

Tennessee Department of Transportation
Division of Materials and Tests

Emulsified Asphalt Certified Supplier Requirements (SOP 3-2)

Purpose- The purpose of this document is to establish the minimum requirements for an emulsified asphalt supplier to become certified in Tennessee, and therefore provide emulsified asphalt on TDOT projects.

Policy- All Emulsified Asphalt supplied to a TDOT project must come from a certified emulsified asphalt supplier and be in compliance with TDOT Specifications (Section 904). To become certified, the supplier or manufacturer must submit a quality control plan (QCP) in resemblance with AASHTO R-26, and as modified or required in this procedure, to TDOT for approval. The supplier must also demonstrate a history of quality control data and proof of full QCP implementation. New emulsified asphalt suppliers must submit three (3) consecutive split samples for each emulsion being shipped for TDOT verification testing.

Procedure- Definitions- The *manufacturer*, as further referenced in this procedure will be the last source to produce or modify the final product. The *supplier* will be the last source to handle the product before being shipped, and the supplier will provide the emulsion certification report with each shipment. In many instances, the manufacturer and the supplier will be one in the same. When using a live batching system, a lot will be defined as once every two weeks.

Laboratory- Each manufacturer and supplier must have a designated laboratory to either certify the emulsion or to conduct quality control testing. Laboratories used to certify emulsified asphalts must be AMRL Accredited in the following tests or they must be under the direct jurisdiction of an accredited laboratory and participate in AMRL proficiency testing:

1. AASHTO T-59, Residue by Evaporation
2. AASHTO T-59, Residue by Distillation
3. AASHTO T-59, Sieve Test
4. AASHTO T-59, 24 Hour Storage Stability Test
5. AASHTO T-59, Saybolt Viscosity
6. AASHTO T-51, Ductility Test
7. AASHTO T-49, Penetration Test

Supplier laboratories that conduct quality control testing must have equipment to perform a Saybolt-Furol viscosity test, a Sieve test, and Percent Residue by evaporation or Percent Distillate. Quality Control testing may be defined by the supplier for rapid testing. However, all Specification Compliance testing shall follow AASHTO current test methods. Personnel conducting quality control testing must be qualified; either by training from the equipment manufacturer, trained under the direct supervision of an individual who routinely completes AMRL demonstrations and proficiency testing, or trained by other highly proficient and competent individuals with emulsified asphalt testing experience.

Quality Control Plan (QCP)- Each manufacturer and supplier must submit a QCP for approval. The QCP shall contain the information required in resemblance with Section 9.1 and 9.2 (or as revised below) of AASHTO R-26. In addition the plan shall include the following:

- A plan view of the facility and description of storage tanks,

- A narrative description on how each emulsified asphalt will be blended and handled to assure a consistent product.

Testing for tanks

As a minimum *quality control* testing shall be completed on every batch added to a tank. Quality Control shall be completed before the material is shipped. *Quality Control* shall consist of the tests in Table 1.

As a minimum, TDOT will require specification compliance testing on every lot. Testing shall include all tests in *Table 1* for each emulsified asphalt.

If a tank remains idle for more than 2 weeks, it shall be tested for quality control before shipment and every 2 weeks thereafter until another batch is added to it.

Asphalt Emulsions that are used for Microsurfacing, Slurry Seals, and other Specialty Applications shall meet specification compliance testing before they may be shipped.

Each manufacturer and supplier shall keep a record of all specification compliance and quality control test results on file for immediate review by the TDOT. All records shall be retained for a minimum of 5 years.

If test results indicate a lot is not in compliance with TDOT Specifications, in addition to the resemblance of Section 9.2 of AASHTO R 26, the supplier must provide a list of all shipments (date, quantity, contract number) to which the questionable material was shipped.

Quality Assurance (Split samples, random sampling and Round Robin testing) - The manufacturer shall split samples for specification compliance testing and for quality control testing. Half of each sample shall be retained at the supplier's facility for a minimum of 30 days to act as a referee sample. The producer shall obtain samples for TDOT verification testing when requested and in the presence of a TDOT inspector (every 2 weeks).

The TDOT, at any time, may request additional quality control samples to be taken and tested by the supplier or by TDOT, for assurance purposes.

