

VII. APPENDIX I.

SAMPLING FOR TRICHLOROETHYLENE

Atmospheric Sampling

(a) General Requirements

(1) The measurement of air concentrations shall be within the worker's breathing zone and shall meet the following criteria in order to evaluate conformance with the standard:

(2) Samples collected shall be representative of the individual worker's exposure.

(3) Sampling data sheets shall include a log of:

(A) The date and time of sample collection.

(B) Sampling duration.

(C) Volumetric flowrate of sampling.

(D) A description of the sampling location.

(E) Other pertinent information.

(b) Breathing Zone Sampling

(1) Breathing zone samples shall be collected as near as practicable to the worker's face without interfering with his freedom of movement and shall characterize the exposure from each job or specific operation in each production area.

(2) A portable battery-operated personal sampling pump plus an activated charcoal tube shall be used to collect the sample.

(3) The activated charcoal tube shall be attached to the worker's clothing; the shirt collar is convenient for this purpose.

(4) The sampler shall be operated at a flowrate of one (1) liter per minute and samples shall be collected for a maximum of 10 minutes for ceiling values and a minimum of 10 minutes for time-weighted averages.

(5) Breathing zone samples shall be collected to permit calculation of a time-weighted average exposure for every operation involving exposure to trichloroethylene in sufficient numbers to express the variability of the work situation. The number of samples to be collected and analyzed, as a minimum, based on the number of workers exposed at any single type of operation or in any given work area is listed in Section 8 of this standard.

(6) An unused activated charcoal tube from the same batch shall be provided to the analytical laboratory to determine the blank correction which must be applied to the analytical results.

(c) Apparatus

(1) Pump, battery-operated, complete with clip for attachment to the worker's belt or a reliable, calibrated hand pump. All pumps and flowmeters must be calibrated using a calibrated wet test meter, or other reference, as described in (d)(5), below.

(2) Charcoal tubes: glass tube with both ends flame-sealed 7 cm long with a 6 mm O.D. and a 4 mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2 mm portion of urethane foam. The absorbing section contains 100 mg of charcoal, the back-up section 50 mg. A 3 mm portion of urethane foam is placed between the

outlet end of the tube and the backup section. A plug of glass wool is placed in front of the absorbing section. The pressure drop across the tube must be less than one inch of mercury at a flowrate of 1 liter per minute.

(d) Calibration of Sampling Instruments

(1) Air sampling instruments shall be calibrated after making any repairs or modifications to the sampling system and at least once a year with a reference such as a wet test meter over a normal range of flowrates and pressure drops.

(2) The wet test meter shall be in good working condition and shall have been calibrated against a spirometer (or other primary standard) upon procurement, after each repair, and at least annually.

(3) Calibration curves shall be established for each sampling pump and shall be used in adjusting the pumps prior to field use.

(4) The volumetric flowrate through the sampling system shall be spot checked and the proper adjustments made before and during each study to assure obtaining accurate airflow data.

(5) Flowmeter Calibration Test Method

(A) Apparatus

- (i) Wet test meter or other reference
- (ii) Activated charcoal tube
- (iii) Pump with rotameter
- (iv) Rubber or vinyl tubing

- (v) Barometer
- (vi) Thermometer
- (vii) Stopwatch
- (viii) Small screwdriver
- (ix) Graph paper

(B) Procedure

(i) Level wet test meter. Check the water level which should just touch the calibration point at the left side of the meter. If water level is low, add water 1 to 2 F warmer than room temperature to fill point. Run the meter for 30 minutes before calibration.

(ii) Check the voltage of the pump battery with a voltmeter. A reading of 7.0 volts (for Mine Safety Appliances Company, Model G) is required for calibration. If reading is lower, charge batteries until a reading of 7.0 volts is obtained.

(iii) Break the tips of an activated charcoal tube to openings at least 2 mm in diameter at the ends.

(iv) Assemble the calibration train with the test meter, then the charcoal tube, and finally the pump in series.

(v) Turn the pump on, adjusting the rotameter with a screwdriver to a reading of 10 (read middle of the float).

