuels. These change from time to time. Service personnel are kept up to date through the medium of EO 45-1-4. Aircraft fuels for engine combinations are specified in EO 45-1-2. Fuels are correctly identified by undergoing standard laboratory analysis.

3 Standard color dyes are used for visual identification in the field. The following colors are international standards:-

(a) Avgas 80/87 - Red

(b) Avgas 91/96 - Blue

(c) Avgas 100/130 - Green

(d) Avgas 108/135 - Brown

(e) Avgas 115/145 - Purple

(f) Jet Turbo 1 and 2 - Straw or off yellow color.

NOTE

In no case must color be accepted as positive proof of grade if any reason for doubt exists. Analysis is the only positive test.

TYPES OF FUEL

AVIATION GASOLINE 80/87

4 This fuel contains a maximum of 0.6 ml. of tetraethyl lead per imperial gallon and has a minimum lean mixture rating of 80 octane, and a minimum rich mixture rating of 87. Since all leaded fuel must be dyed this product is colored red. It is distributed throughout all of Canada. The low lead content of Grade 80/87 fuel offers definite maintenance and operational advantages over higher leaded Grade 91/96 gasoline and is therefore preferred for engines which will operate satisfactorily on this lower octane fuel.

AVIATION GASOLINE 91/96

5 This is a blue, leaded aviation fuel used extensively by commercial airlines and in military training aircraft. This gasoline has a maximum lead content of 5.52 ml. per imperial gallon, and a minimum lean mixture rating of 91 octane, and a minimum rich mixture rating of 96. This grade of fuel is distributed everywhere in Canada.

AVIATION GASOLINE 100/130

6 This is a green, leaded aviation fuel embodying a considerable percentage of selected blending agent. It is used in most long range commercial aircraft and in operational military service. The anti-knock qualities for lean and rich mixture operation are controlled by careful blending at the refinery. This grade of gasoline contains a maximum of 5.52 ml. of tetraethyl lead per imperial gallon, and a minimum lean mixture rating of 100 octane and a minimum rich mixture rating of 130. This product is distributed to all the major airports in Canada.

AVIATION GASOLINE 115/145

7 This is a high performance fuel; it is a purple, leaded aviation gasoline consisting chiefly of selected alkylate blending agent, and developed to meet the requirements of certain high powered military and commercial aircraft. Compared with Grade 100/130 its

improved performance at lean and rich mixtures make possible further improvements of fuel economy under cruise conditions, and higher rated powers for take-off. This fuel contains up to 5.52 ml. of tetraethyl lead per imperial gallon and a minimum lean mixture rating of 115 performance number and a minimum rich mixture rating of 145 performance number.

AIRCRAFT TURBINE FUELS

8 The product quality requirements of turbo-jet and turbo-prop engines are now well established. Many commercial operators are using a kerosene-type fuel known as Type 1 (US-JP1). With expanding use of jet aircraft the supply of this product became inadequate to meet military requirements. A gasoline type of jet fuel was designed for maximum availability while still retaining those properties required for dependable operations.

AVIATION TURBINE FUEL
TYPE 1 (US-JP1)

9 This is a straw or off yellow color, a kerosene type product with a freezing point lower than -48.4°C (-55°F).

AVIATION TURBINE FUEL
TYPE 2 (US-JP4)

10 This is a clear, straw or off yellow color, a wide cut gasoline type fuel with a freezing point lower than -60°C (-76°F). This fuel is used in the Canuck, T33 Trainer and Sabre of the RCAF, and in most other military and in some commercial turbine engine aircraft.

PROPERTIES OF AVIATION FUELS

11 The more important properties and characteristics of aircraft engine fuel are briefly described in this EO, detailed technical information is contained in EO 45-5A-2.

PHYSICAL CHARACTERISTICS

HIGH OCTANE AIRCRAFT ENGINE FUEL

12 This is a complex fuel, a mixture or blend of base stocks and synthetic hydrocarbon blending agents, with the addition of chemical agents, such as tetraethyl lead, inhibitors, and dye. Its principal value lies in its ability to develop a maximum of power in a high compression or a supercharged engine without detonating or knocking, thus making it possible to reduce the weight of the aircraft engine per horsepower produced. Although it is a highly flammable product, it is no more hazardous to store or to handle than a regular motor fuel.

OCTANE NUMBER AND PERFORMANCE NUMBER RATING

13 These are terms used to designate the anti-knock value of the fuel mixture in an engine cylinder. When the fuel grade is 100 or less this number indicates the octane number. Numbers above 100 are performance numbers.

OCTANE NUMBER

14 This is a numerical rating of gasolines based on their anti-knock properties.

PERFORMANCE NUMBER

15 This indicates the relative power that an engine can develop safely with equal knocking tendency. (For example at equal fuel mixture conditions an engine using 130 grade fuel will develop 130% (or 1.3 times) as much power as the same engine will using 100 grade fuel.)

RICH AND LEAN MIXTURES

16 When two numbers are given as the grade numbers for fuel as 115/145 the first number is lean mixture performance number rating and the last is the rich mixture performance number rating.

VOLATILITY

17 "Volatility" is the term used to indicate the tendency of a substance to vaporize. It may be expressed conveniently in terms of vapor pressure, which is the pressure exerted by the vapor of a substance at a specified temperature. Vapor pressure increases as the temperature of the substance is raised. As gasoline is a mixture of many hydrocarbons, and as the vapor pressure is influenced chiefly by the kind and amount of the lightest hydrocarbons present, the vapor pressure alone does not determine its effective volatility when used in an engine. The vapor pressure must be reasonably high to facilitate starting a cold engine, yet it cannot be too high if vapor locking of the engine fuel systems is to be avoided. Because of the possibility of vapor lock at high altitude, aircraft engine fuel is manufactured to a fairly low specified vapor pressure. Vapor pressure is not directly related to the octane number of a fuel. The vapor pressure of gasoline is commonly reported in psi Reid at 37.8°C (100°F). This is a somewhat arbitrary measurement which is approximately equal to the true vapor pressure when a quantity of vapor equal to four times the liquid volume has evaporated. The vapor pressure at the start of vapor formation will be somewhat higher.

BURNING QUALITIES

18 Aircraft engine fuels, like all liquid hydrocarbons, are combustible only in the form of a vapor or gas, when mixed with oxygen (air) within a definite range of proportions, and heated to their ignition temperatures. Gasoline, in a liquid state, is not an explosive.

19 Gasolines will give off ignitible vapors in copious quantities at all temperatures. Mixtures of these gasoline vapors with air are combustible, within certain limits, called the "lower" and "upper" combustible, or explosive limits. For mixtures of aviation gasoline vapors and air, these limits are approximately 1%:6% by volume. Mixtures containing less than 1% are too "lean" to burn under any circumstances at atmospheric pressure; while those containing more than 6 or 7% are too "rich" to burn except upon contact or mixture with additional air. A combustible mixture, to be ignited, must be heated at some point to its ignition temperature, which in the case of gasoline vapor and air is not less than approximately 282°C (540°F). Any flame, an electric spark having enough energy, or any hot body having a high enough temperature (e.g., a hot exhaust pipe), will ignite such a mixture.

20 One gallon of gasoline, completely evaporated, will form approximately 30 cubic feet of vapor. From this fact, the possibility of forming explosive mixtures (1 to 6%), in confined spaces, may easily be estimated. A combustible gas indicator commonly known as an explosion meter must be used if it should be necessary to determine with certainty whether or not a gasoline vapor-air mixture is within the combustible or explosive range.

21 The gasoline vapor-air mixture in the vapor space of a gastight tank above the surface of the gasoline is ordinarily too rich to ignite. As the temperature falls the gasoline vapor-air mixture becomes constantly leaner. When the temperature of the liquid gasoline has fallen to between -15°C and -9.44°C (5°F and 15°F) the mixture will be within the 6-1% explosive range. This factor must not be overlooked as it offers a combustion hazard of first magnitude in cold weather.

LIQUID WEIGHT

22 The specific gravity of an average grade 130 aircraft engine fuel is about, or slightly above 0.72. Water being heavier than gasoline, and soluble in it only to a very minor extent, will settle to the bottom of a tank in a short period of time, regardless of the relative volumes of the water and the gasoline thrown into contact with one another. Water and gasoline violently mixed, e.g., by passing through a centrifugal or a rotary pump, may require a few hours time to separate completely by gravity.

EXPANSION

23 Liquid gasoline expands about 0.7% for each 5.6°C (10°F) increase in temperature. Under an expected temperature rise of 33.4° to 39°C (60° to 70°F) above the filling temperature, an allowance of 5% outage should be made for expansion. The pressure, in a closed section of pipe line or hose will mount very rapidly on a rise in temperature. Unless relieved, this may result in a loss of product and permanent damage to a valve, or other piece of equipment.

VAPOR WEIGHT

24 Gasoline vapor is heavier than air. It will thus flow into pits and low areas. When it accumulates in such places, it is dangerous to breathe and introduces an explosion hazard. At locations where gasoline vapors may be emitted, such as tank car or truck unloading or loading sites, the direction and velocity of the wind and other atmospheric conditions are of continuing significance.

CHEMICAL PROPERTIES

SOLVENT ACTION

25 Gasoline is a good solvent of most greases. This is taken into consideration, in the selection of lubricants and in the design of lubrication systems for pump shafts and valves for gasoline service.

26 Natural rubber, and several synthetic rubbers and sealants cannot be used in hoses, gaskets, rod or shaft packing, or other seals in contact with gasoline or its vapors. Aircraft engine fuel contains aromatic hydrocarbons which have an especially weakening effect on such materials. The chemical composition and combustion characteristics of the different grades of gasoline differ very greatly. When materials other than steel are used for tank construction, under war restrictions, consideration must be given to the effect of these materials on the gasoline as well as the effects of gasoline on the construction materials. Certain gum inhibitors in gasoline are adversely affected by alkaline substances. If alkaline materials such as unprotected concrete are used for storage tanks and gum inhibitors are adversely affected, the period that gasoline can be stored without deterioration may be shortened. Neutral lining materials can be installed in concrete tanks where necessary.

PART 2

GAUGING, SAMPLING AND TESTING

1 The efficient operation of any type of gasoline storage depends, to a large extent, on the accuracy of the gauging, the care exercised in the taking of samples, the testing of the samples, and the recording and reporting of the information developed.

GAUGING BULK TANKS

2 The operation of gauging a tank includes the determination of the height (or depth) of the gasoline in a tank, the depth of water (or thickness of the water layer) beneath the gasoline, and the temperature of the gasoline.

3 Gauges taken on storage tanks must be innage gauges; on tank cars or trucks they may be either innage or outage gauges; ("innage" is the term used to designate the height of the liquid level above the tank bottom; "outage", the distance from the marker in the tank gauge hatch down to the liquid level).

4 Aboveground and underground horizontal tanks will be gauged through the regular gauge opening by means of a standard gauge stick, read quickly from the wetted part, and the readings recorded to the nearest 1/8". The gauge stick will be a wooden stick, graduated in feet, inches, and one-eighth inches, equipped with a brass or other non-spark-striking metal protector strip on the bottom.

5 All vertical tanks will be gauged through the gauge hatch and by means of a steel tape, if the height requires it. The gauge tape will be a steel tape, graduated in feet, inches, and one-eighth inches, equipped with a standard plumb bob of brass or other non-spark-striking metal.

6 Usually a marker is set on the gauging connections and the exact distance from this point to the bottom of the tank is established. Where clip angles are provided, the exact distance from the bottom of the tank to clip angle will also be established. This can best be done when the tanks are new and before they are put into service. This distance, known as the depth, will be recorded on the tank gauge table and stencilled on the gauging and sampling connection. By knowing this depth, it will be easier to obtain uniformly correct gauges, and it will also be possible to determine the product content of a tank if any water that may have collected in the bottom has frozen, or if scale or foreign material has accumulated.

7 The maximum height to which a vertical tank may safely be filled is known as the oil height. This oil height is usually taken to be about 1" for each 5 ft. of tank height, below the top of the top angle of the tank, to provide for an expansion of product of about 2%. The oil height should be measured and recorded on the tank gauge table. When receiving a product into storage, care must be taken not to fill the tank in excess of the maximum capacity established by the oil height.

8 To gauge a vertical tank, it is the usual practice for the gauger to lower the standard gauge tape into the tank, and as the reading on the tape is approached corresponding with the expected depth of the tank, to move the tape very slowly until the reading on the tape shows this exact depth. At this point, with a little experience, the gauger will know exactly when the tip of the plumb bob touches the bottom of the tank. The tape must be withdrawn immediately, and as it is reeled in, the gauger must watch for the liquid line on the tape of the approximate expected liquid level. The liquid line can more easily be read on the reverse side of the tape; the gauger placing the thumbnail of the right hand on the liquid line and reversing the tape to the front side for reading.

In dry weather, especially in a wind, the gasoline mark on the tape may be very hard, or impossible, to see. Gasoline finding paste used on the tape at the expected fuel level will help. This reading must be taken to the nearest 1/8" and recorded in the gauge book immediately. Then the gauging must be checked by the same gauger. This gauging operation must be repeated until two consecutive readings agree.

