

Specification 5 100-305b
February 1986

Superseding
Specification 5 100-305a
April 1982

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SPECIFICATION FOR

WETTING AGENT

1. General

1.1. Purpose and Description. The primary purpose of wetting agents as defined in this specification is to help improve spreading and penetration of water into heavy duff, rotten logs, and ashes during mop-up and for initial attacks on matted grass, pine needles, and grain fields in wildland and forest fires; thereby, completely extinguish smoldering fires.

The wetting agent is defined as a chemical compound which, when added to plain water in proper amounts, will materially reduce the surface tension of the water and increase penetration and spreading abilities. The wetting agent is required to meet desired qualities specified herein as regards to efficiency, solubility, foaming property, corrosiveness, flash point, flammability, or fire point, biodegradability, and health and safety.

1.2. Contracting Officer's Instructions.

1.2.1. Required Options. There are no required options in this specification.

1.2.2. Other Options. Bid invitations and instructions may specify options selected by the contracting officer under the following paragraphs:

4.2.1. General Inspection and Tests. Specify locations and arrangements of inspection and tests.

4.3. Test Procedure. Specify tests to be conducted in lieu of independent laboratory tests.

5.1. Packaging. Specify other packaging as required.

1.2.3. Warranty. The contractor shall guarantee to replace without cost to the Government all products that are found to be defective for a period of one year from the date of delivery at FOB destination.

2. Applicable Documents.

2.1. Government Documents. The following Government documents of the issue in effect on the date of invitation for bids form a part of this specification to the extent herein specified.

Federal Specifications

PPP-B-636 Boxes, Shipping, Fiberboard

Federal Standard

Fed. Std. 102 Preservation, Packaging, and Packing Levels

Fed. Std. 123 Marking for Domestic Shipment

Military Standard

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes.

U.S. Department of Commerce

National Technical Information Source [NTIS], Pesticide Assessment Guidelines, Subdivision F, Hazard Evaluation: Human and Domestic Animals, U.S. Environmental Protection Agency, Washington, DC - protocols: FIFRA guidelines, Subdivision F, Series 81 - Acute Toxicity and Irritation Studies.

2.2. Other Publications. The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids shall apply:

American Society for Testing and Materials (ASTM)

- A29 General Requirements for Standard Specification for Steel Bar, Carbon and Alloy, Hot Rolled and Cold Finished
- B16 Standard Specification for Free-cutting, Brass Rod, Bar and Shapes for use in Screw Machines
- B69 Standard Specification for Rolled Zinc
- B221 Standard Specification for Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- D56 Standard Method of Test for Flash Point by Tag Closed Tester
- D92 Standard Method of Test for Flash and Fire Point by Cleveland Open Cup
- D93 Standard Method of Test for Flash Point by Pensky-Martens Closed Tester

- D1173 Standard Method of Test for Foaming Properties of Surface-active Agents
- D2281 Standard Method of Evaluation of Wetting Agents by the Skein Test
- D2667 Standard Method of Test for Biodegradability of Alkylbenzene Sulfonates
- G31 Standard Recommended Practice for Laboratory Immersion Corrosion Testing of Metals
- G46 Recommended Practice for Examination and Evaluation of Pitting Corrosion.

ASTM publications can be obtained by writing to the following:

American Society for Testing and Materials
 1916 Race Street
 Philadelphia, PA 19103

National Association of Corrosion Engineers

NACE Standard TM-01-69, "Test Method for Laboratory Testing of Metals for the Process Industries", March 1969 (or latest revision).

Stillmeadow, Inc. Biological Testing Laboratory

Protocols: S9-F14, S9-F24, S9-F34, S9-F43, S9-F66

NOTE: Copies of Government documents and other publications required by contractors in connection with specific procurement functions should be obtained from the procurement activity or as directed by the contracting officer.

3. Requirements.

3.1. Qualification. The wetting agent furnished under this specification shall be prequalified in accordance with 4.1.

3.2. Chemical Composition. The wetting agent shall be in concentrated form, consist of any chemical composition, and shall meet the performance and test requirements specified herein. The wetting agent shall be the type that increases the spreading and penetration of water on and into porous material such as matted grass, pine needles, grain fields, heavy duff, burned and rotten logs, ashes, etc., in forest and wildland fire areas. It shall not be flammable nor increase the flammability of any material it comes in contact with.

