

INCH-POUND
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VV-L-825C

18 March 1997

SUPERSEDING

VV-L-825B

10 November 1987

(See 6.8)

## FEDERAL SPECIFICATION

## LUBRICATING OIL, REFRIGERANT COMPRESSOR, UNINHIBITED

The General Services Administration has authorized the use of this federal specification by all federal agencies.

## 1. SCOPE

1.1 Scope. This specification covers lubricating oils for use in refrigerant compressors.

1.2 Classification. The oil shall be of the following military symbols, as specified (see 6.2):

	<u>Military symbol</u>	<u>NATO symbol</u>
Type II - For reciprocating-type refrigerant compressors using refrigerant 12 (for example, dichlorodifluoromethane, methyl chloride, or ammonia).	RCO-2	0-282
Type III - For special applications such as two-stage rotary compressors.	RCO-3	---
Type IV - For use with refrigerant 22 (for example, monochlorodifluoromethane).	RCO-4	0-290

Beneficial comments, recommendations, additions, deletions, clarifications, etc. and any data which may improve this document should be sent to: Commander, SEA 03R42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy., Arlington, VA 22242-5160.
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## 2. APPLICABLE DOCUMENTS

2.1 Government publications. The issues of the following documents, in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

### Federal Standards

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

FED-STD-791 - Lubricants, Liquid Fuels, and Related Products; Methods of Testing.

(Activities outside the Federal Government may obtain copies of federal specifications, standards and commercial item descriptions as specified in the General Information section of the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index is for sale on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification, and other federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from the General Services Administration, Federal Supply Service Bureau, Specification Section, Suite 8100, 470 L'Enfant Plaza, SW, Washington, DC 20407.)

(Federal Government activities may obtain copies of federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

### AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

Z1.4 - Sampling Procedures and Tables for Inspection by Attributes.

(Private sector and civil agencies may purchase copies of these voluntary standards from the American Society for Quality Control, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

(DoD activities may obtain copies of those adopted voluntary standards listed in the DoD Index of Specifications and Standards free of charge from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup. (DoD adopted)
- D 97 - Standard Test Method for Pour Point of Petroleum Products. (DoD adopted)
- D 130 - Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test. (DoD adopted)
- D 189 - Standard Test Method for Conradson Carbon Residue of Petroleum Products. (DoD adopted)
- D 287 - Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method). (DoD adopted)
- D 445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity). (DoD adopted)
- D 482 - Standard Test Method for Ash from Petroleum Products. (DoD adopted)
- D 611 - Standard Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents. (DoD adopted)
- D 877 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes. (DoD adopted)
- D 974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration. (DoD adopted)
- D 1500 - Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale). (DoD adopted)
- D 1744 - Standard Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent. (DoD adopted)
- D 4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products. (DoD adopted)
- D 4727 - Standard Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Sheets.

(Private sector and civil agencies may purchase copies of these voluntary standards from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2859.)

(DoD activities may obtain copies of those adopted voluntary standards listed in the DoD Index of Specifications and Standards free of charge from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-  
CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 86 - Methods of Testing the Floc Point of Refrigeration Grade Oils.

ASHRAE 97 - Sealed Glass Tube Method to Test the Chemical Stability of Material for Use Within Refrigerant Systems. (Private sector and civil agencies may purchase copies of these voluntary standards from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 1791 Tullie Circle, NE, Atlanta, GA 30329.)

(DoD activities may obtain copies of those adopted voluntary standards listed in the DoD Index of Specifications and Standards free of charge from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

### 3. REQUIREMENTS

3.1 Qualification. Refrigerant compressor lubricating oils furnished under this specification shall be products which are qualified for listing on the applicable qualified products list.

3.2 Material. Refrigerant compressor lubricating oils shall be well-refined petroleum oils, without admixture of fatty acids, fatty oils, resins, soaps, or other objectionable materials.

3.3 Toxicity. The oil shall have no adverse effect on the health of personnel when used for its intended purpose. The oil shall contain no components which produce noxious vapors in such concentrations as to be an annoyance to personnel during formulation or normal use under conditions of adequate ventilation while exercising caution to avoid prolonged contact with the skin and while observing Occupational Safety and Health Administration (OSHA) guidelines. Questions pertaining to the toxic effects shall be referred by the contracting activity to the Chief, Bureau of Medicine and Surgery, 2300 East St., Washington, DC 20372-5300, who will act as a medical advisor to the contracting activity.