9 Under certain atmospheric conditions persons in motion may accumulate a charge of static electricity. A gauger, approaching the top of a tank to gauge it, must, prior to opening the gauge hatch, touch the steel handrail of the stairway or platform, or the tank shell, to ensure that his body is thoroughly grounded, or of the same potential as the tank.

10 During the gauging operation, from the moment the gauge bob enters the hatch until it reaches the gasoline in the tank, the gauger will ensure that contact is maintained between the tape and the gauge hatch cover or nipple. This precaution must be observed at all times.

11 The tape must be wiped dry after each use, and the gauger must stand in the same position when each gauging operation is performed, preferably on a platform provided within easy reach of the gauge hatch, so that gauge heights measured do not differ from the gauge height established, because of a variation from the normal deflection of the roof plates.

12 No gauging is to be performed during an electrical storm, or when there is a fire in an adjacent area. Gauging is to be held to a minimum during freezing weather.

DETERMINATION OF WATER IN TANKS

13 The depth of water in any container is determined by thiefing using one of the following methods:-

(a) Horizontal tanks are thiefed by covering or coating the lower portion of the gauge stick with water finding paste. After coating, the stick is carefully inserted through the regular gauging connection and allowed to rest on the bottom for a short period of time. Any water at the bottom of the stick will discolor the paste, leaving a clear mark thus indicating the thickness of the water layer.

(b) Vertical tanks are similarly thiefed for water by coating the lower section of the calibrated bob or tape and lowering it just as carefully as for taking a product gauge. Check thiefs must be taken as well as check gauge.

14 In order to arrive at the correct product content in storage tanks, the gallons of water should be deducted from the total content of the tank. For example:-

Product level (20 ft. 7 1/2")	254,200 gals.
Water level (0 ft. 4 1/2")	4,100 gals.
Net Product	250,100 gals.

NOTE

The accumulation of water bottoms of such magnitude is not to be tolerated, the foregoing is for example only.

GAUGING TANK CARS

15 In gauging a tank car, the innage or the outage of the contents is measured and recorded as it relates to the shell of the car. The car is considered shell full when its contents reach the underside of the top plate at the dome, which is normally the highest point of the shell.

16 A special gauge stick is used in gauging tank cars. The measurement will always be taken on the high point of the shell, on the opposite side of the dome from the hand lever, which operates the valve on the inside of the car. Where there is a double thickness of metal, the reading will be taken from the bottom of the top plate. The graduations on the face of the gauge stick read upward from the zero point for reading when the liquid level is below the top of the shell. If the product is in the

dome above the inside of the shell, the reading is recorded as "Innage" if below the shell, it is recorded as "Outage". In either case the reading is taken at the nearest 1/8" graduation.

NOTE

For accurate measurements, the unloading track must be level.

17 Trucks are usually loaded to a marker capacity, the marker being checked and sealed. However, these markers are used by many only as a guide for filling. Some rules may require the filling of truck compartments with emergency valve opened. In the latter case, the contents of each compartment includes the liquid in the line. The gauge stick will be used in all cases as a final check of the contents of a truck.

18 The temperature of the gasoline in any tank is determined by lowering a standard gasoline thermometer into a tank by means of a cord to a depth of about one-half the distance from the surface of the liquid to the bottom of the tank. The thermometer must be suspended in this position for about 2 minutes, then withdrawn, the temperature quickly read to the nearest degree, and recorded in the gauge book. It is common practice to take depth gauges while the thermometer is suspended in the liquid.

19 The temperature of the contents of a tank car is taken by suspending a standard gasoline thermometer at a point approximately in the center of the contents of the car for about 2 minutes.

20 In the preparation of reports from the gauging records, it is customary to show all quantities of gasoline on the basis of 15.6°C (60°F) temperature. Computations are to be made in accordance with fuel temperature correction chart contained in CAP 16, Vol.1, Chapter 18.1.05, Appendix "C".

TANK WAGON GAUGING

21 All trucks must be checked before unloading to ensure that the compartments are filled to the markers. If a compartment is not filled to the marker it must be gauged or the quantity otherwise ascertained. In emergencies gauging may be curtailed or even omitted.

22 When receiving a product from tank cars or trucks, an opening gauge and closing gauge are to be taken on each tank receiving products from the tank cars or trucks.

PIPE LINE DELIVERIES

23 When pipe line deliveries are made, opening gauges must be taken on the receiving tank or tanks within a 2 hour period before the start, and closing gauges must be taken on the completion of the operation.

SAMPLING

24 Taking test samples is just as important as gauging. A standard sample container as specified in CAP 16, Vol.1, Chapter 18.3.13 is to be used.

25 All sample containers that have been stained or used for other products must be thoroughly cleaned by washing in water and dried before using, (special care being taken to see that no lint or other fibrous material remains in or on them), rinsed with a fresh stock of gasoline (stock not previously used for cleaning purposes) and dried; finally rinsed with a portion of the same product to be sampled. It is also good practice to rinse the sample containers after sampling has been completed and to place them in an inverted position in a clean cabinet. Sample containers must be closed immediately after filling and properly labelled.

26 It is common practice to take samples of gasoline with a 1-quart size weighted, stoppered glass bottle, mechanically equipped to fill at any desired liquid level of the tank, and to be withdrawn without undue contamination of the contents of the bottle.

27 As gasoline is very volatile and the portion that is most easily evaporated possesses some of its most valuable properties, in warm weather samples should be taken early in the morning, when the gasoline is cool. Every precaution must be taken to minimize the handling of the sample, and to avoid any loss due to evaporation, in order that the results of laboratory tests will not be misleading. Precautions must be taken to avoid the unnecessary exposure of samples to light.

28 Average samples (customarily called "true average samples") are obtained by lowering a stoppered container to the bottom of a tank, pulling out the stopper by jerking the line and withdrawing the container at a uniform rate, so that it will not be quite full when it breaks the surface of the gasoline.

29 Composite samples of products in tanks are taken by mixing equal portions of top, middle, and bottom samples, drawn as spot samples, from the middle of the top third, and in the order named. If these samples are not mixed, they may be tested separately and the results averaged.

30 Samples shipped to laboratories, by express, aircraft, or messenger, should be well packed to avoid spillage, leakage, breakage, and loss by evaporation while in transit. Packing shall conform to existing commercial shipping regulations.

WHEN GAUGING, SAMPLING AND TESTING ARE PERFORMED

31 Gauging for quantity and water content and temperature checks are to be carried out at RCAF units:-

(a) On all tank cars of fuel, when received before unloading commences.

(b) On all tank trucks of fuel when received before unloading commences.

(c) On all vessel compartment (ships and barges) of fuel before unloading operations are commenced.

(d) On all storage tanks daily before commencement of operations.

SAMPLING FOR QUALITY ANALYSIS

32 Samples of petroleum products are to be taken at the time of delivery, prior to being mixed with existing stocks, when:-

(a) Requested by AMCHQ.

(b) It is suspected that the product is contaminated or does not conform to specification.

(c) Semi-annually for gasoline or turbine fuel type 2 in inactive storage.

(d) When there is reason to believe that the quality of the product has either deteriorated through contamination or other cause, or does not conform to specification.

(e) When required in the course of an investigation.

REASONS FOR THE RCAF METHOD OF SAMPLING

33 Paragraphs 34 to 38 outline the reasons behind the present procedure and frequency of sampling POL at RCAF units.

34 All firms supplying aviation petroleum to the RCAF are subjected to a facilities and procedures inspection by an RCAF petroleum specialist. Before a firm is allowed to supply, it must be proven capable of supplying an acceptable product. When this has been established the firm is given an RCAF approval number. An academically competent employee of the firm is designated as Chief Inspector (usually the refiner's chief chemist), who becomes responsible to the RCAF for the supply of quality products. He certifies every batch of fuel made and records the test results on a batch analysis, a copy of which is forwarded

to AMC/CQC. He then certifies every delivery from that batch on a covering release note, and this release note may be accepted as proof that the product meets specification requirements.

35 To maintain a quality audit on the supplier, periodic check samples are drawn from the delivery vehicle at the receiving unit. The results of this test are graphically charted against the applicable batch analysis. This confirms the quantity of the supplies and effectiveness of the inspection and handling facilities. These samples are not designed as acceptance checks, as it will readily be realized that the delivery represented is used before the test results are received, but are used as a quality audit only. The approved firm's inspector has carried out the initial inspection and his release note is to be accepted as evidence of this.

36 To better implement this quality audit, the frequency of sampling at units has been revised. Previously the size of the contract dictated the number of samples a unit would submit. A record of all contracts is now maintained by AMC/CQC who is the inspection authority. Records, past experience, and batch analysis dictate the batch analysis frequency for each refinery and product. A sample frequency register is maintained and AMC/CQC directs the submission of samples from units either by signal, or letter, in accordance with CAP 16, Vol. 1, Chapter 18.3, paragraph 3a. This sampling procedure was adopted for two reasons:-

(a) A controlled systematic check could be maintained on each supplier.

(b) An even flow of test samples could be funnelled into the testing laboratories.

37 Under the old procedure, units generally submitted their samples early in the first of each quarter. Many of these samples were from one batch of fuel and between the quarters, batches were not being tested. This old procedure also led to an uneven flow of samples through the test labs.

38 The procedure outlined above does not preclude the submission of samples from suspect POL or inactive POL storage; the sample procedure in this regard remains as heretofore.

PART 3
UNLOADING AND RECEIVING FUEL AT UNITS

TANK CARS

GENERAL INFORMATION

1 The NCO in charge of the compound or a responsible representative, must always be present during the receipt of gasoline or oil supplies. The actual unloading of tank cars must be performed only by persons properly instructed and made responsible for careful compliance with the prescribed procedures.

2 These procedures are closely patterned after the regulations of the Board of Transport Commissioners and established practices of the oil industry. Many different types of tank cars will be found. For simplicity, however, the description of these operations is based on the use of typical Canadian or American type tank cars.

3 Before any product is unloaded the NCO in charge of unloading shall measure the storage tank selected to receive the fuel to ensure it has ample capacity to receive the contents of the tank car. Consideration shall be given to an approximate 2% fuel expansion allowances for changes in temperature.

4 If there is product already in any tanks, these tanks must be thiefed, and gauged, before unloading is started. If the tanks are empty they must be inspected to see that they are clean and in good condition, with openings properly closed and equipment operable. The proper valves on the tanks as well as on the line to the unloading spots may then be opened. To prevent static electrical sparks or sparking due to metal friction, tools of non-sparking type only are to be used in gasoline compounds. Tools are listed in scale D92 CAP 603.

THE UNLOADING TRACK

5 The unloading track must be equipped with grounding cables. Sufficient grounding cables must be provided to permit individual connections for cars at all unloading arms or hydrants. The track must be inspected frequently, to be sure that the grounding and bonding insulated joints are in operable conditions; and that electrical equipment if of vapor-proof construction, and in good working order. Welding, open flames of any kind, or light, other than approved vapor-proof flashlights or hand lamps, must not be allowed in the vicinity (within 100 ft.) of the unloading operations. Employees, including train crews, must use only approved electric flashlights or electric lanterns with shatter-proof lenses near the unloading rack. Carrying of open lights or matches, other than safety matches, is prohibited. Signs must be provided on each unloading rack track prohibiting the approach of locomotives closer than 100 ft. from any unloading spot, except by permission of the NCO in charge of unloading operations.

6 Tank cars must be properly placed on the insulated section of the track only, where insulated joints have been provided, and in position for unloading so that there will be no unnecessary strain on the connections. In no case should a tank car rest partly on insulated and partly on uninsulated track. Brakes must be set and wheels blocked on all tank cars to be unloaded to prevent any car movement affecting the safety of the unloading connections.

NOTE

A standard car-mover must be used for hand-spotting cars.

7 The warning signs bearing the words "STOP - TANK CAR CONNECTED" must be placed between the rails on the open end, or ends, of lead track 25 ft. away from the nearest car, or, if possible, 50 ft., but not beyond the clearance point of the lead from the main or passing track. When another car is spotted between the car being unloaded and the switch, place the sign between the interposed car and the switch. Signs must not be removed until all operations are completed, and the hoses have been removed from the cars. The signs shall be at least 12 inches by 15 inches with the word "STOP" having a minimum height of 4 inches, the other words a minimum of 2 inches in height. All lettering should be white on a blue background.

8 The track used for unloading tank cars must not (except in emergency) be used for other purposes. Where this segregation is not possible and other traffic is expected, derails may be found installed at the head of the unloading siding to prevent other cars from backing into the siding during unloading operations. Derails may also be found installed in other locations to prevent tank cars from rolling onto other tracks should the brakes be released accidentally or fail to hold. In either case, where derails are provided, they must be set and locked or so operated as to provide the protection intended.

9 When a tank car is in correct unloading position is must be connected to the grounding cable. Care must be taken to connect the grounding cable to a spot of unpainted bare metal. The grounding cable must be attached before opening the dome or bottom outlet valve.

