

DEPARTMENT OF THE ARMY SUPPLY BULLETIN

SULFUR TRIOXIDE SOLUTION (FS)

TITANIUM TETRACHLORIDE, FM

SERVICEABILITY STANDARD

Headquarters, Department of the Army, Washington, D.C.

25 June 1964

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**1. Purpose and Scope.** *a. Purpose.* This bulletin supplements SB 3-30 in providing the method for determination of the serviceability of Sulfur Trioxide Solution (FS) and Titanium Tetrachloride, FM.

*b. Scope.* The provisions of this bulletin are applicable to all elements of the Department of the Army including overseas commands.

**2. Basis and Interval of Surveillance** *a. Basis* Conduct surveillance on the basis of manufacturer's lots, grand lots, or mixed lots.

*b. Interval (for Sulfur Trioxide Solution (FS) only).* Conduct surveillance at an interval not to exceed 3 years, except visual examination for which the interval will not exceed 1 year.

*c. Interval (for Titanium Tetrachloride, FM, only).* Conduct surveillance at an interval not to exceed 2 years.

*d. Formation of Grand Lots.* Manufacturer's lots will be combined to form grand lots provided the following criteria are met:

(1) *Kind and type.* Containers must be of the same kind and type.

(2) *Manufacturer.* Material must be the product of the same manufacturer.

(3) *Storage.* Containers must be stored under similar conditions at the same depot.

(4) *Class.* Material must be of the same serviceability classification (serviceability known based upon prior surveillance, or serviceability unknown).

*e. Formation of Mixed Lots.* Mixed lots will be formed from those containers of material on which the name of the manufacturer or the lot number are obliterated. The size of the mixed lot shall be no larger than one hundred containers.

*f. Reporting Forms.* Use DA Form 985 (Data Sheet for Grand Lots, Miscellaneous Lots, and Depot Lots), DA Form 984 (Materiel Serviceability Report), DA Form 987 (Test Data Sheet, Serviceability of Materiel other

\*This bulletin supersedes SB 3-30-277, 15 October 1956.

than Burning Type Munitions), and DA Form 988 (Visual Inspection Sheet, Serviceability of Materiel).

**3. Safety Precautions for Sulfur Trioxide (FS).** Sulfur trioxide solution (FS) is a highly corrosive acid solution and safety precautions outlined in technical manuals and

safety bulletins for this material should be strictly adhered to during surveillance.

**4. Sampling.** a. *Sulfur Trioxide Solution (FS) and Titanium Tetrachloride, FM.* Select sample containers from each manufacturer's lot, or grand lot in accordance with table I. For mixed lots use table II.

Table I. Manufacturer's lots and grand lots (FS and FM)

Lot size	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Up to 100 .....	15	0	2	14	29	1	4	3	0.30
101 to 500 .....	30	1	4	29	59	3	10	4	.28
501 to 1,000 .....	49	2	8	44	93	5	17	5	.27
1,001 and over .....	57	2	9	74	131	7	25	7	.27

Table II. Mixed lots (FS and FM)

Lot size	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
250 or less .....	30	1	4	29	59	3	10	5	0.50

Columns:

- (1) First sample size (visual).
- (2) Acceptance number-type I defectives (first sample).
- (3) Acceptance number-type II defects
- (4) Second sample size.
- (5) Combined sample size.
- (6) Acceptance number-type I defectives.
- (7) Acceptance number-type II defects.
- (8) Number of containers sampled for test (FS only).
- (9) Acceptance constant (K) (FS only).

b. The combined sample size (col. (5)) and associated acceptance numbers (cols. (6) and (7)) will be used when the surveillance (visual only) interval exceeds 1 year by 25 percent or more, or when approximate date of last surveillance is unknown. The combined sampling plans may be used when additional assurance of quality is desired.

c. In using sampling table for visual inspection, when the number of type I defectives exceeds the acceptance number shown in column (2) but does not exceed the acceptance number shown in column (6), select a second sample size indicated in column (4). The acceptance numbers shown in column (6) must be used for evaluation in every case that a second sample is selected. No second sample is ever selected for evaluation of type II defects.

d. In evaluating test results obtained in paragraph 5a(2), the following statistic will be computed:

$$X-KR$$

Where: X=average of test results.  
R=range (difference between highest and lowest results).  
K=factor in column (9), sampling table.

e. Because of the hygroscopic nature of sulfur trioxide solution, extreme care shall be taken to avoid absorption of moisture by the sample during sampling and subsequent sample handling and testing. Those containers selected for removal of sulfur trioxide solution for test will be sampled as follows:

- (1) Roll container in order to mix contents thoroughly.
- (2) Sulfur trioxide solution will be drawn from the container through a coneshaped glass tube by means of an aspirator bulb induced vacuum. The cane-shaped glass tube will be emptied into a ground glass stopper bottle approximately 100 ml. in capacity.
- (3) The container from which a sample was withdrawn and the sample bottle

will be marked with appropriate identification.

- (4) Samples will be tested in accordance with paragraph 5a (2).

**5. Inspection.** *a. Sulfur Trioxide Solution (FS) and Titanium Tetrachloride, FM.* Subject samples selected from each manufacturer's lot, grand lot, or mixed lot to visual examination.

- (1) *Visual Examination.* Examine each sample container for the following:

*Check points      Type of defect*

- (a) rusting or pitting of metal container(s) (more than 25 percent of the surface of container covered with rust or pitted)
- (b) Leaky container
1. Perforated      I
  2. Closure missing I
  3. Closure damaged      I
  4. Closure insecure      I
- (c) Bulged container
- (d) Lightly rusted or inadequately coated metal container(s) (10 to 25 percent of the surface of container covered with rust)      II
- (Note. Indicate condition(s) causing defect.)

- (2) *Test (total acidity) Sulfur Trioxide Solution (FS).* Subject to test samples selected from

each manufacturer's lot, grand lot, or mixed lot.

(a) *Procedure.* Weigh approximately 0.2 gram of sulfur trioxide solution to the nearest milligram in a sealed glass bulb. Place the bulb in a strong walled bottle containing approximately 100 ml. of water. Break the bulb by shaking and continue to shake until the fumes disappear. Titrate with 0.1 normal sodium hydroxide solution using methyl red as an indicator.

(b) *Method of calculation.* Calculate the total acidity of sample as SO<sub>3</sub>, in the following manner:

$$\frac{\text{ml. sodium hydroxide} \times \text{normality} \times 4.003}{\text{weight of sample}}$$

(c) *Requirement.* The derived acidity result when calculated using the statistical formula outlined in paragraph 4d shall be equal to, or greater than 95.0 percent.

- (3) *Special Instruction.* Installations other than depots or overseas commands need not perform test in paragraph a(2) ; however, sulfur trioxide solution containers should be examined in accordance with paragraph a(1).

By Order of the Secretary of the Army:

**EARLE G. WHEELER,**  
*General, United States Army,*  
*Chief of Staff.*

Official:

**J. C. LAMBERT,**  
*Major General, United States Army,*  
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USAAPSA (CBR Br) (5)  
MDW (1)  
Armies (1)  
Corps (2)  
Div (5)  
Bde (2)  
Regt/Gp/BG (2)  
Bn (1)  
Instl (2)  
Army Depots (5)  
Arsenal (1) except  
CBR Arsenals (3)

NG: State AG (3); Div (1).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

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## The Metric System and Equivalents

### *Linear Measure*

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

### *Weights*

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

### *Liquid Measure*

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

### *Square Measure*

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

### *Cubic Measure*

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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