Designation: D632 – 12

Standard Specification for Sodium Chloride[1]

1. Scope

1.1 This specification covers sodium chloride intended for use as a deicer and for road construction or maintenance purposes.

1.2 The values stated as SI units are to be regarded as the standard.

1.3 For purposes of determining conformance to this specification, values for chemical analysis shall be rounded to the nearest 0.1 %, and values for grading shall be rounded to the nearest 1 %, in accordance with the rounding method in Practice E 29E29.

1.4 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes shall not be considered as requirements of the specification.

1.5 The following precautionary caveat pertains only to the test method in Annex A1, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E287 Specification for Laboratory Glass Graduated Burets

E288 Specification for Laboratory Glass Volumetric Flasks

E534 Test Methods for Chemical Analysis of Sodium Chloride

3. Classification

3.1 This specification covers sodium chloride obtained from natural deposits (rock salt) or produced by man (evaporated, solar, other) and recognizes two types and two grades as follows:

3.1.1 *Type I*—Used primarily as a pavement deicer or in aggregate stabilization.

3.1.1.1 *Grade 1*—Standard grading (Note 1).

3.1.1.2 *Grade 2*—Special grading (Note 1).

3.1.2 *Type II*—Used in aggregate stabilization or for purposes other than deicing.

NOTE 1—Grade 1 provides a particle grading for general application, and has been found by latest research to be most effective for ice control and skid resistance under most conditions. Grade 2 is the grading typical of salt produced in the Western United States and is available in states of the Rocky Mountains Region and west, which may be preferred by purchasers in that area.

4. Chemical Requirements

4.1 The sodium chloride shall conform to the following requirement for chemical composition, except for the tolerance stated in 6.1 and 6.2:

Sodium chloride (NaCl), min, %	95.0

5. Physical Requirements

5.1 *Grading:*

5.1.1 *Type I*—The grading of Type I sodium chloride, when tested by means of laboratory sieves conforming to Specification E 11, shall conform to the following requirements for particle size distribution, except for the tolerance stated in 6.1 and 6.1.1:

	Mass % Passing	
Sieve Size	Grade 1	Grade 2
19.0 mm (¾ in.)	...	100
12.5 mm (½ in.)	100	...
9.5 mm (⅜ in.)	95 to 100	...
4.75 mm (No. 4)	20 to 90	20 to 100
2.36 mm (No. 8)	10 to 60	10 to 60
600 µm (No. 30)	0 to 15	0 to 15

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[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.31 on Calcium and Sodium Chlorides and Other Deicing Materials.

Current edition approved April 1, 2012. Published April 2012. Originally approved in 1941. Last previous edition approved in 2001 as D632 – 01 which was withdrawn in January 2010 and reinstated in April 2012. DOI: 10.1520/D0632-12.

5.1.2 *Type II*—The grading of Type II sodium chloride shall conform to the grading requirements imposed or permitted by the purchaser under conditions of the intended use.

6. Permissible Variations

6.1 In the case of sodium chloride sampled after delivery to the purchaser, tolerances from the foregoing specified values shall be allowed as follows:

6.1.1 *Grading*—5 percentage points on the maximum value for the range for each sieve size, except the 12.5 mm (½ in.) and 9.5 mm (⅜ in.) for Grade 1 and 19.0 mm (¾ in.) for Grade 2.

6.1.2 *Chemical Composition*—0.5 percentage point.

7. Condition

7.1 The sodium chloride shall arrive at the purchaser's delivery point in a free-flowing and usable condition.

8. Sampling

8.1 Not less than three sample increments shall be selected at random from the lot (Note 2). Each increment shall be obtained by scraping aside the top layer of material to a depth of at least 25 mm (1 in.) and taking a 500-g (approximately 1-lb) quantity of sodium chloride to a depth of at least 150 mm (6 in.). Sampling shall be done by means of a sampling thief or other method that will ensure a representative cross section of the material. The sample increments shall be thoroughly mixed to constitute a composite sample representative of the lot.

NOTE 2—A lot may be an amount agreed upon between purchaser and supplier at the time of purchase.

9. Test Methods

9.1 *Chemical Analysis*—Test for compliance with the requirements for chemical composition in accordance with the following methods:

9.1.1 *Routine Control*—Use of the "Rapid Method" in Annex A1 is permitted for routine control and approval.

9.1.2 *Referee Testing*—In case of controversy, determine the chemical composition of the sample, using the current version of Test Method E 534E534.

9.2 Grading shall be determined by Test Method C 136C136.

10. Inspection

10.1 The purchaser or his representative shall be provided free entry and necessary facilities at the production plant or storage area if he elects to sample sodium chloride at the source.

11. Rejection and Rehearing

11.1 The sodium chloride shall be subject to rejection if it fails to conform to any of the requirements of this specification.

11.2 In the case of failure to meet the requirements on the basis of an initial sample of a lot represented, two additional samples shall be taken from the lot and tested. If both additional samples meet the requirements, the lot shall be accepted.

12. Packaging and Marking

12.1 The sodium chloride shall be delivered in bags or other containers acceptable to the purchaser, or in bulk lots. The name of the producer and the net weight shall be legibly marked on each bag or container, or in the case of bulk lots, on the shipping or delivery report.

13. Keywords

13.1 salt; snow and ice removal; sodium chloride; stabilization; winter maintenance

ANNEX

(Mandatory Information)

A1. RAPID METHOD OF ANALYSIS FOR SODIUM CHLORIDE

A1.1. Scope

A1.1.1 This annex covers a rapid method for chemical analysis of sodium chloride.