PREPARING TANK CARS
FOR UNLOADING

10 Car numbers must be checked against shipping papers to see that the cars handled are at the right destination. Seals on dome covers of cars will be inspected and car numbers and fuel grades compared with those contained in the shipping papers. In instances where seals are found to be broken or the numbers do not correspond with the shipping notice or release notes are not available the car shall not be unloaded. The consignor shall be notified by message and requested to advise disposal instructions. If the seals are intact, release notes are available and data given agrees with the shipping papers the car is ready for opening.

11 The actual quantity of fuel in the tank car is to be determined prior to commencing unloading operations.

12 The seals or locks on the unloading connections of the piping system will be examined. If the seals or locks have not been tampered with, connections will be opened and unloading hose attached. If they have been tampered with, connection will not be made to the piping system and no product will be unloaded until the officer in charge or the senior NCO has investigated and satisfied himself that the lines are clear and that the product remaining in storage has not been sabotaged.

13 At least two dry chemical powder, or two portable CO_2 or two foam fire extinguishers, must be placed near the cars to be unloaded in a location where they will be plainly visible and easily accessible.

14 When removing dome covers break the seal and unscrew the dome cover slowly to relieve the vapour pressure. The dome cover shall not be completely unscrewed while there is a sound of escaping vapour. The following precautionary measures shall be taken to prevent any friction sparks occuring while this operation is being conducted.

(a) Screwtype - place hardwood bar, preferably hickory 2" x 3" x 36", between dome cover lug and knob. Give two complete turns and wait until all vapour escapes, then remove dome cover completely.

(b) Hinges and bolted type-unscrew nuts and eye bolts one or two turns. Raise the cover

slightly to eliminate any adhesion which may exist between the cover and ring. Wait until all vapour escapes then open or remove completely.

(c) Interior type - remove all dirt and cinders before the yoke is unscrewed.

15 If the tank car is equipped with a bolted type dome cover, all nuts must be unscrewed one complete turn, after which the same precaution for venting the internal pressure as recommended for cars equipped with screw type dome covers must be followed. All dirt and cinders must be carefully removed from around the cover before the yoke is unscrewed.

UNLOADING TANK CAR

16 Tank cars must, where possible, be unloaded through the dome. The unloading may be accomplished by gravity, flow being started by siphon action, or by pumping. Precautions must be taken to be sure that the pipe or hose is securely fastened to prevent its being pushed or pulled out of the dome. An auxiliary dome cover must be placed on the dome to reduce gas losses and for protection from sparks.

17 When unloading by overhead standard, the following physical operations are to be performed:-

(a) Insert a suction stub (non-sparking) into the dome of the car. Screw the top end of the stub into the elbow at the end of the arm making sure that the screwed connection is air-tight. When a suction stub has a flat end, it is to be raised two or three inches above the bottom of the tank car. This can be accomplished by placing a wooden block between the edge of the dome and the swing arm. When the bottom end of the suction stub is bevelled or equipped with a cage, it should rest on the bottom of the tank car.

(b) The loading dome cover is to be installed. Details of the construction of this cover are shown in drawing S21-8.

(c) When the car has been emptied as far as overhead unloading will permit, the remaining fuel is to be pumped from the bottom outlet as outlined below.

18 If a tank car can only be unloaded through the bottom outlet, a tub must be placed in position to catch any liquid that may be in the outlet chamber before attempting to remove the outlet cap. The valve rod handle or control in the dome must be operated a few times to ensure that the outlet valve in the bottom of the tank is on its seat, before the valve cap is removed. If the valve cap does not unscrew easily with the use of a proper wrench, it may be tapped lightly with a wooden mallet or bumped with a wooden block in an upward direction. When upon starting the removal of the outlet cap, any leakage develops, sufficient time must be allowed to permit the escape of any accumulation of liquid that may be in the outlet chamber. If the initial rate of leakage continues, further effort must be made to seat the outlet valve. If this fails, the cap must be screwed up tight, and the oil company contacted to assist in unloading.

19 Unloading connections must be securely attached to discharge outlets of the tank cars, and to the receiving connections of the unloading header leading to the tanks, before the discharge valves are opened.

20 While the tank car is being unloaded through the bottom outlet, the screw-type dome cover must be placed over the dome opening, without engaging any threads, in such a way that air may enter the tank car. Hinged and bolted type dome covers must be placed over the dome opening and a block of wood must be inserted under one edge so that air may enter tank cars during unloading. Otherwise, the tank cars would be subjected to a vacuum.

21 In cold weather, and in the event that water has collected in the outlet valves and has frozen, preventing the free movement of the valve, a steam jet, hot water, or hot cloths, must be used for thawing the ice. If steam facilities or equipment for heating water are not available, calcium chloride in crystal form may be used to thaw out the ice so that the valve may be raised. Placing the crystals around the valve inside the car may be accomplished by the use of a piece of 1" pipe, lowered through the dome of the car to the outlet valve, carefully placed so that the crystals, when dropped through the pipe will lie directly on the ice around the valve. A flashlight may be used to advantage when placing the end of the pipe at

the valve. About three minutes will be required for the calcium chloride to thaw the ice and free the valve. After freeing the valve, it should be raised and about 2 pounds of crystals put down into the outlet leg of the valve, for the purpose of thawing the ice in the outlet leg. The car must be completely closed and after 5 or 6 hours, it will usually be found that the outlet valve and the outlet leg are completely thawed.

22 The calcium chloride solution is much heavier than gasoline. It must be drained from the car before the car is connected for unloading so that it does not get into the lines leading to the storage tanks. Only if steam or hot water is not available will calcium chloride be used. It is undesirable and is dangerous to use other methods for thawing valves and outlet legs; however, in extreme sub-zero weather the thawing has been accomplished by use of hot air forced through a duct from a portable force-draft aircraft motor heater, (Herman Nelson heaters). If this method is resorted to, only one car is to be thawed at one time and the heater must be located on the windward side of the car and a safe distance from it. Under no circumstances will any open flame or element be used directly on a frozen tank car for thawing the outlet leg. If the outlet cannot be thawed by safe means, unloading must be accomplished through the dome.

23 Careful examination should be made to prevent loss of product from a cracked outlet chamber. If any cracks are found, or if for any reason the valve cannot be properly seated, the shipper or other authorities concerned must be notified.

24 As a guide to what may be considered an excessive leak, the Association of American Railroads has recently ruled that a leak greater than 30 drops per minute shall require a car to be returned for repair before again filling.

25 If, during the preparation of a tank car for unloading sparks are observed, indicating the presence of an electric current, a close examination will again be made of grounding connections, rail bonds, and insulated joints. Any loose joints or connections must be made tight at once. Should the sparking continue, further operations will be stopped until special investigation has been made by the unit engineering officer or an engineer employed by (or connected with) the nearest power system. He may find the source of the trouble to be stray currents from a street railway or from a grounded power system.

26 Unloading operations must be stopped in the event of a fire, on the approach of an electric storm, or an enemy attack, and tank car valves and manhole covers must be closed and connections removed so that cars can be taken away from the danger zone on short notice.

27 Tank cars are not to be unloaded after dark, unless special permission has been granted by the CTSO.

28 When delivery has been completed to the receiving tanks, the valves on the line from the unloading spots must be closed, the tanks thiefed, gauged, and the temperature of product taken. Water must be drawn off immediately. Unloading reports must be raised as per CAP 16, Chapter 18.1, Appendix "A"

PRECAUTIONS AT UNLOADING AREAS

29 In addition to precautions mentioned above, signs must be placed at least 50 ft. from any car at an unloading track forbidding anyone not connected with the work to approach nearer than this distance to the car; and prohibiting smoking in this hazardous area.

30 Throughout the entire period of unloading, or while a car or cars are connected to the unloading device, the cars must be attended by the unloader. On all operations of this nature involving the handling of aviation fuel, where one man can perform the duties assigned, a second man must be within call. Tank cars must not be allowed to stand with unloading connections attached when unloading is discontinued for any reason, or after unloading has been completed.

31 Under no circumstances is air under pressure to be admitted into tank cars, trucks, drums, or barrels for unloading by displacement.

32 The unloader must stand on the windward side of the dome when releasing the internal pressure through vent valves and when removing the dome cover.

33 A man must not place his head inside the dome of a car as there is danger of asphyxiation.

34 Any spills must be cleaned up immediately. Gasoline pools must be hosed down with water and the area covered with sand or dry earth. When adequate water supply is not readily available, and there is a source of ignition nearby the use of a foam blanket from a foam extinguisher will be of value in cutting down vaporization and preventing ignition. The area will be policed until the vapor has been dissipated.

35 Each car unloader must be familiar with the use of fire-fighting equipment and instructed in the method of extinguishing fires in or near tank cars.

36 In general, no one is to be permitted to enter a tank car at an unloading point. However, if it should be necessary to do so, owing to some unusual circumstances, the same precautions must be taken and procedures followed as for entering any gasoline storage tank.

37 After all gasoline has been unloaded from cars, the cars must be visually checked to verify that they are empty. The filler caps on the unloading connections on the receiving lines are to be replaced immediately and sealed or locked, in order to avoid the entrance of water or dirt into the tanks, or to prevent sabotage.

RETURN OF TANK CARS

38 As soon as tank cars have been completely unloaded and disconnected, the outlet caps and the dome covers must be made tight by use of a proper wrench or tool.

39 All "dangerous" placards shall be removed by completely detaching the paper placard pasted or tacked on the car or reversing the placards when the car is equipped with metal placard holder. All shipping cards and seals, except railroad defect cards, are to be removed from the car.

40 If the track is otherwise clear, the blue flag and the derail must be removed, and the railroad agent informed that the cars are ready for removal.

41 The supply technician in charge of unloading is to personally sign the tank car release form before the tank car is removed from the railway siding.

TANK WAGONS

UNLOADING ROAD TANK WAGONS

42 When fuel is received by road tank wagon from the contractor, the actual physical operations of unloading will be conducted by the contractor's representative in charge of the tank wagon. The supply technician will operate the pump house controls as applicable. Proper notation of the actual amount delivered will be made for accounting purposes.

UNLOADING ROAD TANK WAGONS

43 If service personnel have occasion to unload tank wagons, the same general precautions must be taken in unloading of aircraft engine fuel from transport trucks and trailers as for unloading tank cars, but the mechanical details of the equipment will be somewhat different.

44 The truck must be parked with its front toward the best and least obstructed exit from the premises. Other vehicles must not be allowed to park near or in the route of the exit of the truck.

45 The delivery of gasoline in trucks is only to be made to storage when the NCO in charge or his representative, is present.

46 The truck must be inspected for any indications of a leak. It must be ascertained that a ground cable from ground and unloading connection is attached to a bare clean metal part of the truck tank or chassis before the hose connection is made between the truck and the receiving connection. This is to avoid an accumulation of a charge of static electricity.

47 The unloading connections on pipe lines leading to tanks must be sufficiently above ground to prevent any water or dirt from getting into the pipe line. The filler caps must then be removed. The truck compartments must be inspected to verify that they are full.

48 Any unloading hose used must be in good condition and of the type provided with a built-in bonding wire.

49 No welding, no open flames, no smoking, nor light or switches of other than vapor-proof construction are to be allowed within 100 ft. of any truck unloading spot. Truck motors must not be left running nor ignition switches turned on during unloading and loading operations except when it is necessary to use a pump provided on a truck.

50 The drain cock on the segregator of the truck must be opened and observed to be sure that it is in good working order, see EO 80-D-7C. If the truck is not equipped with a segregator, the truck tanks must be thiefed for water as well as checked. If water is found, it must be drawn off before the truck is unloaded into the storage tank. This is the only safe way to check a truck delivery to be sure that the truck is full of product, and not partially full of water, and that no error was made in the loading of the truck.

DELIVERY FROM PIPE LINE

51 In some locations gasoline will be delivered to units by pipe line. The line may be a commercial line, RCAF line, or a combination of both.

52 Marine deliveries are likely to contain some water in spite of all precautions taken. Some water may on occasions be received at a unit from a pipe line if due care is not taken to avoid it.

53 Pipe line deliveries therefore, must be made only into designated receiving tanks. No connections without block valves, or shut-off valves, are to be permitted between the lines used for receiving the gasoline, and the lines being used for delivering gasoline to truck fill stands or pits from the remaining storage tanks.

54 As in the case of receipts from tank cars and trucks, the receiving tanks must be checked for capacity and product contained; thiefed for water; and freed from water. If empty they must be checked to see that they are clean or in good condition, the openings properly closed, the equipment operable, and that the proper tank and pipe line valves are opened.

55 Similarly, when product has been received, these tank and pipe line valves must be closed, the tanks gauged and thiefed, any water removed, and temperature taken. Pipeline receipts must be promptly checked against pipe line deliveries on a tender-to-tender basis and any unaccountable differences will be investigated. Pipe line leaks should be looked for and if any are found repairs must be made to the line immediately. If leaks are found to have been caused by excessive external corrosion or pitting, the corrosion may be suspected to be the result of electrolysis. An electrolysis survey should be arranged for, and bonds, insulating flanges, or cathodic protection provided if the findings confirm the suspicion.

PART 4

UNLOADING AND LOADING FUEL FROM SEA TRANSPORT

PREPARATORY INSTRUCTIONS FOR RECEIPT OF FUEL

1 At least three hours before the tanker is due, the following action is to be taken:-

(a) It is to be determined which tank is to be filled first and qualified personnel are to be detailed for attendance at each tank.