(vi) Operate the system 10 minutes before starting the calibration.

(vii) The pointer on the meter should run clockwise and a pressure drop of not more than 1.0 inch of water indicated. If the pressure drop is greater than 1.0, disconnect and check the system.

(viii) Record the following on calibration data sheet: wet test meter reading, start and finish; elapsed time; pressure drop at manometer; air temperature; barometric pressure; and serial number of pump and rotameter.

(ix) Adjust the rotameter reading to 9.0, 8.0, and 7.0, respectively, and repeat step viii at each reading. Each point should run for 10 minutes or at least 0.5 cubic foot of air.

(x) Record the name of person performing the calibration, the date, serial number of the wet test meter, and the number of the pump and flowmeter system being calibrated.

(xi) Correct the wet test meter readings to standard conditions of pressure and temperature by means of the gas law equation.

(xii) Use graph paper to plot the actual airflow and the rotameter readings. Determine the rotameter reading that will result in a 1 liter/minute flowrate for the pump being calibrated.

VIII. APPENDIX II.

ANALYTICAL METHOD FOR TRICHLOROETHYLENE

(a) Principle of the Method

(1) A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

(2) The charcoal in the tube is transferred to a small test tube and desorbed with carbon disulfide.

(3) An aliquot of the desorbed sample is injected into a gas chromatograph.

(4) The area of the resulting peak is determined and compared with areas obtained from the injection of standards.

(b) Range and Sensitivity

(1) The lower limit for trichloroethylene at a 16x1 attenuation on a gas chromatograph with a 10:1 splitter is 0.05 mg/sample. This value can be lowered by reducing the attenuation or by eliminating the 10:1 splitter.

(2) The upper limit value for trichloroethylene is 13.0 mg/sample. This value is the number of milligrams of trichloroethylene which the front section will hold before this compound is found on the backup section. The charcoal tube consists of two sections of activated charcoal separated by a section of urethane foam (see description of apparatus, Part VII). This upper value cannot be changed. If a particular atmosphere is suspected of containing a large amount of trichloroethylene, it is recommended that a smaller sampling volume be taken.

(c) Interferences

(1) When the amount of water in the air is so great that condensation actually occurs in the tube, organic vapors will not be trapped. Water vapor does not seem to be a problem, only water present as a mist.

(2) Any compound which has the same retention time as trichloroethylene at the operating conditions described in this method could be considered an interference. This type of interference can be overcome by changing the operating conditions of the instrument.

(d) Precision and Accuracy

(1) Precision of the analytical method: plus or minus 4.8%.

(2) Precision of the analytical method plus field sampling with the personal sampling pump has not been established.

(3) The accuracy of the sampling and analytical method, as established during breakthrough testing of the front section of activated charcoal: 91%.

(e) Advantages and Disadvantages of the Method

This method is advantageous in that it provides one basic method for determining many different organic solvents. The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The analysis of the tubes is accomplished using a quick instrumental method.

One disadvantage of the method is that the amount of sample which can be taken is limited by the weight of sample which the tube will hold before overloading. Also the precision of the method is limited by the reproducibility of the pressure drop across the tubes. Variability in this pressure drop will affect the flowrate, causing the volume to be imprecise since the pump is usually calibrated for one tube only.

(f) Apparatus consists of:

(1) An approved coal mine dust personal sampling pump for personal samples or any vacuum pump whose flow can accurately be determined at 1 liter per minute or less.

(2) Charcoal tubes: glass tube with both ends flame-sealed, 7 cm long with a 6 mm O.D. and a 4 mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2 mm portion of urethane foam. The adsorbing section contains 100 mg of charcoal, the back-up section 50 mg. A 3 mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than one inch of mercury at a flowrate of 1 liter per minute.

(3) Gas chromatograph equipped with a flame ionization detector.

(4) Column (20 ft x 1/8 in) with 10% FFAP stationary phase on 80/100 mesh acid washed DMCS Chromosorb W solid support.



(5) A mechanical or electronic integrator or a recorder and some method for determining peak area.

(6) Small glass-stoppered test tubes or equivalent.