The TDOT, at any time, may request the manufacture or supplier to participate in round robin proficiency testing. TDOT will provide a reasonable time period for the test results to be submitted.

The TDOT will have the right to visit each approved supplier to review quality control activities and records, to obtain random check samples, or to inspect production.

Shipment- All shipments from the supplier must be accompanied with a completed Form DT-0293 Emulsion.

Table 1, Certified Emulsified Asphalt Suppliers Tests for Quality Control & Compliance

| | SS-1 | | AEP | | CRS-2 | | AE3 | | CRS-2P | | RS-2 | | RS-1 | |
|---|-----------------|-------------|-----------------|--------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
| | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance |
| *Saybolt-Furol Viscosity @ 77°F (seconds) | 20 - 100 | 20 - 100 | 10 - 50 | 10 - 50 | NA | NA | NA | NA | NA | NA | NA | NA | 20 - 100 | 20 - 100 |
| *Saybolt-Furol Viscosity @ 122°F (seconds) | NA | NA | NA | NA | 100 - 400 | 100 - 400 | 50 Minimum | 50 Minimum | 100 - 400 | 100 - 400 | 75 - 400 | 75 - 400 | NA | NA |
| *Storage Stability Test, 24-h, % | NA | 1 | NA | NA | NA | 1 | NA | NA | NA | 1 | NA | 1 | NA | 1 |
| ^E *Settlement, 5 days, % 24 hours | NA | NA | NA | 5 | NA | NA | NA | 5 | NA | NA | NA | NA | NA | NA |
| *Particle Charge | NA | NA | NA | NA | NA | Positive | NA | NA | NA | Positive | NA | NA | NA | NA |
| Sodium Diocyl Sulfosuccinate, % | NA | NA | NA | NA | NA | 40 Minimum | NA | NA | NA | 40 Minimum | NA | NA | NA | NA |
| *Distillate @ 500°F, % | NA | NA | 55 Maximum | 55 Maximum | NA | NA | 30 Maximum | 30 Maximum | NA | NA | NA | NA | NA | NA |
| *Oil Test, % (by Volume) | NA | NA | NA | 12.0 Maximum | NA | 3.0 Maximum | NA | 6.0 Maximum | NA | 3.0 Maximum | NA | NA | NA | NA |
| *Demulsibility min. % | NA | NA | NA | NA | NA | 40 Minimum | NA | NA | NA | NA | NA | 60 Minimum | NA | 60 minimum |
| ^D *Stone Coating | NA | NA | NA | NA | NA | NA | NA | 90 Minimum. | NA | NA | NA | NA | NA | NA |
| ^C *Cement Mix | NA | 2.0 Maximum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Sieve Test, % | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | NA | NA | NA | NA | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum |
| *Residue, % | 57 Minimum | 57 Minimum | NA | NA | NA | 65 Minimum | NA | NA | 65 Minimum | 65 Minimum | 63 Minimum | 63 Minimum | 55 | 55 |
| *Float Test, (seconds) | NA | NA | NA | 20 Minimum | NA | NA | NA | 20 Minimum | NA | NA | NA | NA | NA | NA |
| ^B Solubility in Trichloroethylene, % | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | NA | NA |
| Penetration Elastic Recovery @ 50°F, % (AASHTO T301-99) | NA | 100 - 200 | NA | NA | NA | 100 - 250 | NA | NA | NA | NA | NA | 100 - 200 | NA | 100 - 200 |
| Ductility @ 77°F, cm (AASHTO T 51) | NA | 40 minimum | NA | 40 minimum | NA | 40 minimum | NA | 40 minimum | NA | 125 minimum | NA | 40 minimum | NA | 40 minimum |
| Ductility @ 40°F, cm (AASHTO T 51) | NA | NA | NA | NA | NA | NA | NA | NA | NA | 30 Minimum | NA | NA | NA | NA |
| Softening Point, °C (AASHTO T 53-96) | NA | NA | NA | NA | NA | NA | NA | NA | NA | 100 - 126 | NA | NA | NA | NA |

* Tests shall be performed in accordance with AASHTO T 59-97

^A For Quality Control Testing, the supplier may use a defined rapid testing protocol.

^B Solubility in Trichloroethylene will be required on the base asphalt as QC every 3 months.

^C Cement Mixing Test will not be required if emulsions are used only for tack coats.