(b) All valves in the system are to be tested to ensure that each valve is closed and that the blank flange on the wharf is properly gasketed and bolted in place.

(c) The wharf valve is to be kept closed and the tank valve opened on the tank that is to be filled first.

(d) Any intermediate valves in the line leading to that tank are then to be opened to fill the wharf line with fuel, from that tank only.

(e) All other tank valves are to be kept closed.

(f) The blank flange is to be removed from the end of each pipe line and all steps taken to ensure that the remainder of the handling system is in readiness in order that no delay occurs when the tanker is docked.

(g) All pipe connections, valves and vents are to be carefully inspected, and fire fighting apparatus placed in readiness for emergencies.

TANKER UNLOADING OPERATIONS

2 The tanker crew will effect the actual hook-up of the unloading hose. The tanker's draft fore and aft, is to be read immediately the vessel is tied to the wharf.

3 The ullage and temperature of all tanker compartments are to be recorded and the compartments tested for water, so that the actual gallonage may be computed as at 15.6°C (60°F) in accordance with CAP 16, Chapter 18.1, Appendix "C", and checked against the bill of lading and manifest carried by the ship's master.

4 The contractor making the delivery will furnish compartment capacity tables of the tanker concerned. These tables are approved by the government inspector, Department of Weights and Measures and will be carried in the vessel.

5 Any trace of water, no matter how small, is to be reported on the ullage statement. Computations are to be made on a gallonage basis at observed temperature, not in linear measure.

6 Before the hose connection is made, the tanker is to be grounded to a ground rod on shore. The clip of the grounding cable is to be a proper metallic contact. Any non-conducting material such as paint is to be removed before the attachment is made. This grounding cable is to remain connected until the cargo hose has been disconnected and put on board.

7 The individual in charge of bulk storage at the site is responsible for checking all shore equipment such as pipe lines, pumps, valves and tank connections immediately the unloading pumps are started. This is to ensure that no leaks develop in the system and that the proper valves are open to the correct storage unit.

8 When the tanker crew reports the cargo discharged, the stop valve on the wharf is to be closed. Before signing the ullage statement or ship's receipt of cargo, all compartments of the ship are to be checked and certified as being dry. In the case of split cargoes, ullages and temperatures are to be taken again, in

order to determine the quantity delivered.

9 When the transfer is completed, the fuel is to be allowed to settle for three hours. This is necessary as the liquid is aerated by the pumping, and accurate measurement cannot be obtained immediately after pumping. The temperature and quantity of fuel in storage are then to be checked again. The quantity of fuel received is to be determined by its column at 15.6°C (60°F), using Appendix "C" to Chapter 18.1 of CAP 16, Vol. 1.

10 Care is to be taken not to mix grades of fuel either in storage tanks or in pipe lines. Tanker compartments containing similar octane grades are to be pumped first.

11 When it is necessary to use the same shore pipe line for unloading two or more grades of aviation fuel, the line is to be cleared of one grade of fuel, into storage holdings of the same grade, before starting to unload a different grade of fuel. This may be accomplished as follows:-

(a) Calculate the capacity of the shore pipe line containing fuel to be cleared, estimated on the following basis:-

2" line, per foot.....	.136	gals.
3" line, per foot.....	.3052	gals.
4" line, per foot.....	.545	gals.
6" line, per foot.....	1.225	gals.
8" line, per foot.....	2.18	gals.
10" line, per foot.....	3.405	gals.

(b) Where a meter is installed in the pipe line, the flow should be switched over to the correct tank when the meter reading shows that the quantity in the line has been displaced. When a line meter is not provided, the rate of pumping may be calculated on the basis of displacement per stroke of the vessel's pumps.

12 Information regarding pipe line contents is to be recorded and retained for future reference. Capacity and type of fuel contained in the fuel pipe line are to be taken into account as stock when gauging storage tanks.

GENERAL PRECAUTIONS ON WHARF

13 Automobile or stationary spark ignition engines are not to be allowed in the vicinity of the wharf valve area. In case of fire on the wharf or vessel, all operations are to cease immediately. An alarm is to be given and all valves are to be closed.

14 During unloading operations, one man is to be on continuous duty at the wharf so that the valves may be closed immediately in the case of an emergency.

15 Sufficient portable CO_2 or foam type fire extinguishers are to be kept at the wharf during the entire unloading operation.

16 The tanker crew does not assume responsibility for discharging pressure, therefore, the tanker crew should be informed of the allowable pressure at each discharge. Tanker pumping pressure is not to exceed 85 lbs.

17 Tankers are not to be unloaded during an electrical storm in the immediate vicinity. Lightning on the horizon is not considered a hazard.

18 Wharf valve area is to be roped off and danger notices displayed in conspicuous places.

19 No welding equipment is to be used within 500 ft. of the ship's hull or any storage tank.

20 The dip hatch on a tank is to remain open while the tank is being filled from the tanker.

LOADING - REFUELLING SCOW OR TANKER

21 Precautions similar to those observed in unloading the tanker are to be adhered to during loading operations. The individual in charge of the loading operation is to proceed as follows:-

(a) The storage tanks are to be dipped, the temperature of the fuel recorded, and all shore pipe lines and valves inspected before the transfer is commenced.

(b) The condition of the storage compartments of the scow or tanker are to be inspected with the ship's master and checked for water and cleanliness.

(c) When the terminal operator and the vessel crew are satisfied that all connections, including the tanker loading hose are in safe working order, the valve from the storage is to be opened and the transfer effected.

22 When the transfer is completed, the storage tanks are to be checked to ascertain the quantity loaded. This calculation is to be used for stock records and voucher action.

PART 5

HANDLING AVIATION FUEL IN DRUMS

DRUM CONTAMINATION

1 Aircraft fuel stored in drums is particularly subject to contamination by rust particles and water. Such contamination is increased when fuel is stored for considerable periods of time at isolated points where large quantities of fuel have to be provided in drum stocks at infrequent intervals. However, if reasonable care is taken to remove the water and rust particles when decanting the fuel from the drums no serious defects are normally found in the operating efficiency of the fuel.

DRUMMED FUEL PRECAUTIONS GENERAL

2 Drums containing fuel are never to be opened, filled, or emptied in a closed room, or in any location where escaping vapours may come in contact with a source of ignition.

3 When filling or emptying a drum, care is to be taken that all equipment used is clean, and that adequate precautions are taken to ensure that foreign matter does not enter the drum.

4 When filling a drum by hose the hose nozzle is to be bonded to the drum.

5 When filling a drum, the liquid level of the fuel is to be approximately 3" below the top of the drum to allow subsequent expansion.

6 Bungs are to be removed slowly from drums to allow the gradual release of any excessive pressure.

7 Drum storage compounds are not to be located within 250 ft. of any structure.

HANDLING DRUMS AT UNITS

8 Some units will receive aircraft engine fuel in drums and may even keep it stored in these packages for some months. When gasoline is so received and stored, it is to be used on the "first-in-first-out" basis. When storage tank capacity is available the contents of the drums must be transferred to the tanks as promptly as possible.

9 Drums must be handled with care in loading and unloading. They are to be unloaded

from a truck, car, or platform to ground level by sliding down skids, end first. They are not to be rolled down from, or permitted to roll off or drop off a platform. They are to be loaded on trucks, cars, or platforms by rolling up similar skids, two or more men being used in loading a drum or barrel. These barrel skids must be of adequate strength and provided with hooks. The hooks of the barrel skids must be securely fastened to the truck or platform before operations are started.

10 Drums containing aircraft engine fuel should be inspected immediately upon receipt. Those received with broken seals, and any bung leakers that are noted, will be set aside and checked for mishandling or sabotage. Containers found leaking in any part other than at a bung must be emptied at once through a filter into an intermediate tank. When any question of sabotage in connection with bung leakers, or packages received with broken seals, has been eliminated as a result of an investigation by SSO, these containers, too, should be emptied at the earliest date.

11 If on investigation the suspicion of sabotage is confirmed and the drums of gasoline are contaminated, then all the drums in the lot must be looked on with suspicion and inspected, tested, and disposed of as the results of the tests may dictate.

12 Containers passing inspection, that are to be stored, are to be segregated by grades and lot shipments and protected from the sun. If there is any possibility that the labels or stencils on the packages may become illegible or be obliterated, the packages should be distinctly marked for ready identification by boldly stencilling, or painting on them the octane or grade rating, the lot number, and the month received.

13 A record is to be kept of the information noted on the package, especially if it is an overseas shipment, including the new markings, the date of receipt, and the source of supply. In the event that signs of deterioration are noted on the testing of a sample, this information will aid in the tracing of stock to the correct lot and source. This will permit arrangements being made for the early use or disposal of the entire lot.

STORAGE OF DRUMS AT UNITS

14 When possible, drums or barrels containing aircraft engine fuel should be stored under cover, in a cool place where air can circulate. If stored on a concrete floor, the floor should be sloped to permit draining.

15 No empty, nor partly filled drums should be stored in a building. Gasoline must never be poured from one container to another in a closed room or building.

16 Gasoline drums whether full, part full, or empty must never be stored in hangars used for storing aircraft or ME vehicles.

17 When of necessity containers are stored in the open, they will preferably be placed on dunnage lumber, when available, to keep them clear of the ground.

18 Containers stored in the open are to be arranged in groups of preferably not more than 50 barrels or drums. Each group to include drums of the same lot, that is, packages containing the same grade of gasoline and received in the same shipment. The piles to be well dispersed. All drums may be stored on their sides but if possible should be stored on end on a slight tilt. Bungs and vent holes will be positioned at the top and at 3 o'clock and 9 o'clock.

19 In emergencies, where large quantities of gasoline in drums must be stored in a single area, as at shipping or receiving points, these limitations may of necessity be lifted.

20 In the selection of the drum storage site and the method of storage at units, consideration must be given to accessibility, protection against fire and theft, as well as the protection of containers from corrosion and rust. Container storage must be at least 200 ft. from any gasoline tankage area.

21 All fuel obtained from drums is to be suspected of water contamination and a careful check is to be maintained on the fuel system sumps, regardless of the method used to transfer the fuel from drums to the aircraft.

22 Drums used for the storage or draining of aircraft fuels must be clean and free from any other petroleum products. Aircraft fuel drums should not be used for any product other than the type of fuel contained in the original sealed container.

DECANTING FUEL FROM DRUMS

23 Pumping facilities for decanting the fuel must be made available. The packages to be emptied must be brought to the tank site from the drum dump in small batches to minimize the risk of fire. Empty drums must be removed immediately.

24 Before opening, bungs of all packages must be carefully wiped with a clean cotton rag (wool rag or cotton waste is not to be used for this purpose). The tops of all drums which are provided with a bung in the head should be wiped. After the drums have been placed in proper position, a bung wrench is to be used to remove the bungs.

25 The contents of drums will be pumped slowly through grounded funnel type filters, fitted with chamois to remove any trace of moisture, scale, or foreign substance of any kind. Filters may be provided with a fine mesh screen to remove sediment only, where adequate provision is made for the subsequent removal of water. If it recognized that a considerable amount of vapor will escape in the emptying of drums into tanks through filters, but results obtained in eliminating sediment alone will be found to justify the additional handling. It is because of this vapor release that the somewhat isolated location is necessary. When many drums are to be emptied into a tank, several large size funnel filters may be used to minimize the time required for this operation.

CHAMOIS LEATHER FILTER 32B/442

26 The efficiency of the chamois type of funnel filter depends to a large extent upon the quality of the chamois, the care exercised in the handling of the chamois, and the rate of flow (usually restricted to between 15 and 25 gallons per minute).

27 Only first-quality chamois will be used. New chamois must be washed in soap and water before using, in order to remove the natural oil from the skin. It must be carefully examined each time before attachment to the funnel, and must be discarded if punctured or found to be defective in any way. Each chamois must be clearly marked to be sure that the same side is uppermost each time it is used so that any impurities, left as residue during a previous operation and that might not have been removed in washing, will not be washed with the product into the tank. The chamois must be securely attached to the funnel.

28 A water-soaked chamois will prevent the flow of gasoline, but will allow water to pass. Therefore, the filtering operation must be stopped if any water passes into the funnel and the chamois must be replaced before resuming the filter operation. Should a chamois become clogged, with the consequent restriction of flow of gasoline, it must be immediately replaced. Before any chamois is placed in a funnel filter it must be ascertained that the barrel of the funnel is clean and free from dust. Filters will be covered when they are not actually in use.

29 Fouled chamois must be cleaned immediately after use by soaking and washing in fresh unleaded gasoline, or washing with soap

and water and rinsing to remove all accumulated foreign matter, and then dried. After it has been thoroughly dried, and when not in use, it must be stored in a closed container, free from moisture or dust.

SCREEN-TYPE FILTER

30 Owing to the fact that chamois is not readily available and the rate of filtering is so low, the screen type funnel filter of commercial manufacture will more often be used. The screen type filter is adequate if the tanks are periodically checked at the lowest point for water and any water accumulation entirely removed.