3.3. Wetting Action Efficiency. Wetting action efficiency shall be less than 10 seconds as determined by averaging three trial tests when tested in accordance with 4.3.1. The mix ratio of concentrate and water required to meet the less than 10 second value will be the "qualified use level" of the wetting agent.

3.4. Solubility. The wetting agent, when mixed in accordance with value established in 3.3., shall be considered soluble when the average of the three

trial tests in water is less than 100 revolutions when tested in accordance with 4.3.2.

3.5. Foaming. The maximum foam height of the wetting agent when mixed in accordance with value established in 3.3., as determined by the average of the three trial tests shall be less than 6.5 inches and after 5 minutes be less than 2.0 inches when tested in accordance with 4.3.3.

3.6. Corrosiveness. The corrosive effect of the wetting agent in its concentrated form shall be not more than 3 mils per year, no pits more than 2 mils deep on aluminum alloy 2024-T3, ASTM B221, zinc ASTM B69, cold-finished carbon steel ASTM A29, and free-cutting brass No. 360, 836, 838, or 844, ASTM B16, when tested in accordance with 4.3.4.

3.7. Flash Point. The flash point of the wetting agent in its concentrated form shall not be below 140 F when tested in accordance with 4.3.5.

3.8. Flammability or Fire Point. The flammability or fire point of the individual liquid chemical components used in production of the wetting agent shall be below 392 F when tested in accordance with 4.3.6.

3.9. Biodegradability of Anionic Surfactants. The mixed wetting agent, when mixed in accordance with the value established in 3.3., and the concentrate containing anionic surfactant shall be biodegradable and biodegradability shall be acceptable when the anionic surfactant reduction is 80 percent or greater when tested in accordance with 4.3.7.

3.10 Health and Safety. The toxicity of the mixed wetting agent, when mixed in accordance with the value established in 3.3., and concentrate of the wetting agent as it is shipped or operationally handled shall meet the performance requirements exhibited in tables 1 and 2 when tested in accordance with procedures and rating scales defined in 4.3.8 Health and Safety. Where Primary Eye and Primary Dermal limits are exceeded for components of the retardant as they are operationally handled, the manufacturer's recommended gear/handling procedures will be reviewed, and, if acceptable, approved by the Forest Service.

Table 1. Toxicity requirements for the wetting agent mixed at recommended use level

<u>Test</u>	<u>Requirement</u> ^{1/}
Acute oral toxicity	LD ₅₀ > 5000 mg/kg
Acute dermal toxicity	LD ₅₀ > 2000 mg/kg
Primary eye irritation	Mildly irritating
Primary dermal irritation	Primary irritation score < 5.0

^{1/} Requirement definitions provided in the test procedures for respective toxicity test.

Table 2. Toxicity requirements for the components of the wetting agents as they are shipped or operationally handled.

<u>Test</u>	<u>Requirement</u> ^{1/}
Acute oral toxicity	LD ₅₀ > 500 mg/kg. If LD ₅₀ > 50 but < 500, demonstrate protective gear/handling procedures. No LD ₅₀ ≤ 50 are acceptable.
Acute dermal toxicity	LD ₅₀ > 2000 mg/kg or if LD ₅₀ > 200 but < 2000, demonstrate protective gear/handling procedures. No LD ₅₀ < 200 are acceptable.
Primary eye irritation	Mildly irritating. or if more irritating, demonstrate protective gear/handling procedures.
Primary dermal irritation	Primary irritation score < 5.0 or, if more irritating, demonstrate protective gear/handling procedures.
Acute inhalation toxicity	Inhalation LC ₅₀ > 2.0 mg/l if oral LD ₅₀ is ≤ 500 mg/kg or dermal LD ₅₀ ≤ 1000 mg/kg.

^{1/} Requirement definitions provided in the test procedure for respective toxicity test.

4. Sampling, Inspection, and Testing Procedures.

4.1. Qualification, Inspection, and Tests.

4.1.1. Submission Procedures. A manufacturer desiring to have its product qualified under this Specification shall make a request to the National Forest Systems Liaison Officer (NFSLO), Aviation and Fire Management, Forest Service, USDA, P.O. Box 2417 Washington, D.C. 20013. The NFSLO will provide the manufacturer with submission instructions and forms for product evaluation.