(7) Micro syringes: 10  $\mu$ l, and convenient sizes for making standards.

(g) Reagents

(1) Spectroquality carbon disulfide.

(2) Trichloroethylene, preferably chromatquality grade.

(3) Bureau of Mines Grade A helium.

(4) Prepurified hydrogen.

(5) Filtered compressed air.

(h) Procedure

(1) Cleaning of Equipment

All equipment used for the laboratory analysis should be washed in detergent followed by tap and distilled water rinses.

(2) Collection and Shipping of Samples

Both ends of the charcoal tube should be broken to provide openings of at least 2 mm which is one-half the I.D. of the tube. A smaller opening causes a limiting orifice effect which reduces the flow through the tube.

The smaller section of charcoal in the tube is used as a backup section and should therefore be placed nearest the sampling pump. Tubing may be used to connect the back of the tube to the pump, but no tubing must ever be put in front of the charcoal tube.

One liter per minute is the recommended sampling rate. A 10-liter sample is normally adequate. The tube must be supported in a vertical position for sampling. Due to the high resistance of the charcoal tube, this sampling method places a heavy load on the personal sampling pump. Therefore, it should not be assumed that this pump will run a full 8 hours without recharging the battery. After the sample is collected, the tube must be capped; caps are provided with commercial tubes.

One charcoal tube should be treated in the same manner as the sample tubes (break, seal, ship) with the exception that no air be drawn through it. This tube will serve as a blank.

If bulk samples are submitted in addition to charcoal tubes, the tubes should be shipped in a separate container from the bulk sample.

### (3) Analysis of Samples

#### (A) Preparation

Each charcoal tube is scored with a file and broken open in front of the first section of charcoal. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a small stoppered test tube. The separating section of foam is removed and discarded; the second section is transferred to another test tube. These two sections are analyzed separately.

#### (B) Desorption

Prior to analysis, 0.5 ml of carbon disulfide is pipetted into each test tube. (Caution: do not pipet by mouth.)

Tests indicate that desorption is complete in thirty minutes if the sample is agitated occasionally during this period.

EXTREME CAUTION MUST BE EXERCISED AT ALL TIMES WHEN USING CARBON DISULFIDE BECAUSE OF ITS HIGH TOXICITY AND FIRE AND EXPLOSION HAZARDS. IT CAN BE IGNITED BY HOT STEAM PIPES. ALL WORK WITH CARBON DISULFIDE MUST BE PERFORMED UNDER AN EXHAUST HOOD.

(C) Gas chromatographic conditions

Operating conditions for a typical gas chromatograph (Perkin-Elmer 900) are:

- (i) 85 cc/min. (70 psig) helium  
carrier gas flow
- (ii) 65 cc/min. (24 psig) hydrogen gas flow  
to detector
- (iii) 500 cc/min. (50 psig) airflow to detector
- (iv) 200 C injector temperature
- (v) 200 C manifold temperature (detector)
- (vi) Oven temperature 90 C isothermal
- (vii) Either dual column differential operation  
or the uncompensated mode may be used.

(D) Injection

The first step in the analysis is the injection of the sample into the gas chromatograph. To eliminate difficulties arising from blowback or distillation within the syringe needle, the solvent flush injection technique is employed. The 10  $\mu$ l syringe is first

flushed with solvent several times to wet the barrel and plunger. Three microliters of solvent are drawn into the syringe to increase the accuracy and reproducibility of the injected sample volume. The needle is removed from the solvent, and the plunger is pulled back about 0.2  $\mu$ l to separate the solvent flush from the sample with a pocket of air to be used as a marker. The needle is then immersed in the sample, and a 5  $\mu$ l aliquot is withdrawn, taking into consideration the volume of the needle, since the sample in the needle will be completely injected. After the needle is removed from the sample and prior to injection, the plunger is pulled back a short distance to minimize evaporation of the sample from the tip of the needle. Duplicate injections of each sample and standard should be made. No more than a 3% difference in area is to be expected.

#### (E) Measurement of area

The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary sample results are read from a standard curve prepared as discussed below.