31 The efficiency of the screen type filter in removing foreign materials depends upon the care given it and upon its proper use. The fine mesh screen will be found to be effective in the removal of impurities such as dirt, fine sand, rust particles, or lint, and even limited amounts of water. If the screen once becomes wet with water it will pass water freely and may retard the flow of gasoline until dried and cleaned.

32 When it is apparent that foreign material is impairing the efficiency of the filter, the filter must be taken apart and carefully cleaned, by a man thoroughly familiar with the unit. The screens are made of fine and delicate material which must be periodically removed and cleaned with a fine bristle brush.

33 The operation of pumping from barrels or drums through filters is a slow one, and should proceed during slack periods of work, as under stress, careful handling may not be possible.

34 Immediately after drums have been emptied, the bungs must be carefully cleaned and replaced in the drum to prevent the excape of gasoline vapors and to safeguard against the accumulation of moisture and foreign substances inside the drum. The bung must be screwed in tightly using new gaskets where available. If new gaskets are not available, care must be taken to preserve the old gasket for this purpose. In screwing in the bungs, care must be taken to avoid the stripping of the threads. The empty drums must be promptly removed from the immediate vicinity.

FIRE PRECAUTIONS

35 At least two chemical powder, CO_2, or foam extinguishers are to be at the site during this operation. The filter must be grounded to the tank and to the discharge hose through which the contents of the barrel are pumped.

36 In theatres of operation, it has been necessary occasionally to dump gasoline drums instead of pumping them, because of inadequate facilities or other emergency conditions. This method must be recognized as a most hazardous procedure, and if adopted by necessity, must be in isolated instances and controlled to minimize the chances of fire and to keep dirt and water out of the product.

REFUELLING FROM RESERVE FUEL POINTS

37 When it is necessary to refuel aircraft at reserve fuel points, extreme care is to be observed to ensure that only clean fuel enters the aircraft fuel tanks. The filtering instructions contained in this Part must be followed carefully.

CAUTION

Normally only fuel from drums sealed with overseals is to be used for refuelling aircraft from reserve fuel points. However contents of the unsealed drums may be used provided the aircraft captain or operation commander so authorizes and is aware of the source of the fuel and the conditions under which the drums were unsealed.

PART 6

TANK TRUCK AND TANK CAR LOADING

GENERAL INFORMATION

1 Loading tank trucks with gasoline is one of the most hazardous of the unit operations, as it involves vapor release and potential ignition hazards. It is, therefore, essential that particular attention be given to the loading facilities, and accessories provided, as well as to the requirements for their safe use.

2 Before loading tank truck the tank from which the fuel is drawn must have settled completely. The minimum settling periods in storage tanks for aviation gasoline and turbo Type 2 - 12 hours.

3 Tank truck-loading facilities may be of the conventional type loading stands, protected by islands, with or without a small wooden loading platform.

4 To minimize the vapor release, the end of the filling hose or bottom loader should extend down into a truck compartment to a point near the bottom, and the truck should be filled with the hose or bottom loader in this position. To reduce turbulence, it is customary to cut the end of the bottom loader at an angle of 60° with the horizontal.

5 The potential ignition hazard may be minimized in several ways:-

(a) Loading stand is to be situated 200 ft. away from other structures. Known sources of ignition, which cannot be controlled, must be well removed from the loading facilities.

(b) Drainage must be away from the truck-loading facilities and other structures, sewers, or waterways, and towards lower areas where ventilation is such that gasoline vapors are easily dissipated.

(c) The emergency-control valves on gasoline lines, must be located at a safe distance away from fill stands so that the flow of product may be stopped in the event of a fire. (These are in addition to regular flow-control valves at the fill stand, and the control or shut-off valves at the storage tanks).

(d) By prohibition of smoking or the carrying of matches, and the use of other than vapor-proof or explosion-proof portable or fixed lights, control switches, and electric conduits within 100 ft. of the stand.

(e) By prohibition of repair or maintenance work that may constitute or produce a source of ignition at any operating truck-loading site.

(f) Hand brakes on vehicle must be set, and motors of vehicles turned off while loading and waiting to load. All other vehicles must be kept away from the immediate vicinity. No vehicle is to be allowed to stand between the truck being filled, and the exit through which the truck would have to pass in case of an emergency. The nearest truck waiting to load must be at least 25 ft. from the fill stand, and its motor must be stopped.

(g) All loading operations must be stopped and all truck manways and valves closed, in case of a nearby fire, an approaching electrical storm, or an impending enemy attack.

(h) All necessary precautions must be taken against the accumulation of a charge of static electricity sufficient to cause a dangerous spark.

(j) The facilities must be protected from stray electrical currents.

(k) Only approved hose that has a grounding wire built into it, and properly bonded to the couplings, is to be used. An adequate training program for all truck loaders and

drivers, must be organized, not only in the use of the bonding and grounding devices provided, but in all other safe-loading practices, and in the prompt extinguishing of fires in their incipiency.

(m) Gasoline is to be delivered to a truck or trailer only when both the truck driver and the loader are present.

STATIC ELECTRICITY

6 A truck in motion under certain atmospheric conditions will build up a considerable charge of static electricity. Until May 1955 it was generally considered that drag chains on trucks reduced static electricity. However in May of 1955 the National Fire Prevention Association ruled that drag chains perform no useful purpose and should be discontinued.

7 The flow of gasoline through pipe lines or hose may also generate static electrical charges, as will a solid stream or drops of gasoline falling through the air to the free surface of gasoline in a tank. A flexible bonding cable will maintain the truck-loading stand, the truck tank, and the contents of the truck at the same potential, and thereby prevent the accumulation of a charge that would cause a spark.

8 The ground rod, located near the base of the fill stand, is driven in to permanently moist ground. It is connected to the base of the stand by a grounding wire, and thus brings the connected truck to ground potential. Ground rods are provided where the pipe lines leading to the fill stands are in very dry ground, or being closer to the ground surface, are heavily coated for protection against soil corrosion, and are thus not in themselves a satisfactory ground. It is desirable to have the truck at ground potential; it is essential to have the truck and the fill spout at the same potential.

9 As soon as the loading operations have been completed, care must be taken to detach the ground clamp from the truck, and to coil the cable carefully, and hang it up in a convenient and safe location

STRAY CURRENTS

10 Stray currents may be picked up in some localities from underground cables, motors, or other electrical apparatus, or from pipe lines not properly insulated from connecting sections of a piping system that is provided with cathodic protection. When stray currents are likely, the fill stand and truck must be protected by providing insulating joints in the pipe lines leading to the fill stands. These insulating joints will be provided at or near the point where branch lines are taken from main lines. In addition, when stray currents are found to be present in any installation, a complete survey must be conducted, and the condition relieved. Where lights or control switches are installed on fill stands, they must be properly and separately grounded and checked, to be sure that no stray currents exist that might enter the isolated system established for static protection.

11 If some different form of protective device is provided, it must be checked to see that the protection provided is at least equal to that given by the arrangement previously described.

FIRE

12 Aside from the hand extinguishers and fixed, CO_2 units provided on trucks and trailers, a portable foam extinguisher must be kept conveniently located to the loading stand, to assist in extinguishing ground fires.

13 A hydrant must be located about 100 ft. from the loading stand, at units where an ade-

quate supply of water under pressure is available.

14 In the event of a fire, the control valves nearby must be shut off, the dome covers on truck tanks closed, and the trucks removed, if possible, from the area. Once the gasoline flow is cut off, the fire may be extinguished by the use of chemical powder, foam or water fog. Water from a hydrant may serve as well as any other extinguishing agency, provided further spread of the fire will not be occasioned thereby.

LOADING

15 Gasoline that has been in storage for the longest period of time must be moved out first.

16 Before any product is delivered to a truck each compartment must be inspected to be sure that it is free from foreign materials or any liquid. If a compartment is found to contain a liquid, the loader must make certain that it is the same product with which the truck is to be loaded. If the liquid is not the same product it must be drawn off through the outlet valve from the compartment effected, in accordance with the procedures laid down in Part 9 of this EO. If there is an accumulation of rusty scale or dirt in the compartment, this also must be removed and the compartment line and strainer cleaned and rinsed with a small amount of the product to be loaded. Before the filling of the truck is started, it must be ascertained that all outlet valves are closed, and all compartment covers closed except the cover of the compartment to be filled.

17 As soon as a truck is stopped for loading and brakes are applied, the following physical operations shall be performed:-

(a) The engine is to be stopped.

(b) Apply the Mak Saf switch.

(c) The supply Technician shall bond the pumping system to the fuelling tender.

(d) The tender operator shall bond the loading arm to the fuelling tender.

(e) Open the tender dome cover.

(f) Insert the loading arm.

(g) The supply Technician shall set the pointer of the meter dial on the loading rack to read "0".

(h) The valve on the loading arm shall be opened and the fuelling tender filled to the indicator.

(j) The meter on the loading rack shall be read and recorded by the supply Technician.

18 Close attention must be given in loading a truck to see that the bottom-loaded pipe is held close to the bottom of the truck tank and that each compartment is filled to its marker height and not overflowed or spilled. As the liquid level approaches the top of the compartment, the rate of filling must be decreased and the compartment "topped off". The topping-off operation is merely the final filling at a very low rate until the marker height is reached. This permits closer control and prevents overflow or spills.

19 The loading valve, usually located in the fill arm and next to the riser of a truck-fill stand, must be held open manually by the refuelling tender operator. If a chain or rope is provided for his convenience, in no case must the chain or rope be tied so that the valve will be held open, for this would nullify the automatic closing feature (deadman release) provided in the construction of the loading valve. The loader must not stand on the ground and hold the rope until he estimates that the tank is nearly full.

20 When it is necessary to load trucks in heavy rain or snow and no shelter is provided, canvas dome covers must be used to keep the water or snow out of the truck compartments.

21 To prevent any spills on the truck or pavement, gasoline must be drained from the hose or bottom loader before withdrawing it entirely from the truck.

22 A complete log of truck filling will be kept. This will show, by identifying number, the trucks and trailers, the time of loading, the product loaded, and any unusual conditions observed in their loading. The log is to be kept at the dispensing compound by the Supply Technician in charge of dispensing the fuel.

23 Trucks must be filled as soon as possible after they are emptied so that any slight difficulties at the gasoline-storage or truck-loading facilities will not result in an interruption in the servicing of aircraft.

24 Preferably only one truck at a time should be loaded at a truck-fill stand, even though the stand be equipped with two arms and other trucks await product. A single truck loader will not attempt to load two trucks simultaneously, except in cases of extreme emergency.

25 Trucks must always be filled to capacity, before being placed in storage, or when flying operations have been suspended.

26 After filling the truck the fuel must be given time to settle before dispensing it into an aircraft. After the settling period has been completed the drain cock of the segregator on the tender must be opened to expel any water or sediment. The fuel drained is to be run into a wide mouthed glass jar for a visual check of the fuel. If contamination is evident it must be traced back to its source, the circumstances that caused it discovered and these corrected as promptly as possible.

LOADING A TANK CAR

27 When it is determined that fuel is contaminated or "off specification" it may be necessary to load the fuel into tank cars for shipment to a refinery or it may be necessary to ship fuel between units in an emergency. When a unit is instructed to move fuel by tank car, for any reason, the following instructions are to apply.

28 Precautions similar to those observed in the unloading of rail tank cars are to be strictly adhered to during loading operations. When the car has been placed at the loading rack, the NCO in charge of loading operations is to proceed as follows:-

(a) Ensure tank cars with bottom outlets have the outlet cap "OFF" during the entire time of loading. Tank cars equipped with interior heater coils are to be loaded with the inlet and outlet caps "OFF".

(b) Ensure that the interior of the tank car is clean. The car is not to be entered but is to be inspected from the top using an explosion proof flashlight.

(c) Ensure that the bottom outlet valve is closed.

(d) Insert the loading pipe into the tank car through the manhole. The special manhole cover (Ref. DWB Drawing S21-8) is to be placed in position to prevent sparks from passing locomotives igniting the fuel vapors.

(e) Open the correct valves and fill the car, shutting off the flow when the fuel level reaches the top shell of the car, before it extends into the dome. Innage or outage to be gauged and recorded in event of quantity dispute by consignee.

29 The capacity of the tank car may be ob-

tained from the railway company and is usually stencilled on either end of the car. The temperature correction is to be calculated according to Appendix "C" to CAP 16, Vol. 1, Chapter 18.1. Railway bills of lading as well as other necessary vouchers are to show the contents of the car calculated at the basic temperature of 15.6°C (60°F).

30 After the loading operation is completed the tank car dome cover is to be securely replaced and all outlet caps tightened in position. Care is to be taken not to cause a spark by the sharp contact of metal to metal. The cover and under cap are to be sealed and "inflammable" placards applied. Wheel blocks are to be removed and the railway company notified to pick up the car for delivery.

NOTE

Ensure that grounding cable is connected before removing covers, and disconnected when covers replaced.

PART 7

ROUTINE CARE AND SERVICING OF FUEL STORAGE SYSTEMS

RESPONSIBILITIES AND INSPECTIONS

1 Care and maintenance of the unit fuel storage systems is the responsibility of the CTSO. This responsibility in relation to the various stages of POL handling, is normally delegated to the Supply, CE, MSE, and AE&AF trades. In general terms this delegation is at follows:-

(a) Supply - Bulk fuel receipt, storage and accounting. The operation and minor servicing of installation systems. The issue of fuel at dispensing platform to refuelling tenders.