3.4 Material safety data sheet. The contracting activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS shall meet all the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification (see 6.5).

3.5 Physical and chemical requirements. Refrigerant compressor lubricating oil shall conform to the requirements specified in table I.

TABLE I. Physical and chemical requirements.

Property	Type II	Type III	Type IV	Test method
Viscosity, cSt, 40 degrees Celsius (°C)	61.2 - 74.8	---	28.8 - 35.2	ASTM D 445
Viscosity, cSt 100C	---	21.7 - 26.3	---	ASTM D 445
Flash point, degrees Fahrenheit (°F), min	350 (177°C)	450 (232°C)	325 (163°C)	ASTM D 92
Pour point, °F, max	Minus 30 (minus 34°C)	0 (minus 18°C)	Minus 40 (minus 40°C)	ASTM D 97
Floc point, °F, max	Minus 50 (minus 46°C)	0 (minus 18°C)	Minus 60 (minus 51°C)	ASHRAE 86
Color	Report	Report	Report	ASTM D 1500
Total acid no., mg KOH/g, max	0.05	0.05	0.05	ASTM D 974
Dielectric strength KV min	25	20	25	ASTM D 877
Aniline point, °F	160 - 195 (71 - 90°C)	---	160 - 195 (71 - 90°C)	ASTM D 611
Gravity, API	21 - 26	---	22 - 27	ASTM D 287
Chemical stability, percent R-22	0.8 - 1.5%	---	0.4 - 0.8%	ASHRAE 97
Corrosion <u>1</u> /	1A	1A	1A <u>4</u> /	ASTM D 130/1A
Bearing compatibility <u>2</u> /	Pass	Pass	Pass	Method 3452
Journal bearing test <u>3</u> /	0.9 min	---	0.9 min	Method 3452 <u>2</u> /
Carbon residue, percent, max	0.3	1.25	0.2	ASTM D 189
Ash, percent, max	0.005	0.005	0.005	ASTM D 482
Moisture, ppm max	35	35	35	ASTM D 1744

See footnotes at top of next page.

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- 1/ Discoloration of test strip shall be not greater than that caused by oxidation of a blank copper strip when exposed to dry heat oven at 212°F (100°C) for 3 hours.
- 2/ FED-STD-791 for bearing tests need not be run when there is a change in approved base oils only and the originally approved additive package is retained to formulate the oil.
- 3/ Journal speed - 3500 revolutions per minute, bearing temperature:  $150 \pm 1^{\circ}\text{F}$  ( $51.3 \pm 0.55^{\circ}\text{C}$ ).
- 4/ Pass if there is no evidence of corrosion such as deposit or discoloration.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.3 Qualification inspection. Qualification inspection shall be conducted at a laboratory satisfactory to the Naval Sea Systems Command. Qualification tests shall consist of tests for the requirements specified in table I (see 3.5).

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 9601 of FED-STD-791. Lot determination shall be as specified in 4.4.1. Each sample selected as specified in 4.4.2 shall be subjected to the tests as specified in table I, except the bearing compatibility, chemical stability and journal bearing tests are not required. However, any additional tests deemed necessary by the contracting activity to determine conformance to this specification may be required.

#### 4.4.1 Inspection lot.

4.4.1.1 Bulk lot. A bulk lot shall be an indefinite quantity of a homogeneous mixture of lubricating oil offered for acceptance in a single isolated storage container, or made in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in the ingredient materials or formulation processes.

4.4.1.2 Packaged lot. A packaged lot shall be an indefinite number of unit containers of identical size and type offered for acceptance, and filled with a homogeneous mixture of lubricating oil from a single isolated container, or filled with a homogeneous mixture of lubricating oil made in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in the ingredient materials or formulation processes.

4.4.1.3 Delivery lot. For the purpose of sampling, a delivery lot shall be all lubricating oil in a single shipment.

#### 4.4.2 Sampling.

4.4.2.1 Sampling a storage tank. Unless otherwise specified (see 6.2), a representative sample of 5 gallons of lubricating oil shall be taken from each lot in accordance with ASTM D 4057.