#### (i) Calibration and Standards

##### (1) Preparation of Standards

It is convenient to prepare standards in terms of mg/0.5 ml of carbon disulfide because samples are desorbed in this amount of carbon disulfide. To minimize error due to the volatility of carbon disulfide, twenty times the weight can be injected into 10 ml of carbon disulfide. For example, to prepare a 0.3 mg/0.5 ml standard,

6.0 mg is injected into exactly 10 ml of carbon disulfide in a glass-stoppered flask. The density for trichloroethylene is used to convert 6.0 mg into microliters for easy measurements with a microliter syringe. A series of standards is prepared varying in concentration over the range of interest and analyzed under the same gas chromatographic conditions and during the same time period as the unknown samples. Curves are established by plotting concentration vs average peak area.

(2) Determination of Desorption Efficiency

It is necessary to determine the percentage of trichloroethylene on the charcoal that is removed in the desorption process. This desorption efficiency is determined once for a given compound, provided the same batch of charcoal is always used.

Activated charcoal, equivalent to the amount in the first section of the sampling tube (100 mg), is measured into a 2-in, 4-mm I.D. glass tube, flame-sealed at one end. The open end is capped. (The charcoal may be obtained from unused charcoal tubes.) A known volume of trichloroethylene is injected directly into the activated charcoal with a microliter syringe, and the tube is capped. The amount injected is usually equivalent to that present in a 10-liter sample at a concentration equal to the environmental standard.

A minimum of five tubes are prepared in this manner and allowed to stand for at least one day to assure complete adsorption of the trichloroethylene onto the charcoal. These tubes are desorbed and analyzed in exactly the same manner as sampling tubes. The results of

each analysis are compared to standards to determine what percentage of the original amount of trichloroethylene is desorbed. The average percentage is termed the desorption efficiency and is used as a factor in all sample analyses.

Experiments indicate that the desorption efficiency determined in this manner is essentially the same as that obtained by trapping a known amount of trichloroethylene vapor on the charcoal tube and analyzing. The first method is used because of its simplicity.

Because desorption efficiencies may vary from one laboratory to another and with different batches of charcoal, each laboratory should determine its own. However, for comparison, NIOSH determined a value of 97% for trichloroethylene, with one lot of activated charcoal.

(j) Calculations

(1) The first step in calculating the results is to read the weight in milligrams corresponding to each peak area from the standard curve. The standard curve is based on mg/0.5 ml of carbon disulfide, and therefore, no correction need be made for the volume of the sample injected, since this is identical to the volume of the standards injected.

(2) The weight of trichloroethylene in the front section of the blank tube is subtracted from the weight determined for the front section of each sample; a similar procedure is followed for the backup sections.

(3) Amounts present on the front and backup sections of the same tube are then added to calculate the total amount in the sample.

(4) This total weight of trichloroethylene in the tube is corrected by dividing by the desorption factor to determine the total number of milligrams in the sample.

(5) Milligrams are converted into parts per million by volume in the air sampled using the following equation:

$$\text{at 25 C} \quad \text{ppm} = \frac{24450 \text{ ml/mole} \times \text{mg/liter}}{\text{molecular wt}}$$

for a 10-liter air sample of trichloroethylene:

$$\text{ppm} = \frac{24450 \text{ ml/mole} \times \text{mg in sample}/10 \text{ liters}}{131.40 \text{ g/mole}}$$

$$\text{ppm} = 18.61 \times \text{mg in sample}$$

IX. APPENDIX III.  
MATERIAL SAFETY DATA SHEET

The following items of information which are applicable to a specific product or material containing trichloroethylene shall be provided in the appropriate section of the Material Safety Data Sheet or approved form. If a specific item of information is (ie, flash point) initials "n.a." (not applicable) shall be inserted.

(a) The product designation in the upper left hand corner of both front and back to facilitate filing and retrieval. Print in upper case letters in as large a print as possible.

(b) Section I. Source and Nomenclature.

(1) The name, address, and telephone number of the manufacturer or supplier of the product.

(2) The trade name and synonyms for a mixture of chemicals, a basic structural material, or for a process material; and the trade name and synonyms, chemical name and synonyms, chemical family, and formula for a single chemical.