(b) CE - Installation and heavy maintenance of bulk storage system.

(c) MSE - Operation and maintenance of refuelling tenders including tender filtering system.

(d) AE&AF - Refuelling aircraft and the operation and maintenance of aircraft fuel system.

2 To ensure that these responsibilities are co-ordinated, consideration should be given to the appointment of a POL Services Officer, from the aircraft maintenance or station technical services who shall be responsible to the CTSO and whose duties shall include:-

(a) Advising the CTSO on matters pertaining to POL quality control.

(b) Maintaining liaison with the section commanders concerned with receipt, storage, handling, and dispensing POL.

(c) Performing weekly inspection of the operational and maintenance phase of handling POL and of equipment used in these phases.

(d) Making specific recommendations to section commanders on improvements which would raise the standard of quality control.

(e) Maintaining a record of inspections, observations, and recommend corrective action.

3 The CTSO personally shall make a periodic inspection, at least quarterly, of the entire fuel compound to ensure that the system is operating properly and to verify from the records that water test, daily dips, inspection and repairs are being regularly and efficiently performed.

4 The SSupO in the exercise of his responsibilities shall ensure that supply personnel employed in the fuel section are thoroughly familiar with the operation of the system and all aspects of fuel handling. He shall ensure that all necessary publications, manufacturer's manuals, and diagrams pertaining to the fuel system shall be available for immediate reference. He shall personally conduct a weekly inspection of the entire system.

5 The supply technician in charge of the fuel section shall conduct a daily inspection of the fuel storage system to ensure that the system is functioning efficiently. He shall follow the instructions and safety precautions pertaining to the care and maintenance of fuel storage as prescribed hereafter.

6 The CTSO shall provide qualified personnel to effect maintenance and repairs which are beyond the capabilities of the supply section.

7 A register shall be maintained and made available in the pumphouse to record inspections, dates, the names and signature of the individual performing the inspection, and the findings.

8 All leaks and other defects shall be reported immediately to the SSupO and CTSO.

GENERAL INSTRUCTIONS

9 A register is to be maintained and made available in the pumphouse to record inspections, dates, the name and signature of the individual performing the inspection and the findings.

10 Each tank or dip pipe is to be painted with the grade or octane rating of its contents, and the tank number as outlined in AFHQ Drawing S21-1057-2. Similarly, the header valve controlling the pipe to and from each tank is to be numbered.

11 All pipe connection openings in the system are to be locked when not in use and all valves and outlets shall be closed and locked when not in use. All leaks or other defects are to be reported immediately to the SSO and CTSO.

12 Valves must be kept closed on all storage tanks that are not actually in use, whether the tanks are located underground or aboveground, in order to prevent the loss of product from a tank in the event of a break or leak in any section of the piping system; or to prevent another product from entering a tank when transfers are being made through connected lines.

13 In some cases connections may be found between piping systems carrying different grades of gasoline. These connections are to be provided with double valves and drains, or "blinds". In case they are not so protected from contamination, such protection must be provided as soon as practicable. If drains are provided between the main valves they are to be opened for inspection to be sure that no mixing or contamination of products occurs due to the leaking of valves or due to failure to properly close them. Valves must be permanently and prominently marked for ready identification.

14 It must be borne in mind that the mixing or contamination of one grade of gasoline with another is not only a waste of the better grade of product, but if unnoticed and substantial in amount, may result in irreparable damage to aircraft or other high-compresion engines. Storage systems must be operated on the basis of zero contamination. If appreciable contamination takes place the product must not be used for the higher grade until samples have been tested and approved for such use. Care must, therefore, be exercised in the transferring of a product from one tank to another, to see that the proper valves, and no other, are opened.

15 Normally, underground fuel tanks are not to be pumped entirely dry. The tank is to be refilled or pumping operations are to cease when 2/3 of the fuel has been removed.

WATER IN STORAGE TANKS

16 Where gasoline is in contact with air (as when it is breathed into a tank through relief valves with changes in temperature, or when the product is removed), the moisture in the air may be condensed, or it may be absorbed by the gasoline. In either case, under certain circumstances, free water will accumulate at the bottom of the storage vessel, regardless of whether it be a tank, a pipe line, or the fuel tanks of an aircraft.

17 Gradual accumulation of small amounts of water in storage tanks, pipe lines, tank trucks, etc., is a natural phenomenon. Water is actually soluble in gasoline to the extent of about 4 gallons per 1000 barrels at 37.8°C (100°F), or approximately 1 gallon per 10,000 gallons. A drop in temperature reduces this solubility and water will settle out.

18 While the occasional accumulation of a small amount of water in a segregator or sump, etc., does not necessarily indicate a mechanical failure, such accumulations should always be drawn off and in every case the reason should be investigated.

WATER TESTING

19 It cannot be over-emphasized that water in fuel is a great hazard. Care is to be exercised that water is not permitted to remain in the storage or handling systems, or enter the tank through leaking lines.

20 A water check is to be conducted daily for active tanks, twice weekly for inactive tanks, and prior to making withdrawals from inactive tanks.

21 Water is not to be permitted to accumulate in bulk tanks beyond 1" for gasoline or 2" for aviation turbo fuel. In instances where an excessive water content is evident, pumping operations are to cease until the source is discovered and corrected.

22 The check for water content is to be made by applying water finding paste to the end of a dip stick. The measurement of discolouration will indicate the quantity of water in the tank. During cold weather the possibility of ice forming on the bottom of the tank is to be taken into consideration.

23 In locations where the tank type water trap is used, this unit provides an automatic cut-off when water is trapped. Any water accumulation is to be drained off once per week.

CARE OF THE PUMPING SYSTEM

24 The following instructions are to be strictly adhered to with regard to the pumping system:-

(a) A blue print diagram of the pumping system is to be displayed in a prominent location in the pumphouse.

(b) All valves are to be properly tagged.

(c) Where pumps are fitted with grease cups, cups are to be given one full turn daily before starting.

(d) The pump grease cups are to be checked weekly and refilled with grease as necessary. Only grease supplied or approved by the pump manufacturer is to be used.

(e) The pump is to be switched off immediately the delivery is completed.

(f) The vent screen is to be checked at least once every two weeks and cleaned when necessary.

(g) The strainer baskets are to be cleaned once a month or for every 500,000 gallons of fuel issued, whichever occurs first. Defective baskets are to be replaced immediately.

(h) The condensation tanks are to be drained at least once per month.

(j) Filter water separators are to be checked for water daily through the drain valve provided. The newer type of water separator is equipped with a sight glass which will readily indicate the presence of water in the system.

(k) A semi-annual inspection of the filter-water separator is to be carried out as described in the manufacturer's publications.

(m) Filter water separator cartridges are to be changed once a year and/or when the difference in pressure between the inlet and the outlet gauges reaches 10 lbs., and/or when inspection detects a damaged cartridge. When it becomes necessary to replace the water cartridge, this operation is to be conducted in accordance with the manufacturer's instructions, by qualified personnel delegated by the CTSO.

(n) Due to the much larger amount of fuel that is passed by the filter-water separator cartridges in the bulk fuel installation than in the individual refuelling tender systems, the period of change is one year as compared with two years in the refuelling tender.

CARE OF METERS

25 Each meter is to be tagged indicating that manufacturer nearest service representative who is to be contacted whenever repairs are necessary. It is not recommended that any attempt be made to repair metering equipment through station facilities.

26 The meters on the loading rack shall be checked annually for accuracy by a representative of the Department of Weights and Measures. Payment shall be affected in the manner described in CAP 16, Chapter 17.8.

27 The type of fuel being metered must be specified when meters are returned to the manufacturer or his agent for overhaul.

CARE OF LOADING RACK

28 The following instructions are to be strictly adhered to:-

(a) The supply Technician is to inspect daily the 100 mesh nozzle screens in the loading rack dispensing arm to ensure that they are clean and serviceable.

(b) The swing arms are to be kept parallel to the loading rack when not in use.

(c) When driveways are of gravel, stone or other loose material the area on both sides of the rack is to be raked level.

(d) The totalizer cover is to be kept closed and locked.

STATIC CONNECTIONS

29 Immediately a truck or tank car is located for loading or unloading, static connections are to be made to prevent the possibility of an explosion from a static spark. All connections are to be checked once every week and maintained in a first class condition.

30 In addition where the loading of tenders is carried out at a loading rack where loading arms are used, a bonding wire is to be permanently attached to the arm of spider and is to be connected to a grounding button near the dome prior to the opening of the dome.

31 Where the tenders are loaded by a portable pumping unit from drum storage, the hose nozzle entering the tender tank manhole is to be bonded to the tender tank. In addition, the portable pumping unit is to be bonded by a grounding cable to the fuel tank and the tender.

TANK REPAIRS

32 No person is to be permitted to enter a tank which has contained fuel until arrangements have been made for proper supervision and the provision of the proper equipment.

UNDERGROUND STORAGE

33 As there is little variation in the air temperature in the vapor space of an underground tank, there will be a minimum of breathing. There is therefore, little likelihood of any water collecting between the receipt of a product, and its delivery, because of condensation inside of the tank.

34 If an excessive amount of water should be found, especially at a time when the gasoline level in the tank is low, a leakage of ground water into the tank might seem likely, and an immediate investigation should be conducted to determine the location of the leak, or other source of the water.

35 At some RCAF units the water level at flood stage inundates the gasoline storage area, special precautions must be taken to prevent the tanks and their pipe line connections from movement and damage, as well as to avoid any loss or contamination of the product.

36 The NCO in charge will recognize such conditions and when a flood is imminent he should arrange for any further necessary protection of the installation by:-

(a) Filling the tanks at lower level, to weigh them down, with similar products from tanks in areas above the floor stage.

(b) Filling empty tanks with water if product is not immediately available; or, if independent water supply is not available, by removing the shell manway covers so that flood waters may enter the tanks.

(c) As a last resort, pumping water into tanks partially filled with product so that they will not be moved by the flood waters.

37 Vent pipes for underground storage tanks should extend 12 feet above the ground whether or nor flame arrestors are installed in such vent lines.

ABOVEGROUND STORAGE

38 The gasoline inlet and outlet connections on most vertical aboveground tanks will be located about a foot or a foot and a half above the tank bottom. These connections must be closed by gate valves installed directly against or close to the tank shell. A water draw-off connection will be found which extends to within about 1/2" of the bottom of the tank. If the tank is equipped with a sump, the draw-off connection will be bound to extend 3" below the bottom of the tank, into the sump.

PART 8

INSPECTION, MAINTENANCE AND REPAIR OF FUELLING FACILITIES

GENERAL

1 In order to be sure that the gasoline storage and fuelling facilities at an RCAF unit will deliver clean dry gasoline at the desired rate, it is necessary that every piece of equipment be periodically inspected, retested occasionally, and that it be maintained in good working order. One of the most serious defects fuel can have is water contamination and it is essential that inspections and checks for water content in bulk storage systems be performed when stock checks are carried out. A water check is always to be conducted on inactive tanks prior to withdrawals. All inspection, maintenance and repair of installations and facilities are the responsibility of the unit Chief Technical Services Officer.

INSPECTIONS

2 It is recommended in addition to the daily routine inspections incident to good operating practice outlined in Part 6, there should be certain general and specific inspections that must be made by the NCO in charge and the CE representative. These will, of course, vary with the size of the unit and the equipment provided.

3 Each year, preferably in the spring, a detailed inspection should be made of the general condition of the buildings, tanks, lines, pumps, fences, roadways, drainage, railroad trackage, water supply reservoirs, etc. Any urgent repairs noted on regular operating tours are to be promptly reported, and repairs effected as soon as possible.

4 All underground gasoline lines must be tested for leaks once each year. These lines are to be tested with the same grade of gasoline in them as is used in normal operations. They are to be tested at one and a half times the normal operating pressure, but in no case at less than 75 psi. In conducting the test, a 10% drop in pressure is to be allowed for the first 2 hours, after valves have been closed and pressure established. If the pressure drop in this time exceeds 10% in the first two hours, then a leak is probably indicated, and it must be located and repaired immediately. After repairs have been completed, the test is to be repeated.

5 This may be simplified, and positive test results obtained, if the portion of pipework under test, is blanked off from the remainder of the installation until tests are completed. These tests are to be recorded and covered by a report. Underground gasoline lines are usually installed at a minimum of 2 ft. below grade; however, tractors and trucks crossing above these lines may cause fuel leaks.

6 The ground over underground pipelines should be observed occasionally to detect signs of fuel leakage. Fuel fire is a hazard at that point, but the seepage may also extend to drainage sewers, in which case it becomes very dangerous.

7 All pumps and compressors are to be inspected semi-annually for alignment, wear, condition of valves, packing, seating of valves, corrosion, lubrication, etc.

8 Cathodic protection of tankage and lines, will be tested quarterly to ensure that actual protection of the tankage and pipe lines against corrosion is being provided.