4.4.2.2 Sampling during plant run. A representative sample of lubricating oil shall be drawn at the discharge pipe where it enters the receiving vessel or vessels. At least four samples shall be taken at regular intervals during the entire period of loading or filling with each sample being 1 pint.

4.4.2.3 Sampling of filled containers. Where the lubricating oil is contained in 1-quart and 1-gallon cans, samples shall be drawn from the containers as specified in ASTM D 4057. When the lot contains less than five containers, each container shall be sampled.

4.4.3 Rejection of lots. When the sample of lubricating oil fails any of the tests, this shall be cause for rejection of the lot represented by the sample.

4.5 Examination of filled containers. A random sample of filled containers shall be selected from each lot in accordance with ASQC Z1.4 at inspection level I. The Acceptable Quality Level (AQL) shall be 2.5 percent defective to verify compliance with this specification regarding fill, closure, marking, and other requirements not involving tests. Samples shall be examined for defects of the container and the closure, for evidence of leakage, and for unsatisfactory markings. Each sample filled container shall also be weighed to determine the amount of the contents. Any container in the sample having one or more defects or under required fill shall be cause for rejection of the container. If the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of ASQC Z1.4, this shall be cause for rejection of the lot represented by the sample.

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4.6 Toxicity. To determine conformance to requirements of 3.3, the manufacturer of the material shall disclose the formulation of his product to the Bureau of Medicine and Surgery, 2300 East St NW, Washington DC 20372-5300. The disclosure of proprietary information, which shall be held in confidence by the Bureau of Medicine and Surgery shall include: the name, formula, and approximate percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; identification of its pyrolysis products; and any such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, disposal, or combustion of the material. Information submitted shall be clearly marked or identified to show it is being provided in connection with qualification under VV-L-825.

## 5. PACKAGING

5.1 Packaging. For Acquisition purposes, the packaging requirements shall be specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System command. Packaging data retrieval is available from the managing Military Department's or Defence Agency's automated packaging files, CD-ROM Products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature which is helpful, but is not mandatory.)

6.1 Intended use. The lubricating oils covered by this specification are intended for the lubrication of the compression unit of refrigeration equipment operated on refrigerant 12 (for example, dichlorodifluoromethane), refrigerant 22 (for example, monochlorodifluoromethane), methyl chloride, or ammonia.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Symbol required (see 1.2).
- (c) When representative sample of lubricating oil is different than specified (see 4.4.2.1).
- (d) Quantity in gallons. The material should be purchased by volume, the unit being a U.S. gallon, at 60°F (15.6°C).
- (e) Packaging requirements, if needed (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the supplier is called to this requirement, and manufacturers are urged to arrange to have the products they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Sea Systems Command, SEA 03R4, 2531 Jefferson Davis Hwy., Arlington, VA 22242-5160, and information pertaining to qualification of products may be obtained from that activity.

6.4 The index of test methods in FED-STD-791 lists the corresponding equivalent test methods of ASTM.

6.5 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in appendix B of FED-STD-313. In order to obtain the MSDS, federal acquisition regulation FAR clause 52.223-3 must be in the contract.

6.6 Subject term (key word) listing.

Ammonia  
Dichlorodifluoromethane  
Lubricating oil  
Methyl chloride  
Monochlorodifluoromethane  
Reciprocating refrigerant compressors  
Refrigerant compressors  
Viscosity

6.7 International standardization agreements. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations. Identified below are the specific paragraph numbers and the international standardization agreements applicable to this specification; NATO-STANAG-1135.

6.8 Suggested packaging.

(The Packaging requirements specified herein are suggested and apply only for direct Government acquisition.)

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6.8.1 Packaging, packing and marking. The lubricating oil in the quantity and container specified (see the contract or order), should be packaged and packed level B, C or commercial (see the contract or order), and marked in accordance with MIL-STD-290. In addition, for Navy acquisitions, the following Navy fire-retardant requirements should apply:

- (a) Lumber and plywood. When specified (see the contract or order), all lumber and plywood including laminated veneer material used in shipping container and pellet construction, members, blocking, bracing and reinforcing should be fire-retardant treated material conforming to MIL-L-19140 as follows:

Level B - Type II - weather resistant.