^D Stone Coating - Individual project aggregates shall be verified annually or as directed by the engineer.

^E 5 Day Settlement Test - The producer may conduct a 24 hour (1% Max) storage stability test in lieu of the 5 Day Settlement Test, if the emulsions are to be used within 5 days.

Table 1, Certified Emulsified Asphalt Suppliers Tests for Quality Control & Compliance (Continued)

| | CAE-P | | CSS-1 | | CSS-1H | | SS-1H | | TST-1P | | CQS-1H (Slurry Seals) | CQS-1H-P (Microsurface) |
|--|-----------------|--------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|--------------------------|----------------------------|
| | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | QC ^A | Compliance | Compliance | Compliance |
| *Saybolt-Furol Viscosity @ 77°F (seconds) | 10 - 50 | 10 - 50 | 20 - 100 | 20 - 100 | 20 - 100 | 20 - 100 | 20 - 100 | 20 - 100 | 10 - 75 | 10 - 75 | 20 - 100 | 20 - 100 |
| *Saybolt-Furol Viscosity @ 122°F (seconds) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Storage Stability Test, 24-h. % | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | NA | NA | NA |
| ^E *Settlement, 5 days, % 24 hours | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Particle Charge Sodium Diocyl Sulfosuccinate, % | NA | Positive | NA | Positive | NA | Positive | NA | NA | NA | NA | Positive | Positive |
| *Distillate, % (by volume) | 55 Maximum | 55 Maximum | NA | NA | NA | NA | NA | 43 | NA | NA | NA | NA |
| *Oil Test, % (by Volume) | NA | 12.0 Maximum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Demulsibility min. % | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Stone Coating | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| ^C *Cement Mix | NA | NA | NA | 2.0 Maximum | NA | 2.0 Maximum | NA | 2.0 Maximum | NA | NA | NA | NA |
| *Sieve Test, % | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum | 0.1 Maximum |
| *Residue, % | NA | NA | 57 Minimum | 57 Minimum | 57 Minimum | 57 Minimum | 57 | 57 | 55 - 60 | 55 - 60 | 62 Minimum | 62 Minimum |
| *Float Test. (seconds) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| ^B Solubility in Trichloroethylene, % | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | NA | 97.5 Minimum | 97.5 Minimum |
| Penetration | NA | 300 Minimum | NA | 100 - 250 | NA | 40 - 90 | NA | 40 - 90 | NA | 75 - 150 | 40 - 90 | 40 - 90 |
| Elastic Recovery @ 50°F, % (AASHTO T301-99) | NA | NA | NA | NA | NA | NA | NA | NA | NA | 25 Minimum | NA | NA |
| Ductility @ 77°F, cm (AASHTO T 51) | NA | 40 minimum | NA | 40 minimum | NA | 40 minimum | NA | 40 minimum | NA | NA | 40 minimum | 70 minimum |
| Ductility @ 40°F, cm (AASHTO T 51) | NA | NA | NA | NA | NA | NA | NA | NA | NA | 10 - 35 | NA | NA |
| Softening Point, °C (AASHTO T 53-96) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 135 minimum |

* Tests shall be performed in accordance with AASHTO T 59-97

^A For Quality Control Testing, the supplier may use a defined rapid testing protocol.

^B Solubility in Trichloroethylene will be required on the base asphalt as QC every 3 months.

^C Cement Mixing Test will not be required if emulsions are used only for tack coats.

^D Stone Coating - Individual project aggregates shall be verified annually or as directed by the engineer.

^E 5 Day Settlement Test - The producer may conduct a 24 hour (1% Max) storage stability test in lieu of the 5 Day Settlement Test, if the emulsions are to be used within 5 days.

Appendix A: Rapid Testing Protocol for Quality Control Testing

Method for Rapid Sieve Test

Purpose: A rapid method for sieve test of emulsified asphalt for quality control purposes.

Scope: This method identifies asphalt particles or other discrete solids larger than 20 mesh.

Safety: Utilize safety precautions and personal protective equipment according to facility procedures. Dispose of materials according to facility procedures.