4.1.2. Submission of Test Results. The manufacturer shall be responsible for performance of all tests defined herein at an independent laboratory acceptable to the Government. The results of this testing shall be certified by the Independent laboratory and submitted to the Manager, San Dimas Equipment Development Center, USDA, Forest Service, 444 E. Bonita Ave, San Dimas, CA 91773 for review and recommendations for approval.

4.1.3. Documents.

4.1.3.1. Independent Laboratory Acceptability Questionnaire. The manufacturer shall submit, prior to having tests conducted, a complete reply to the Independen-

dent Laboratory Acceptability Questionnaire (Form EDC 7100-21). Laboratory approval must be granted by the Manager, San Dimas Equipment Development Center, before any certification testing is done.

4.1.3.2. Formulation Disclosure Sheet. Prior to initiating laboratory testing the manufacturer shall submit a Formulation Disclosure Sheet - Wetting Agent (Form EDC 7100-27). Required information includes formulation ingredients, product identification numbers, use level, (correlates to the wetting action efficiency minimum test concentration) arrived at in 4.3.1. and other specifics.

4.1.3.3. Materials Safety Data Sheet. The manufacturer shall complete the U.S. Department of Labor, Occupational Safety and Health Administration, Material Safety Data Sheet (Form OSHA-20). Required information includes special handling procedures, protective clothing required and other safety precautions/as well as other specifics.

4.1.3.4. Summary of Fire Chemical Toxicity Tests. To be completed and submitted by the independent laboratory conducting the health and safety tests in accordance with 3.10.

4.1.3.5. Container Label. The manufacturer shall submit a sample label with information printed on it in accordance with 5.3. Labeling.

4.1.4. Notice of Qualification. Notice of qualification will be issued upon determination by the Government that the wetting agent meets the requirements of this specification.

4.1.5. Notice of Failure to Qualify. The manufacturer will be notified in writing if qualification cannot be granted.

4.1.6. Requalification. If any changes are made to the contents or composition of the product or supplier of materials used in the formulation of the product, the contractor shall notify SDEDC immediately in writing. The need for requalification will be determined by the Government.

4.2. Acceptance Inspection and Tests.

4.2.1. General Inspection and Tests. The contractor is responsible for performance of all inspection and test requirements of this specification prior to acceptance by the Government. The Government reserves the right to perform any of the inspection and test requirements set forth in this specification where such inspection and tests are deemed necessary to assure that the product conforms to prescribed requirements.

When Government inspection and tests to determine compliance with this specification become necessary, the contracting officer will specify locations and arrangements. In case of factory inspections, the contractor shall furnish the inspector all reasonable facilities for his work.

4.2.2. Lot. All products delivered in one shipment will be considered a "lot" for the purposes of acceptance inspection and tests.

4.2.3. Sampling for Lot Acceptance. A random sample, amount depending on container size, i.e., vials, bottles, or larger containers, will be selected from each lot for inspection in accordance with General Inspection Level II, Table 1, single sampling for normal inspection, MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes. The acceptable quality level shall be 4.0 percent defective.

4.2.4. Inspection and Tests.

4.2.4.1. Visual Inspection. The sample will be visually inspected to verify compliance with the requirements of this specification. If the sample contains significant visual defects, including leakage of container or contamination of the product, it will be considered as defective and rejected when the 4.0 percent quality level is exceeded.

4.2.4.2. Lot Acceptance Tests. At the discretion of the Government, a random sample will be subjected to any or all the tests in 4.3. conducted by the Government or an independent test laboratory. If the sample fails any of these tests, it shall be considered defective and the lot rejected.

4.2.4.3. Rejected Lots. Rejected lots may be reoffered for Government inspection provided all defective products have been removed. Resubmitted lots will be inspected by the Government to determine compliance with requirements of this specification.

4.3. Test Procedure. The wetting agent will be subjected to various tests indicated below as required by 4.1.1. and 4.2.1. Unless specified otherwise by the contracting officer, the contractor is responsible for having the tests conducted by an independent laboratory and the submission of the certified test results to the Government.