Category 1 - general use.

Level C - Type I - non-weather resistant.

Category 1 - general use.

- (b) Fiberboard. When specified (see the contract or order), fiberboard used in the construction of unit containers should conform to the class-domestic/fire-retardant or class-weather resistant/fire-retardant material requirements of ASTM D 4727.

6.9 Supersession data. Type IV lubricating oil can be used in place of type I oil. Type I oil was listed in revision A of VV-L-825.

6.10 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

## MILITARY INTERESTS:

CIVIL AGENCY COORDINATING ACTIVITY:  
GSA-FSSCustodians:

Army - MR  
Navy - SH  
Air Force - 68

Preparing activity:  
Navy - SH  
(Project 9150-1168)

Review activities:

Army - MI  
DLA - GS

## APPENDIX

EQUIPMENT AND PROCEDURES  
FOR MEASURING THE R-22 CONTENT  
IN SEALED TUBES USING GAS CHROMATOGRAPHY

## 10. SCOPE

10.1 Scope. This appendix covers the equipment and procedures used for measuring the content of R-22 refrigerant in gases evolved during the sealed tube stability testing of refrigerant oils in accordance with ASHRAE 97.

10.2 Summary. The procedure consists of isolating the gas evolved during aging of the sealed tube, then analyzing it using gas chromatography. Concentrations of R-22 and R-12 refrigerants in the evolved gas shall then be obtained by integration of the gas chromatogram peaks.

## 20. APPLICABLE DOCUMENTS

20.1 Government publications. The issues of the following documents, in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

Federal Specifications

BB-H-1168 - Helium, Technical.

BB-N-411 - Nitrogen, Technical.

(Activities outside the Federal Government may obtain copies of federal specifications, standards and commercial item descriptions as specified in the General Information section of the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index is for sale on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

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## 30. APPARATUS

30.1 Sealed glass tube. A sealed glass tube containing R-12, refrigeration oil, and strips of copper and steel shall be used in accordance with ASHRAE 97.

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30.2 Tube opening apparatus. The tube-opening apparatus shown in ASHRAE 97, shall be used.

30.3 Gas handling system. A gas handling system equipped with a vacuum pump, a sample port to gas chromatograph, and a manometer shall be used. A diagram of this system is shown on figure 1.

30.4 Gas chromatograph. A gas chromatograph equipped with a thermal conductivity detector and a sampling valve shall be used and shall operate as follows:

- (a) Column temperature: 75°C
- (b) Injector temperature: ambient
- (c) Detector temperature: 125°C
- (d) Helium flow rate: 60 milliliters/minute
- (e) Sample size: 5 mL
- (f) Recorder span: 1 millivolt
- (g) Chart speed: 1 inch per minute
- (h) Filament current: 200 milliamperes at 15 volts

30.5 Column. Ten feet by 1/4 inch Parapak Q, 50-80 mesh, with a 2 inch 50-80 mesh drierite water scrubber at the head of the column.

#### 40. REAGENTS AND MATERIALS

40.1 Helium. Helium shall conform to the requirements of BB-H-1168, type I, grade A.

40.2 Liquid nitrogen. Liquid nitrogen shall conform to the requirements of BB-N-411, type II.

40.3 TFE tape.

#### 50. PROCEDURE

50.1 A sealed tube shall be stored for 14 days in a 175°C environment. After that period, the tube shall be removed and the lower half shall be submerged in a Dewar flask containing liquid nitrogen until the sample is completely frozen. The tube shall then be removed and a small file scratch shall be made near the tip. The sample shall then be refrozen.

NOTE: After the tube is frozen, the refrigerant pressure is no longer present. However, if noncondensable gases (such as carbon monoxide and hydrogen) were developed by reactions during the aging period, then considerable pressure may still be present in the tube. Also, the tube may have been weakened by the attack of fluorine-containing acids which may have formed during the aging period. If proper care is not used in handling the sample tube, then a serious accident will occur. Therefore, all safety procedures specified in ASHRAE 97 shall be followed.