9 At monthly intervals, a visual inspection and detailed report should be made by the CE officer to the CTSO, showing the condition of all tankage, all tank accessories including relief valves, screens on vapor outlet lines leading from these valves, gauging and samp-

ling devices, exhaust fans, pumps, motors with control equipment, protective devices, and emergency repair equipment. This is also to include all operating switches, emergency switches, electrical equipment, electrical grounds, insulated joints, rail bonds, bonding cable and clips, fire protection equipment, fuelling pits. The efficiency of the bonding connections, bonding cables and clamps, and bonding wires built into hose, is to be tested by ringing through a circuit. This is to be done when it is certain that no explosive vapor-air mixture is present using a dry cell battery, a bell, and two lengths of wire fitted with clamps, or equivalent test equipment.

10 All temperature and pressure gauges, and other adjustable instruments, are to be examined quarterly and checked for accuracy.

11 Trucks that are to be used in the delivery of gasoline will also be inspected daily, see EO 80-D-7C. The type of segregator installed is to be noted and its operation tested. The screens, air release devices, relief valves, hose, nozzles, nozzle strainers, electric grounding cable and its fastenings, emergency valve control, chemical powder, and CO2 fire extinguishers, The transfer pumps on trucks are to be operated briefly, particularly to check the vacuum available on the suction. The meters on the tenders shall be checked annually for accuracy by a representative of the Department of Weights and Measures. Payment shall be effected in the manner described in CAP 16, Chapter 17.8.

12 On each week the pumping units on fuel servicing trucks are to be operated in the dark and a careful inspection made of the ignition system of the gasoline engine, including all electrical connections and spark plugs for faulty wiring, loose connections, or dirty equipment to preclude the possibilities of an electrical discharge.

13 A Special inspection is to be made each month in addition to the daily inspections during routine operations to see that every unit is kept clean, is properly lubricated, and that all bearings are properly adjusted.

14 As the fire-fighting system is a facility of the air base, all of its components will be tested and maintained by the station fire department; however, the NCO in charge of the gasoline storage has some responsibility in the effectiveness of fire-fighting equipment to be used at oil fires, and he will semi-annually inspect the fire-fighting facilities that are provided for use at the fuel storage area. He will see that this equipment is easily accessible, and not located inside of pits, or near installations where fire would make it impossible to reach it with safety.

MAINTENANCE

15 Gasoline storage facilities at an RCAF unit must be maintained in first-class condition; good housekeeping is necessary for efficient operation. Rubbish and litter is not to be allowed to accumulate on the premises. Buildings, pits, loading platforms, or fill stands and unloading spots are to be kept free from surplus equipment, discarded clothing, oily waste, glass bottles, boxes, and other undesirable material. The instructions contained in CAP 209, Section 3, are to be followed for mechanical maintenance of storage equipment.

16 Plant drainage ditches will be kept open and their cross sections and depths maintained at all times.

17 A complete set of manufacturer's specifications, operating instructions, spare parts lists, and performance diagrams or charts for each pumping unit, power unit, or piece of equipment, at each RCAF unit gasoline storage area. To get the best performance from this equipment and to minimize repairs, these operating instructions are to be adhered to implicitly except where sound and demonstrated reasons exist for deviations. Operating equipment is to be kept clean, properly lubricated, and in good adjustment. To avoid the possibility of causing serious damage to the equipment, only men who have had experience, or men who have been instructed by example in the operation of equipment of this type, should be permitted to operate, test, or adjust it. In this connection, care is to be exercised to see that only properly trained, equipped and qualified men are allowed to work in any pit, tank,

building, or enclosure where fire, explosion, asphyxiation, and similar hazards may be encountered.

18 A complete log or card record is to be kept by the NCO in charge for each piece of equipment. A simple form should suffice, that shows in chronological order the pertinent information in regard to inspections, adjustments, repairs, or replacement of parts. If the cards, or the system set up is too elaborate, it may become burdensome; if it is simple and accurately kept, it will be of great value.

19 Maintenance and repair difficulties may be minimized by the taking of special precautions during construction, and while conducting initial tests, before the storage facility is put into service, to keep dirt, stone, trash, rags, and trampiron out of the pipe lines, valves, and pumping equipment. Some debris in the system is to be expected but most of this can be detected and eliminated in practice operations. Valves should not be damaged by forcing them closed against obstructions by the use of extra length bars or oversized wrenches. Pump impellers are quite apt to clog when first starting.

20 The extent of necessary maintenance and repairs to pumps, meters, etc., will depend in a large measure on the care given the pumps during acceptance tests and operations.

21 Pump operation and maintenance difficulties are often found to be due to suction troubles. Pumps built for one set of conditions may have to be operated under quite different conditions. When such unusual use occurs allowance must be made for the physical characteristics of the fuel being handled, which may cause suction difficulties. The temperature of the product and the elevation above sea level must also be taken into consideration in determining whether the suction lift desired is within the suction lift capacity for which the pump is designed.

22 Pump suction difficulties may be found to be the result of an air leak in the suction line or in a stuffing box, or may be due to tramp material, including scale from pipe lines, getting into the pump suction or even into the pump.

23 Much time and useless effort spent in locating stoppages, diagnosing faulty equipment, setting the spring tension on relief valves, etc., can be saved by the use of pressure and vacuum gauges. Pressure gauges reading from 0 to 60 psi (or the normal discharge pressure of the pumps supplied) and vacuum gauges reading 0 to 30" should be available. Connections should be provided for their use on suction and discharge sides of pumps, filters, air separators, meters, segregators, and traps. Determination of the pressure drops across sections of the system will often indicate the source of the trouble.

24 Special precautions must be taken in cold weather to ensure that water does not freeze in steam lines and pump bleeders, small drains, traps, radiators, water jackets, small pipe lines, pumps, and valves and cause damage. Some types of portable foam extinguishers must be kept in buildings where the temperature does not fall below freezing; this also applies to instruments with liquid seals. A special inspection is to be made each Autumn to see that these precautions have been taken and that all drains are functioning correctly.

25 All fire-fighting and other emergency equipment, such as portable pumps, portable generating sets, emergency lights, ladders, and alarm systems, that have been provided for the protection of gasoline storage, must be maintained in serviceable condition at all times, and used only for the purpose intended. Immediately after a heavy snowfall, paths are to be cleared to all hydrants, valve controls, and fire-fighting equipment.

26 Gasoline meters generally have a guaranteed accuracy of one-tenth of 1%. When in daily use they should all be check-tested for accuracy about four times per year, by a regular meter repair and test man, or they may be checked at any other time when there is reason for questioning their accuracy. The

test man will make such tests by using a certified test measure, having a calibrated neck, of approximately the same capacity as the normal volume of gasoline delivered by the meter in one minute.

27 No changes will be made in plant equipment, or to the pipe system, without the approval of the unit CO.

28 Strainer baskets are to be cleaned once a month or after each 500,000 gallons of fuel issued, whichever occurs more frequently. Defective strainer baskets are to be replaced immediately, see EO 45-5A-7.

29 Water separators are to be tested for water daily by opening the drain valve on the bottom of the separator. The newer type of water separator is equipped with a sight glass which readily indicates the presence of water in the system. A semi-annual inspection of the water separator is to be carried out as detailed in the manufacturers' publications. Water separator cartridges are to be changed once a year and/or when the pressure differential between the inlet and outlet gauges reaches 15 lbs., and/or when inspections detect a damaged cartridge. Water separator cartridges are to be replaced in accordance with the manufacturers' instructions by qualified personnel delegated by the unit CTSO.

30 Filters are to be tested for water daily by opening the drain valves on the bottom of the filter body. A semi-annual inspection is to be carried out as detailed in the manufacturers' publications. Filter elements are to be changed once a year and/or when the differential in pressure between the two gauges on the filter body becomes greater than 10 lbs., and/or when inspections detect a damaged filter. The filter elements are to be replaced in accordance with the manufacturers' instructions by qualified personnel delegated by the CTSO, see EO 45-5A-7.

REPAIRS

31 The CE officer or assistant CE officer is to survey each repair job, and see that proper instructions are given on each job, and that these instructions are carried out. He is to see that proper materials are used and replacements ordered.

32 The CE officer is to give a written permit to the man who is to be in charge of the crew assigned to perform any work involving electric welding, flame-cutting or burning, sandblasting, chipping, caulking, the use of open lights, or other work which may be a source of ignition in any potentially hazardous area. The permit is to be kept on the job and returned to the CE officer after the work has been completed. These instructions apply to both civilian contractors and service crews. They are promulgated to ensure that only qualified personnel are allowed to undertake the work involved.

33 Spray painting, spray cleaning, and sandblasting are operations which under certain conditions may generate static electricity. Spray nozzles of these units are to be properly grounded to prevent the generation of static sparks. Objects sprayed are also to be grounded or brought to the same potential, when necessary. Steam hose, used for steaming out tanks, tank cars, trucks, and drums or barrels, which have contained petroleum products, must be grounded. Hose of this service should be supplied with built-in grounding conductor. This grounding will minimize the hazards of sparks but will not necessarily prevent them.

34 When it is necessary to clean or make repairs to a tank which has contained gasoline the tank is to be emptied and cleared of all explosive vapors by steaming or airing. Steaming, or airing, and cleaning is to be done by a tank cleaning specialist company or a reputable oil company. As a minimum requirement all safety precautions are to be observed as recommended by the most recent publication of the American Petroleum Institute, which carries instructions for clearing gasoline storage tanks of gas, and for cleaning the interiors of such tanks. Repairs to petroleum storage tanks are to be done only by companies specializing in the repair of tanks used for storage of hazardous petroleum fuels.

35 When it is necessary to discontinue the

use of a tank in gasoline service for an appreciable period of time, the following steps should be taken: -

(a) All the gasoline is to be removed from the tank.

(b) The tank is to be completely drained and flushed with water, if available, and ventilated.

(c) Gauging and fill openings should then be securely closed or plugged, and where the pumps are removed, the suction lines should be flushed, drained, and capped.

(d) The vent lines should remain open.

36 Other precautions to be taken when repairs are to be made include: -

(a) Containers, such as tanks, gasoline lines, manifolds, etc., are to be blanked off or disconnected and made oil and gas-free. Tests are to be made with a combustible gas indicator in good working condition and checked by a responsible person to be sure that any containers are, in fact, gas-free and safe.

(b) No cutting or welding torch or welding arc is to be used in the vicinity of an aircraft, a truck, or tank car, unloading-track or in any other location where gasoline vapors may be found. The above is to be carefully observed in respect to flame-cutting or welding on tanks close to other tanks, ditches, pipe lines, etc., that may contain flammable products. Ground connections from an electric welding machine must be made directly to the pipe or tank which is to be welded and as close to the work as possible. All such ground wires and clamps are to be inspected to be sure that they are tight and that arcs or sparks at connections cannot occur. Hose valves, fittings, etc., on acetylene equipment must be inspected for mechanical condition before using.

(c) The fire department is to be advised when hazardous work, which may result in fire, is undertaken. Fire Department personnel will evaluate the requirement and provide the necessary fire control equipment.

PART 9

CHANGE OF FUEL GRADE IN STORAGE TANKS AND TRUCKS

GENERAL INFORMATION

1 Should it be necessary to change the grade of fuel in bulk storage tanks or truck refuellers, it is preferable to have the tank or truck completely drained and cleaned, the cleaning is to include the dispensing lines, hoses, etc. However, if operational or other urgent requirements make it impossible to drain and clean the tank or truck thoroughly, the procedures outlined in the subsequent paragraphs are to be followed:-

2 When a change is made from a higher to a lower grade of gasoline, no special precautions or cleaning of the tank or truck are necessary provided the tankage, pipe lines and associated equipment are drained as completely as possible. A specially rigged pump should be used for the removal of fuel below the lowest level to which the facilities pumps are effective so that tank bottoms are virtually dry. The order of fuel grades from the highest to the lowest is:-

(a) Aviation gasoline, grade 115/145.

(b) Aviation gasoline, grade 108/135 (commercial).

(c) Aviation gasoline, grade 100/130.

(d) Aviation gasoline, grade 91/96 (91/98 commercial).

(e) Aviation gasoline, grade 80/87.

(f) ME gasoline, motor method 80 octane.

(g) Aviation turbine fuel Type 2 (JP4 US).

(h) Aviation turbine fuel Type 1 (JP1 US).

3 When a change is made from a lower grade to a higher grade fuel, the original fuel is to be pumped from the tank or truck and the residue is to be drawn off by means of the water draw off system. Approximately one hundred gallons of the higher grade gasoline is to be poured into the tank. This mixture of higher grade fuel and lower grade fuel residue is then to be drained as outlined in the preceding paragraph. Upon completion of the draining, the tank or truck may be filled with the higher grade fuel.

4 When a change is made from aviation turbine fuel to an aviation gasoline, great care must be taken to ensure that all turbine fuel is drained from the tank or truck. The procedure outlined in the preceding paragraphs is to be followed carefully and in addition the residue in the tank is to be mixed and drained four times before the tank is considered to be free of contamination from turbine fuel. Associated equipment and pipe lines should be filled and the new fuel circulated in the system for fifteen minutes minimum. Where necessary, add temporary pipeworks to permit circulation or dispense fuel to tender and pump tender contents back to storage tank. Drain the circulated fuel as previously outlined. Upon completion of the final draining, the tank is to be filled to capacity where tank capacities are 10,000 gallons or less. For tanks larger than 10,000 gallons proportionate amounts of fuel should be used for clearing (up to 500 gallons for 200,000 gallon tanks) and action taken as instructed previously. Tanks should then be filled to at least one third capacity with new fuel.