4.3.1. Evaluation of Wetting Agent Efficiency. As required by 3.3., the efficiency of the wetting agent will be determined by conducting three trial tests in accordance with ASTM D2281, Standard Method of Evaluation of Wetting Agents by the Skein Test. The "qualified use level" will be the mixture of distilled water and wetting agent concentrate arrived at in determining efficiency in the Skein Test. The test concentrate arrived at in meeting the less than 10 second requirement will establish the use level at which the wetting agent will be qualified.

4.3.2. Solubility Test. When testing for solubility as required by 3.4., use the following procedure:

4.3.2.1. Place 600 ml of distilled water in a 1,000-ml Griffin beaker.

4.3.2.2. With the "lightning" heavy-duty Model V laboratory stirrer (see fig. 1), or comparable stirrer, with an adjustable speed power supply, set the stirrer shaft to rotate at 200 ± 5 rpm.

4.3.2.3. Position the stirrer shaft in the center of the beaker with the bottom of the shaft 0.40 ± 0.20 inch from the inside bottom of the beaker and turn on the stirrer. Readjust the rpm to 200 ± 5 rpm, then turn off the stirrer.

4.3.2.4. After the distilled water has settled (no visible movement), gently add wetting agent concentrate (by letting the concentrate run down the inside wall of the beaker) until the "qualified use level" established in 4.3.1. is reached.

4.3.2.5. Start the stirrer and rotate 10 revolutions.

4.3.2.6. Stop the stirrer and examine the mixture.

4.3.2.7. If the "qualified use level" has not dissolved* in the distilled water, rotate the stirrer another 10 revolutions then reexamine the mixture. Repeat this procedure until the concentrate is dissolved or until rotation has reached 100 revolutions.

* To determine when the "qualified use level" is dissolved, 600 ml of distilled water in a 1,000 ml beaker is compared with the "qualified use level". The visual examination will be made with a flat white background. Any changing cloudiness or other nonhomogeneous appearance of the mixture will be considered as undissolved. (Reflections or shadows from the foam at the top of the mixture should be carefully observed and discounted.)

4.3.2.8. Record the number of revolutions required to dissolve the "qualified use level".

4.3.2.9. Conduct three trial tests with distilled water.

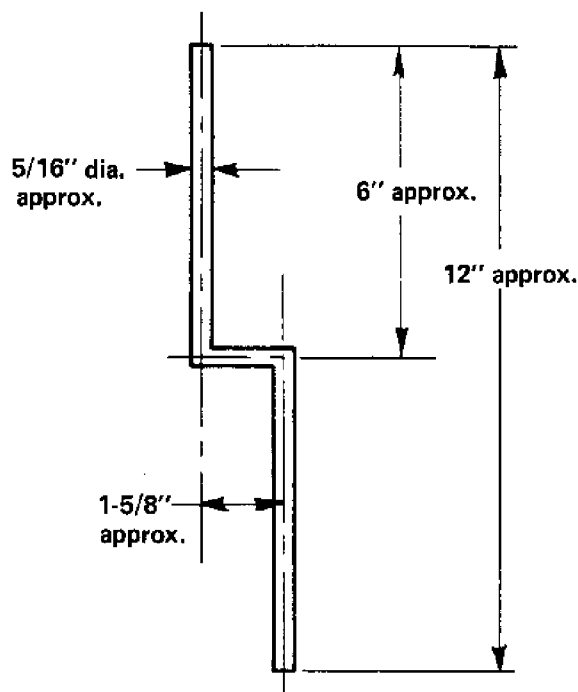


Figure 1. Stirrer shaft for Lightning Heavy-Duty Model V laboratory stirrer.

4.3.3. Foaming Test. Foaming property shall be determined as required by 3.5. by conducting three trial tests of the "qualified use level" in accordance with ASTM D1173, Standard Method of Test for Foaming Properties of Surface-active Agents.

