

**1207****LIGHTWEIGHT PIECES IN AGGREGATES**

AASHTO Designation T 113 (Mn/DOT Modified)

Refer to - ASTM Designation C 123

**1207.1****SCOPE**

This method covers the determination of the percentage of shale and other lightweight pieces in aggregates by means of a sink-float separation in a heavy liquid of suitable specific gravity.

**1207.2****APPARATUS**

- A. Balance - For weighing the aggregates and decanted pieces of lightweight aggregate. For fine aggregates the balance shall comply with AASHTO M 231, Class G2. For coarse aggregates the balance shall comply with AASHTO M 231, Class G20.
- B. Containers - Suitable for drying the aggregate sample, for holding the heavy liquid (ZINC CHLORIDE) and basket, for the coarse aggregate, and for the fine aggregate.
- C. Skimmer - A piece of 300 $\mu$ m (#50) wire cloth sieve of suitable size and shape for separating the floating pieces from the ZINC CHLORIDE.
- D. Oven - Capable of maintaining a temperature of  $110 \pm 5$  °C ( $230 \pm 9$  °F).
- E. Sieves - A 600 $\mu$ m (#30) and 4.75mm (#4) conforming to AASHTO M 92 (Wire-cloth sieves for testing purposes).
- F. Specific Gravity Measurement Device - A hydrometer conforming to the requirements of Section 4 through 10 of ASTM E 100 or a suitable combination of graduated glassware and balance, capable of measuring the liquid specific gravity within  $\pm 0.01$  of the specified value.
- G. Heavy Liquid - A solution of zinc chloride in water. The solution shall have a specific gravity of  $2.00 \pm 0.01$ . The specific gravity of the heavy liquid shall be maintained within the specified value at all times during the test. Mix one 19 liter (5 gallon) pail of zinc chloride with 6.6 liters (7 quarts) of water and stir slowly until all the zinc chloride is dissolved. Let stand overnight and check specific gravity for  $2.00 \pm 0.01$ . If not within the above range, add more water if too high or more zinc chloride if too low.

**1207.3 SAMPLING**

Using an approved sample reduction method (Section 1002), prepare a test sample conforming to the following minimums:

<b>NOMINAL MAXIMUM SIZE of AGGREGATE (mm)</b>	<b>NOMINAL MAXIMUM SIZE of AGGREGATE (in.)</b>	<b>MINIMUM WEIGHT of SAMPLE (g)</b>
4.75	#4	200
12.5	1/2	2000
19.0	3/4	3000
37.5	1 1/2	5000
75	3	10000

**NOTE 1:** The sample shall be obtained in accordance with Sections 1201.4F1, 1202.4F and 1202.6. **Do not use the same material used in the Fine Sieve Analysis for this test.**

**1207.4 PROCEDURE - FINE AGGREGATE**

Do not wash this sample. Dry the sample to a constant weight at  $110 \pm 5$  °C ( $230 \pm 9$  °F), let cool to room temperature, weigh the entire sample to the nearest 0.1 gram.

Sieve over the 600 $\mu$ m (#30) sieve until less than 1% of the retained material passes the sieve in one minute of continuous sieving. Then introduce it into the zinc chloride solution in a suitable container. The volume of liquid shall be at least three times the absolute volume of the aggregate. Agitate the sample by stirring the sample with a long handle spoon (with spoon end bent upward at 1.57 radians (90°) to the handle) with an upward motion until all the sample is in suspension and the lightweight pieces are floating.

Allow the sample to settle until a definite cleavage plane appears between the rising shale and the settling sand (approximately 30 seconds). Decant the floating pieces into the skimmer taking care that only the floating pieces are poured off with the liquid and that none of the fine aggregate (which sinks) is decanted onto the skimmer. (The decanting may be done back into the zinc chloride bath.)

The material in the skimmer shall then be washed with water, placed in a container, placed in an oven and dried to a constant weight at  $110 \pm 5$  °C ( $230 \pm 9$  °F). Allow to cool to room temperature. If this test is for shale only, remove all other materials (sticks, grass, bitumen, etc.) and then weigh to the nearest 0.1 gram, record all weights on MN/DOT form 2429. The remaining **heavier** material (non-shale) shall be thoroughly rinsed with water and discarded.

**NOTE: DO NOT ALLOW THE SAMPLE TO BE IN CONTACT WITH THE ZINC CHLORIDE FOR MORE THAN 2 1/2 MINUTES.**

#### 1207.5 PROCEDURE - COARSE AGGREGATE

Wash the aggregate using only as much water as needed to clean fine particles clinging to the coarse aggregate. **Do not agitate the sample and do not use a mechanical washing device.** If the aggregate is already fairly clean washing is not necessary. Dry the aggregate to a constant weight at  $110 \pm 5$  °C ( $230 \pm 9$  °F), let the sample cool to room temperature and weigh entire sample to the nearest 0.1 gram.

Sieve over the 4.75mm (#4) sieve, place the material retained from the 4.75mm (#4) sieve into a wire basket (approximately 300 X 380 X 215mm [12" X 15" X 8.5"] deep) that can be immersed in the tank of zinc chloride solution with not less than 50mm (2") of solution covering the sample. Stir the sample with a large spoon using an upward motion until all lightweight pieces are floating.

Skim off floating particles and wash with water to remove the zinc chloride. Dry the sample at  $110 \pm 5$  °C ( $230 \pm 9$  °F). If this test is for SHALE only, remove all other material from the sample and weigh the shale particles to the nearest 0.1g; otherwise weigh all floating material and record to the nearest 0.1g on MN/DOT form 2429. The remaining **heavier** material (non-shale) shall be thoroughly rinsed with water and discarded.

**NOTE: DO NOT ALLOW THE SAMPLE TO BE IN CONTACT WITH THE ZINC CHLORIDE FOR MORE THAN 2 1/2 MINUTES.**

**CAUTION: When working with the zinc chloride solution wear rubber gloves and a protective face shield. If the solution comes in contact with the skin or eyes, rinse thoroughly with water at once!!!! DO NOT RUB EYES !!!**

**1207.6**      CALCULATIONS

$$\% \text{ SHALE} = \frac{\text{DRY WEIGHT OF SHALE OR DECANTED PARTICLES}}{\text{DRY WEIGHT OF TOTAL SAMPLE}} \times 100$$

Report the percent of shale to nearest 0.1% on MN/DOT Form #2429.