NOTE

No Avgas is to be withdrawn from the tank or refueller for aircraft use until a sample is withdrawn and an Octane rating check ensures the gasoline is free from turbine fuel contamination. The sample withdrawn is to be forwarded to NRC. The sample tag is to be annotated "FOR A OCTANE RATING CHECK FOR TURBINE FUEL CONTAMINATION".

5 When a change is made from Diesel Fuel or Fuel Oil to aviation gasoline or Aviation turbine fuel the precautions and instructions in para. 4 shall be adhered to. No Avgas or turbine fuel is to be withdrawn from the tank or refueller for aircraft use until a sample is withdrawn and an Octane rating check or distillation check, as applicable, ensures the fuel is free from contamination.

NOTE

The samples withdrawn as per paras. 4 and 5 are to be forwarded to:-

(a) Units in the eastern geographical area, all samples to be shipped prepaid to NRC, Ottawa.

(b) Units in the Western geographical area samples for Octane rating check to be shipped prepaid to NRC Ottawa - samples for distillation check to be shipped prepaid to University of Alberta.

The samples shall be two gallons and the sample tag is to be annotated as follows:-

(a) When change over is from Aviation turbine fuel, diesel fuel or fuel oil to aviation gasoline - "For an Octane Rating Check for possible oil contamination".

(b) When change over is from diesel or fuel oil to Aviation Turbine Fuel - "For a distillation check for possible contamination".

AMCHQ/CQC is to be notified when samples of fuel are forwarded to NRC.

6 The fuel used for wash/rinse purposes is to be used for fire-fighting displays or practices. When a change is made between fuel grades, the markings listing the product designations are to be changed immediately to correspond to the fuel in the tank or truck.

PART 10
FUELLING OF AIRCRAFT
RELATED EO 00-80-4/6 - REFUELLING OF AIRCRAFT

GENERAL INFORMATION

1 In general, the same hazards exist and the same safeguards must be taken at RCAF units in isolated areas, as those taken at non-isolated units, under normal operating conditions. The procedures described herein are to be followed except as changed under abnormal conditions by the commanding officer.

2 The refuelling and draining of aircraft is a hazardous operation, with the ever present danger of fire and explosion resulting from accidental ignition of the highly flammable vapor being released.

3 The constant danger makes it imperative that all personnel engaged in the handling of fuel be constantly alert and that every precaution is taken to minimize fire and explosive hazards.

4 During refuelling operations all other work on the aircraft is to cease, and personnel are to leave confined spaces in or on the aircraft.

5 Adequate and suitable fire fighting equipment is to be readily available and all personnel concerned thoroughly trained in its use.

6 To safeguard against the danger of explosion which exists when an aircraft with partially filled fuel tanks is placed in a hangar, tanks are to be filled to 90% of their capacity prior to hangar allotment. This will permit fuel expansion within the tanks caused by temperature increases yet eliminate any possibility of fuel venting. This does not apply, however, to aircraft:-

(a) Placed in storage with the drained fuel tank.

(b) Being weighed.

(c) Undergoing repair and/or maintenance to fuel systems necessitating defuelling.

(d) Requiring partially filled or empty tanks due to operational or test purposes.

LOCATION OF AIRCRAFT

7 Aircraft to be fuelled or drained are to be located on field aprons or dispersal sites removed at least one hundred feet (or as far as possible when a clearance of 100 feet is not possible) from buildings, open flares, flames, torches, welding, sandblasting, spray painting or other sources of possible ignition. Whenever possible, during fuelling or draining operations, aircraft should be located at a safe distance from other aircraft.

LOCATION OF TENDER

8 During fuelling of an aircraft the tender is to be located as far from the aircraft as possible, consistent with satisfactory fuelling operations. The tender is to be moved from its location near the aircraft as soon as fuelling operations have been completed. If may be parked at the front, side of rear of the aircraft but in such a position that it can be driven away quickly in case of an emergency.

9 The tender operator must remain with the tender during fuelling or draining operations.

10 Fuelling tenders whether loaded or empty, are not to enter or be stored in hangars.

STATIC ELECTRICITY

11 Before refuelling or defuelling oper-

ations, commence where tarmac grounding buttons, ground grids and/or grounding grids are available, the sequence of earthing the tender and aircraft will be:-

(a) Connect aircraft to tarmac grounding button.

(b) Connect tender tank or drum to the same ground button as the aircraft.

(c) Connect the hose nozzle ground wire to the aircraft tank filler ground lug before removing tank filler cap. Where fuel servicing operations are conducted on ice, sandy or desert terrain or wherever it may not be practical to secure a satisfactory ground, the aircraft and the fuel dispenser shall be connected by a bonding cable, and a further bonding cable connected between the fuel nozzle and the aircraft tank filler ground lug prior to opening the cap.

12 Where funnels are utilized to facilitate fuelling or draining, the funnel is to be bonded to the aircraft. Metal retaining devices securing filters in a funnel are to be bonded to the funnel.

PRECAUTIONS

13 Observe the following precautions:-

(a) The fuelling party must ensure that engines have cooled sufficiently after shutting down to permit safe refuelling. A waiting period of at least 5 to 10 minutes after the propellor has stopped turning must be observed before refuelling commences.

(b) A check must be made of the water indicator and drained if necessary.

14 The fuelling party must ensure that the aircraft main switches, all radio equipment, receivers, and transmitters in the aircraft are turned off; that batteries are not being serviced or replaced; that battery carts or generators are not in use; and that no electrical apparatus such as electrical cords, droplights, floodlights, etc., supplied by outside power, is in, or near the aircraft.

15 A member of the fuelling party must stand by with the fire extinguishing equipment.

16 Only one fuel tank filler cap is to be removed at a time. The cap is to be replaced immediately after filling the tank and before removing cap of any other tank. An exception to this rule may be made if duel fuelling equipment and trained personnel are available.

17 When topping off tank, the fuel flow is to be reduced by carefully throttling the valve in the nozzle.

18 To avoid spilling fuel, the nozzle must be drained before withdrawal from the tank opening.

19 The operation of refuelling cabin tanks, where the fuelling must be accumplished inside the aircraft, introduces hazards of an extreme nature. During the entire operation, the cabin must be provided with all possible ventilation.

20 An odour of fuel within a confined space of an aircraft is an indication that an explosive mixture may be present, every precaution must be observed until such time as vapors are dissipated and the condition corrected.

21 Special precautions applicable to specific types of aircraft are to be observed.

22 Where refuelling from drums is carried out, personnel are to observe the foregoing instructions.

23 Mobile equipment, other than when engaged in refuelling is not to approach the aircraft while refuelling operations are in progress.

FUELLING FROM BARRELS, DRUMS OR CANS

24 In outlying locations, aircraft may be

fuelled directly from drums, barrels or cans by emptying the contents of the containers through chamois filters into the tanks of the aircraft. This introduces additional hazards and among these will be water and dirt; increased vapor release; also a potential ignition hazard, due to possible failure to properly bond the filter to the fuel hose, and to the aircraft. Filling through funnel filters can be accomplished only with difficulty during heavy rains and is a most difficult operation to perform safely in the dark.

25 Because of the unknown and variable factors and conditions involved in the transporting of the product to the unit in drums, barrels, and cans, the contents of such containers are at least open to the suspicion of containing water or foreign material. They must be inspected, and their contents identified and thiefed for water. Any water or sediment, but water at least should be removed from containers before the gasoline reaches the filter, to reduce the change of water overflowing or leaking through the filter.

26 On some units, the suction pipes of the pumps are equipped with water-locking foot valves, or small segregators, so that gasoline can be pumped from a drum only after the water has been removed. Even in this instance, pumps and suction pipes are apt to pick up dirt, unless carefully handled.

27 For assurance of clean, dry gasoline, cans other than new cans filled at terminals, should be first dumped into clean inspected drums, intermediate tanks, or trucks, where this is possible. In any case, during this transfer, metal to metal contact between the containers involved must be maintained.

28 It is because of these duel hazards of fire and contamination, that it was strongly recommended previously that an intermediate, or auxiliary storage tank be provided to receive only filtered gasoline from packages, and that the dumping and filtering be performed in a safely removed area at a time of little activity on the unit. The intermediate tank may, on many units, be one of the trucks assigned for this purpose, unless regular tanks have been installed for the service. Due care must be taken in the filtering operation, and in the thiefing of the tanks as already outlined, to assure the delivery of clean dry gasoline.

29 The fuelling of aircraft direct from drums, therefore, will be considered as an emergency operation only, and to be avoided if possible.

30 At isolated bases (reserve fuel points) fuelling from unsealed drums is prohibited except in unusual cases, see Part 5, para. 37.

PART 11
SALVAGE - AVIATION FUELS

GENERAL

1 Aviation fuel shall be salvaged from aircraft in accordance with instructions contained in Engineering Orders and on the following occasions:-

(a) Before overhaul.

(b) Before a transfer when surface transport is utilized.

(c) Immediately after an aircraft incident or accident where it is evident that the aircraft cannot be repaired on the site and flown out.

UNDAMAGED TANKS

2 Aviation fuel being salvaged from undamaged aircraft tanks shall be drained into clean 45 gallon drums free from contamination. The drums shall be painted and marked in accordance with the colour schemes indicated hereunder:-

(a) Gasoline - Paint entire drum bright yellow. Mark octane rating in black on the top of drum.

(b) Aviation Turbo Fuel Type 2 - Paint entire drum blue with the exception of the top which shall be painted white and in addition a yellow band 4" wide shall be painted around the middle. Mark contents and type in blue on top of drum.

3 During draining operations the receiving drum shall be electrically bonded to the aircraft fuel tank and both drum and aircraft adequately grounded. Such draining shall not be affected inside a hangar.

4 When draining operations have been completed, such fuels, shall be returned to the Supply Section on form RCAF E47, Internal Return and Receipt Voucher, annotated "Salvaged from Aircraft No. .....", and filtered into the bulk storage system.

5 Fuel may be drained directly into refuelling tenders and re-issued to aircraft without voucher action.

DAMAGED TANKS

6 Aviation fuel removed from aircraft tanks damaged by contact with the ground or other foreign material shall be screened carefully and drained into 45 gallon drums marked "Contaminated", tagged plainly with the type and description of the contents.

7 Contaminated gasoline shall be returned to the Supply Section on form E47 annotated "Salvaged from aircraft No. ....., contaminated, for ME use only".

8 Such gasoline shall be filtered into ME storage tanks and mixed with the ME gasoline in the ratio of one gallon of avgas to five gallons of ME gasoline.

9 When aviation gasoline is contaminated to the extent that it cannot be used for ME purposes or the quantity involved is too great for ME usage, disposal instructions shall be requested from AMCHQ.

10 Aviation Turbo Fuel shall be converted to "Contaminated" only on instructions of the CTSO. In such instances this fuel shall be returned to the Supply Section on form E47 annotated "Salvaged from Aircraft No. ..... , contaminated".

PART 12

EMERGENCY OPERATIONS

FIRES OR STORMS

1 In the event of a fire, any storage facilities or truck-loading facilities in the immediate vicinity will be shut down, and all operations stopped. Any trucks or tank cars in the area should be removed as quickly as possible to reduce the exposure hazard. Fire-hose streams should be played in the proper direction to retard any encroachment by the fire and to wet down the tankage area, if exposed, in order to keep it cool. In the event any product is spilled, the fire may be extinguished by the use of a fine water spray, as emitted by a fog nozzle, chemical foam, or powder.

2 Similarly, on the approach of a severe electrical storm, all operations accompanied by the escape of vapors, such as unloading a truck or tank car into a tank, transferring from one tank to another, loading trucks, or fuelling aircraft, must be stopped. Lightning is likely to follow the path of a vapor-air mixture. Tank cars or trucks should be disconnected, valves and manways closed so that the trucks and the tank cars will be ready for removal on short notice.

3 Trucks in storage areas will be well dispersed so that they will not be caught in a general conflagration.

ENEMY ATTACKS

4 In an emergency such as an enemy attack on a unit, any special orders necessary will be issued by the commanding officer. On such an occasion, the experience and training of the operating personnel will be of prime importance.

POWER FAILURE

5 In the event of a power failure, the pumps on fuelling units may be used for drawing gasoline from storage tanks into the fuelling units.

6 In mechanical systems gasoline may be drawn out of storage tank through the water draw-off connection. The greater the quantity of gasoline in the tank, the less will be the suction required for its removal.

7 In spotting gasoline trucks and trailers for this purpose the engines driving the pumps should be upwind from both the tank connection and the hatch of the trailer itself.

8 Prior to dispensing gasoline, drawn in this manner, to aircraft, the truck segregator must be carefully checked for water.

NOTE

All valves leading to and from storage tanks must be closed during the preceding operations.