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50.2 The sealed tube shall be placed in the tube-opening apparatus and connected to the gas handling system, leaving the connecting valve open. Each valve in the gas handling system, except the vacuum pump valve, shall be closed. Then the system shall be evacuated to the limit of the vacuum pump (approximately 1 millimeter mercury). The pump shall be isolated from the rest of the system.

50.3 The valve on the tube-opening apparatus shall be closed. Then the tip of the sealed tube shall be broken off by a sideways motion of the tube. The sample tube shall then be submerged in a beaker of hot water to thaw the contents.

50.4 The valve on the tube-opening apparatus shall be opened slowly to allow approximately 1 atmosphere of gas to escape into the gas handling system. The valve shall then be closed. The gas sample valve shall then be opened, and a 5 mL gas sample shall be injected into the gas chromatograph.

50.5 Using an electronic integrator or planimeter, the peak areas for R-22 and R-12 refrigerants shall be determined on the gas chromatogram. (Other peaks on the chromatogram should be ignored.)

## 60. CALCULATIONS

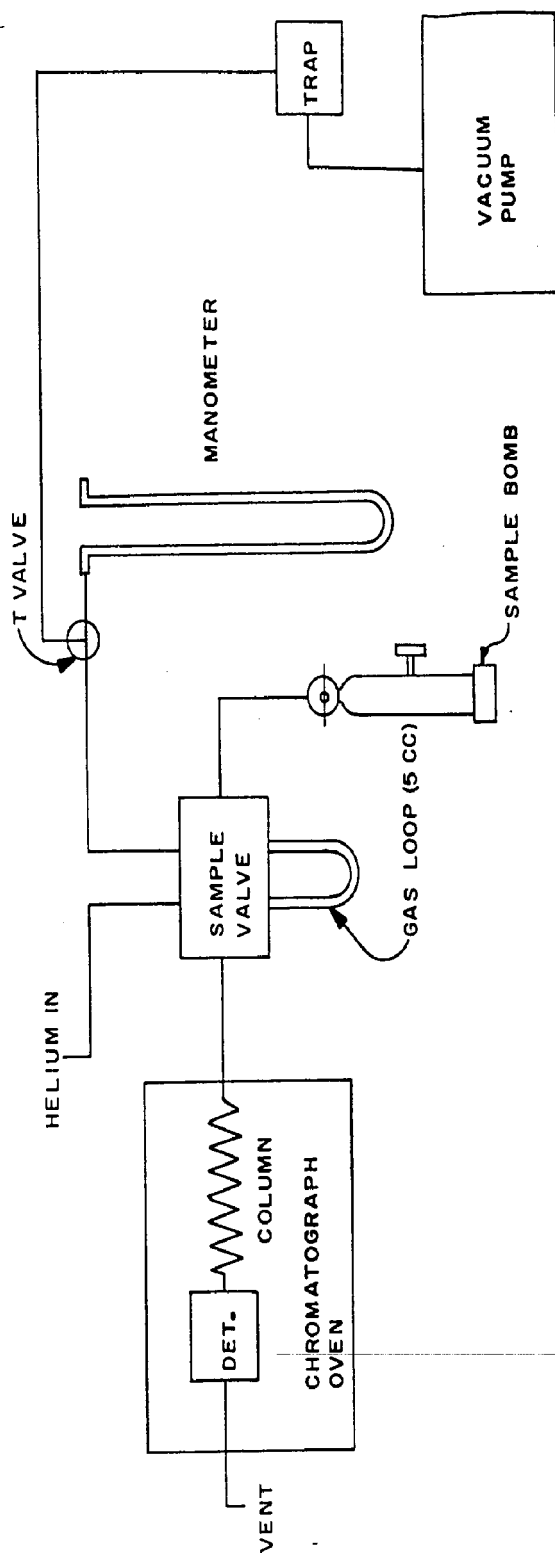
60.1 The percent of R-22 in the gas sample shall be calculated using the following formula:

$$\text{R-22, volume percent} = \frac{\text{AR-22} \times 100}{\text{AR-12} + \text{AR-22}}$$

Where:

AR-22 = R-22 peak area

AR-12 = R-12 peak area



NOTE: NOT TO SCALE

FIGURE 1. Gas handling system.