Apparatus

- #20 mesh sieve having a 76.2-mm frame or a piece of #20 mesh wire cloth approximately 3" by 3"
- Sieve pan or container to retain residue during drying period
- Balance capable of weighing 1000 +/- 1 g.
- Balance capable of weighing 500 +/- 0.1 g

Procedure:

1. Obtain sample using proper sampling procedure
2. The temperature of the emulsion sample is related to the emulsion viscosity.
For emulsions less than 100 SSF @ 25°C perform test at room temperature. Condition sample to room temperature in a closed container using an oven, water bath or allow to cool on counter followed by stirring to achieve homogeneity.

For all other emulsions perform test at $50 \pm 3^\circ\text{C}$. Condition sample in a closed container using an oven, water bath or allow to cool on counter followed by stirring to achieve homogeneity.
3. Once the sample is conditioned remove any skin that may have formed during the conditioning period.
4. Weigh sieve or screen assembly to nearest 0.1g.
5. Pour 1000g +/- 1g of emulsion through sieve or screen
6. Gently rinse sieve or screen with distilled water.
7. If no material is retained on the sieve or screen the test is considered passing.
8. If material is retained, remove free water from the bottom and sides of sieve. Care should be used to not disturb particles. Weigh wet assembly. If the difference between wet and dry assembly weights, "wet weight", is less than 1.0g (failure threshold) the test is considered passing.
9. If the wet weight exceeds 1.0g the sieve assembly will be placed in an oven to dry. During the drying period the assembly can be periodically weighed. At anytime, if the weight gain is less than 1 g (failure threshold) the test will be considered passing.

Method for Rapid Residue by Evaporation Test

Purpose: A rapid residue content test method for emulsified asphalt quality control purposes.

Scope: This method determines residue content of an asphalt emulsion.

Safety: Utilize safety precautions and personal protective equipment according to facility procedures. Dispose of materials according to facility procedures.

Apparatus

- Suitable metal container for evaporation. Capacity should be large enough to retain splatters.
- Balance capable of 1000 +/- 0.1 g.

Procedure:

10. Obtain sample using proper sampling procedure
11. Tare a metal container and weigh into it 50 +/- 0.1 g of emulsion.
12. Heat container using a direct flame or hot plate. Splattering can be controlled by adjusting the heat source to prevent localized overheating and by constantly moving container.
13. Continue heating until sample is smooth or has reached a constant weight. Record weight of container and residue.
14. Determine residue. Divide remaining net residue by the original sample weight and multiply by 100.

For CAEP, AE-P or AE-3 emulsions reported as distillate percentage.

- Distillate % = 100 - % residue

For TST-IP

- % residue range, 56 - 59

15. If results fail to meet material specifications the standard distillation or evaporation will be performed.

Method for Rapid Saybolt-Furol Viscosity Test

Purpose: A rapid viscosity test method for emulsified asphalt quality control purposes.

Scope: This method determines saybolt-furol viscosity of an asphalt emulsion.

Safety: Utilize safety precautions and personal protective equipment according to facility procedures. Dispose of materials according to facility procedures.

Apparatus

- Saybolt-furol viscometer
- #20 mesh sieve or a piece of #20 mesh wire cloth
- Suitable transfer containers
- Suitable timing device

Procedure:

16. Obtain sample using proper sampling procedure
17. Inspect viscometer, making sure it's clean, at the proper test temperature and outlet stopper is in place. Place an approved receiving flask under viscometer outlet.
18. For emulsions tested at 77° F - condition approximately 300g of emulsion to 78 – 80° F in a closed container using an oven, water bath or allow to cool on counter followed by stirring to achieve homogeneity.

For emulsions tested at 122° F - condition approximately 300g of emulsion to 125° F in a closed container using an oven, water bath or allow to cool on counter followed by stirring to achieve homogeneity.

19. Once the sample is conditioned transfer emulsion through a #20 mesh sieve into the viscometer so that a portion begins to overflow into the outer rim.
20. Without further conditioning time, simultaneously remove stopper and start the timer. Emulsion should flow into the receiving flask. Stop timing when flask is filled to fill line.
21. Determine viscosity by multiplying fill time by tube correction factor.
22. If the following limits are exceeded the standard method will be performed

77 F Viscosity 10% of Lower Spec Limit < Vis < 10% of Upper Spec Limit

122 F Viscosity 5% of Lower Spec Limit < Vis < 5% of Upper Spec Limit