(c) Section II. Hazardous Ingredients

(1) Chemical or widely recognized common name of all hazardous ingredients.

(2) The approximate percentage by weight or volume (indicate basis) which each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount; ie, 10-20% V; 10% max. W.



(3) Basis for toxicity for each hazardous material such as established OSHA standard (TLV) in appropriate units and/or LD50 showing amount and mode of exposure and species, or LC50 showing concentration, duration of exposure, and species.

(d) Section III. Physical Data.

(1) Physical properties of the total product including boiling point and melting point in degrees Fahrenheit; vapor pressure, in millimeters of mercury, vapor density of gas or vapor (air=1); solubility in water, in parts per hundred parts of water by weight; specific gravity (water=1); volatility, indicate if by weight or volume, at 70 degrees or ether=1; and appearance and odor.

(e) Section IV. Fire and Explosion Hazard Data.

(1) Fire and explosion hazard data about a single chemical or a mixture of chemicals, including flash point, in degrees Fahrenheit; flammable limits, in percent by volume in air; suitable extinguishing media or agents; special fire fighting procedures; and unusual fire and explosion hazard information.

(f) Section V. Health Hazard Data.

(1) Toxic level for total compound or mixture, relevant symptoms of exposure, skin and eye irritation properties, principal routes of absorption, effects of chronic (long-term) exposure, and emergency and first aid procedures.

(g) Section VI. Reactivity Data.

(1) Chemical stability, incompatibility, hazardous decomposition products, and hazardous polymerization.

(h) Section VII. Spill or Leak Procedures.

(1) Detailed procedures to be followed with emphasis on precautions to be taken in cleaning up and safe disposal of materials leaked or spilled. This includes proper labeling and disposal of containers containing residues, contaminated absorbents, etc.

(i) Section VIII. Special Protection Information.

(1) Requirements for personal protective equipment, such as respirators, eye protection, protective clothing, and ventilation, such as local exhaust (at site of product use or application), general, or other special types.

(j) Section IX. Special Precautions.

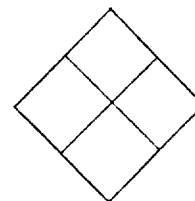
(1) Any other general precautionary information such as personal protective equipment for exposure to the thermal decomposition products listed in Section VI, and to particulates formed by abrading a dry coating, such as by a power sanding disc.

(k) The signature of the responsible person filling out the data sheet, his address, and the data on which it is filled out.

PRODUCT DESIGNATION
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**MATERIAL SAFETY  
DATA SHEET**

Form Approved  
Budget Bureau No.  
Approval Expires  
Form No. OSHA



SECTION I SOURCE AND NOMENCLATURE	
MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
ADDRESS (Number, Street, City, State, ZIP Code)	
TRADE NAME AND SYNONYMS	CHEMICAL FAMILY
CHEMICAL NAME AND SYNONYMS	FORMULA

SECTION II HAZARDOUS INGREDIENTS						
BASIC MATERIAL	APPROXIMATE OR MAXIMUM % WT. OR VOL.	ESTABLISHED OSHA STANDARD	LD 50		LC 50	
			ORAL	PERCUT.	SPECIES	CONC.

SECTION III PHYSICAL DATA			
BOILING POINT	°F.	VAPOR PRESSURE	mm Hg.
MELTING POINT	°F.	VAPOR DENSITY (Air=1)	
SPECIFIC GRAVITY (H <sub>2</sub> O=1)		EVAPORATION RATE ( _____ =1)	
SOLUBILITY IN WATER	Pts/100 pts H <sub>2</sub> O	VOLATILE	% Vol.                      % Wt.
APPEARANCE AND ODOR			

SECTION IV FIRE AND EXPLOSION HAZARD DATA		
FLASH POINT	FLAMMABLE (EXPLOSIVE) LIMITS	UPPER
METHOD USED		LOWER
EXTINGUISHING MEDIA		
SPECIAL FIRE FIGHTING PROCEDURES		
UNUSUAL FIRE AND EXPLOSION HAZARDS		