4.3.4. Corrosiveness Test. As required by 3.6., the corrosive effect of the concentrated wetting agent will be determined by applying ASTM G31, Standard Recommended Practice for Laboratory Immersion Corrosion Testing of Metals. The metal specimens will be strip coupons 2 X 1 X 1/16 or 4 X 1 X 1/8 inch not stamped, and no pits prior to testing. Coupon surface area to liquid concentrate ratio of 20 ml per cm² will be maintained. The coupon will be cleaned and weighed prior to testing on an analytical balance to an accuracy of at least + 0.5 mg. One-half of the coupon will be immersed in concentrated wetting agent. Temperature will be 70 + 5 F. After immersion of the coupon, the solution will not be disturbed or aerated for 30 days. The test coupon will be cleaned chemically (Ref: NACE TM-01-09) after removal from the solution and air dried. The dried specimen will be weighed again and the difference in weight before and after immersion will be used to calculate the corrosion factor by the following formula:

$$\frac{534 \times [\text{initial wt.} - \text{final wt.} - \text{loss by control (mg)}]}{(d) \text{ density} \times (A) \text{ area} \times (t) \text{ time}} = \text{mils/year}$$

Where: WL = weight loss in mg
d = density in g/cm³
A = total surface area in square inch
t = time in hours

Pit depths will be measured in accordance with ASTM G46, Recommended Practice for Examination and Evaluation of Pitting Corrosion.

4.3.5. Flash Point Test. As required by 3.7., the flash point of the concentrated wetting agent will be tested in accordance with ASTM D56 Standard Method of Test for Flash Point by Tag Closed Tester, or ASTM D93, Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, as appropriate depending on viscosity of the wetting agent.

4.3.6. Fire Point Test. As required by 3.8., the individual liquid chemical compounds of the wetting agent will be tested in accordance with ASTM D92, Standard Method of Test for Flash and Fire Points by Cleveland Open Cup.

4.3.7. Biodegradability Test. As required by 3.9., the biodegradability of the wetting agent will be determined for anionic surfactant removed when tested in accordance with ASTM D2667 Standard Method of Test for Biodegradability of Alkylbenzene Sulfonates.

4.3.8. Health and Safety. As required by 3.10., Toxicity Tests will be conducted on the concentrate and the mixed wetting agent (the qualified use level established in 3.8.) in accordance with FIFRA guidelines, Subdivision F, Series 81-Acute Toxicity and Irritation Studies (U.S. Department of Commerce, National

Technical Information Source [NTIS], Pesticide Assessment Guidelines, Subdivision F, Hazard Evaluation: Human and Domestic Animals, U.S. Environmental Protection Agency, Washington, DC)-protocols:

Acute Oral Toxicity Study-Series 81-1 (Stillmeadow, Inc. Protocol S9-F14)
Acute Dermal Toxicity Study-Series 81-2 (Stillmeadow, Inc. Protocol S9-F24)
Primary Eye Irritation Study-Series 81-4 (Stillmeadow, Inc. Protocol S9-F34)
Primary Dermal Irritation Study-Series 81-5 (Stillmeadow, Inc. Protocol S9-F43)

Series 81-4, Primary Eye Irritation, in addition to the standard tests, shall include treatment of three test animals which, 30 seconds after treatment, shall have the treated eye washed with room temperature deionized water for 1 minute. All treatments and examinations to remain the same.

When deemed necessary, as indicated by table 2, Acute Inhalation Toxicity Study will follow protocol series 81-3 (Stillmeadow, Inc. Protocol S9-F66).

5. Preparation for Delivery.

5.1. Packaging. Unless specified otherwise by the contracting officer, the wetting agent shall be packaged in unbreakable leakproof bottles containing 1 U.S. quart (0.9464 l) according to standard commercial practice so as to insure acceptance by common or other carrier for safe transportation at the lowest rate. Packing boxes shall be class domestic, variety SW, grade 275, style RSC with dividers, in accordance with Federal Specification PPP-B636. Preservation packing shall be level B in accordance with Federal Standard No. 102.

5.2. Marking. Shipping container or package shall be marked according to Federal Standard No. 123.

5.3. Labeling. Container labels shall include the following information:

1. Product identification.
2. Manufacturer's name and trademark.
3. Number and date of this specification.
4. Qualified use level.
5. Instructions for mixing to the qualified use level for water container sizes 5 gal, 50 gal, 100 gal, 200 gal, 300 gal, 600 gal, and 1,000 gal. (It would be desirable to have the container or label identify graduated capacity increments for ease of field mixing of concentrate and water.)

6. Notes.

6.1. Preparing Activity. USDA Forest Service, Equipment Development Center, 444 East Bonita Avenue, San Dimas, CA 91773.

NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the U.S. Government thereby incurs no responsibility nor any obligation whatsoever.