PRODUCT DESIGNATION

SECTION V HEALTH HAZARD DATA

TOXIC LEVEL

CARCINOGENIC

PRINCIPAL ROUTES OF ABSORPTION

SKIN AND EYE IRRITATION

RELEVANT SYMPTOMS OF EXPOSURE

EFFECTS OF CHRONIC EXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

SECTION VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

INCOMPATIBILITY (Materials to Avoid)

HAZARDOUS DECOMPOSITION PRODUCTS

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

WASTE DISPOSAL METHOD

SECTION VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS LOCAL EXHAUST

PROTECTIVE EQUIPMENT (Specify Types) EYE

MECHANICAL (General)

GLOVES

SPECIAL

RESPIRATOR

OTHER PROTECTIVE EQUIPMENT

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

OTHER PRECAUTIONS

Signature \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

TABLE X-1

COMMON, BRAND- AND TRADE NAMES FOR TRICHLOROETHYLENE\*

Acetylene Trichloride	TRI
Algylen	Triad
Blacosolv	Trial
Chlorylen	Triasol
Circosolv	Trichloran
Dow-Tri	Trichloren
Ethynyl Trichloride	Trichloroethene
Fleck-Flip	Triclene
Gemalgene	Tri-Clene
Lanadin	Trielene
Lethurin	Trielin
Nialk	Trilene
Perm-A-Clor	Triline
Petzinol	Trimar
Philex	Vestrol
TCE	Vitran
Threthylen	Westrosol
Trethylene	

\*From Stecher, [3] and National Safety Council. [4]

TABLE X-2

## PROPERTIES OF TRICHLOROETHYLENE

Molecular Formula	-	$C_1CH=CCl_2$
Formula Weight	-	131.40
Boiling Point	-	87.1 C at 760 mm Hg
Melting Point	-	-73 C
Liquid Density	-	1.465 g/ml at $\frac{20\text{ C}}{4\text{ C}}$
Solubility	-	0.1 part per 100 parts of water at 25 C; mixes freely with alcohols, ethers; and many other organic solvents.
Flash Point	-	None by standard methods
Ignition Temperature	-	463 C
Vapor Pressure	-	100.0 mm mercury at 31.5 C 74.3 mm mercury at 25.0 C 10.0 mm mercury at -11.8 C 1.0 mm mercury at -42.9 C
Vapor Density	-	4.5 (air = 1.0)
Odor Threshold	-	21.4 ppm [8]
Conversions	-	1 ppm = 5.38 mg/m <sup>3</sup> @25 C 1 mg/liter = 186.1 ppm

TABLE X-3

TRICHLOROETHYLENE EXPOSURES IN  
SWEDISH ENGINEERING WORKSHOPS\*

Job Location	Minutes**	Trichloroethylene (ppm)	
		Range	Mean
Open Air	2.5	0-0	0
Less than 5 meters from tank	4.8	0-140	23
Greater than 5 meters from tank	4.5	0-80	7
Sorting, before degreasing	2.7	0-375	32
Degreasing	4.7	0-400	50
Sorting, after degreasing	2.4	0-375	46
Cleansing	4.8	10-375	225
Inspection of tank	4.7	0-375	70
Refilling	4.8	10-415	36

\*Ahlmarm et al [111]

\*\*Mean time spent by each operator at the various locations.  
It is understood that an operator may perform at a given  
location with greater frequency than another operator.

TABLE X-4

ENVIRONMENTAL HEALTH STANDARDS FOR TRICHLOROETHYLENE  
PROMULGATED BY VARIOUS COUNTRIES

Country	Acceptable Concentration	
	ppm	mg/cu m
Bulgaria	(10)	50
Czechoslovakia	46	250
Finland	100	525
Germany	100	535
Hungary	(10)	50
Japan	100	520
Poland	(10)	50
Rumania	(10)	50
United Arab Republic	200	(1075)
U.S.S.R.	(2)	10
Yugoslavia	100	520

Values in parentheses are approximate conversions where the standard was published in only one of the two units listed above.

From [118]