A1.2. Significance and Use

A1.2.1 The procedure for chemical analysis in this annex determines the total amount of chlorides present in the sample and expresses that value as sodium chloride.

A1.2.2 This rapid method of analysis does not distinguish between sodium chloride and other evaporite chloride compounds with ice-melting capabilities. Typical rock salt and solar salt sometimes contains small amounts of $CaCl_2$, $MgCl_2$, and KCl, depending on the source of the material. When this rapid method is used on continuing shipments from a known source, it will provide a fast, essentially accurate determination of the sodium chloride content of the material furnished. Thus, the need for testing by the referee method, Test Method E 534,E534 is reduced.

A1.3. Apparatus

A1.3.1 *Glassware*—Standard weighing bottles, volumetric flasks (conforming to Specification E 288E288, Class C, or better), and burets (conforming to Specification E 287E287, Class B, or better).

A1.3.2 *Balance,* having a capacity of at least 20 g, accurate and readable to 0.01 g.

A1.4. Reagents

A1.4.1 *Nitric Acid (HNO_3),* dilute (HNO_3:H_2O, 1:4 by volume).

A1.4.2 *Calcium Carbonate ($CaCO_3$)*—Reagent grade-low chloride, powder.

A1.4.3 *Silver Nitrate Solution*—0.05 N $AgNO_3$.

A1.4.4 *Sodium Chloride (NaCl)*—Reagent grade.

A1.4.5 *Potassium Chromate (K_2CrO_4) Solution*—(50 g K_2CrO_4/L).

A1.5. Procedure

A1.5.1 Thoroughly mix the composite sample obtained under 8.1, and reduce by quartering or by means of a sample splitter to approximately 500 g. Pulverize the reduced sample to pass a 300-µm (No. 50) sieve.

A1.5.2 *Standardization*—Standardize the silver nitrate ($AgNO_3$) solution daily, using 10 g of reagent grade sodium chloride (NaCl) following the applicable procedure in A1.5.3.

A1.5.3 From the pulverized sodium chloride, obtain a test sample with a mass of 10.00 ± 0.01 g and place in a beaker with 250-mL distilled water. Add 10 mL of the diluted nitric acid solution (HNO_3, 1 + 4 by volume) and stir for 20 min at room temperature to put the salt in solution. Transfer the solution, including any insoluble material, to a 2-L volumetric flask, dilute to the mark with distilled water, and mix. With a pipet, draw off 25 mL of the solution and place in a white porcelain casserole. Add 0.5 g of calcium carbonate ($CaCO_3$) to neutralize the excess HNO_3, and adjust the pH to approximately 7. Add 3 mL of the potassium chromate (K_2CrO_4) solution as an indicator and titrate dropwise with the silver nitrate ($AgNO_3$) solution until a faint but distinct change in color occurs—a persistent yellowish brown endpoint (see Note A1.1), comparable to standardization. Estimate the titer from the buret to the second decimal place.

NOTE A1.1—The color of the initial solution is lemon-yellow. With addition of the calcium carbonate ($CaCO_3$) and stirring, the initial solution becomes opaque, with a creamy lemon-yellow color. Addition of the silver nitrate ($AgNO_3$) solution produces silver chloride, which begins to agglomerate as the titration progresses, and the lemon-yellow color will begin to have whitish, opaque swirls of silver chloride. As the titration proceeds, the red color formed by addition of each drop begins to disappear more slowly. Continue the addition dropwise until a faint but distinct change in color occurs and the yellow-brown to faint reddish-brown color persists. The first stable presence of red silver chromate is the endpoint. If the endpoint is overstepped, a deep reddish-brown color occurs

A1.6 *Calculate*—Calculate the total chlorides expressed as percent NaCl as follows:

$$P = [(A/B) \times (C/D)] \times 100 \qquad (A1.1)$$

where:

A = reagent grade NaCl used, g,

B = 0.05 N $AgNO_3$ solution required to titrate the reagent grade NaCl, mL,

C = 0.05 N $AgNO_3$ solution required to titrate the sample being tested, mL,

D = test sampling mass, g, and

P = total chlorides, expressed as sodium chloride, in the sample being tested, %.

A1.6.1 If moisture is apparent in the sample, dry a duplicate 10-g sample of the pulverized salt at 105°C and correct the mass of the sample accordingly.

A1.7. Precision and Bias

A1.7.1 *Precision*[2]—An interlaboratory study was conducted and an analysis was made that included three materials ranging from approximately 92 % to 99 % NaCl. Ten laboratories were included in the study.

A1.7.2 *Single-Operator Precision (NaCl composition 95.0 % and greater)*—The single-operator standard deviation of a single test result for average NaCl composition 95.0 % and greater has been found to be 0.248.[3] Therefore, results of two properly conducted tests by the same operator on the same material with the same equipment and under the same conditions should not differ by more than 0.70 %.[3]

A1.7.3 *Multilaboratory Precision (NaCl composition 95.0 % and greater)*—The multilaboratory standard deviation of a single test result for average NaCl composition greater than 95.0 % has been found to be 0.633 %.[3] Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 1.79 %.[3]

A1.7.4 *Single Operator Precision (NaCl composition less than 95.0 % and greater than 90.0 %)*—The single-operator coefficient of variation of a single test result for average NaCl composition less than 95.0 % and greater than 90.0 % has been found to be 0.427 %.[3] Therefore, results of two properly conducted tests by the same operator on the same material with the same equipment and under the same conditions should not differ by more than 1.21 %.[3]

A1.7.5 *Multilaboratory Precision (NaCl composition less than 95.0 % and greater than 90.0 %)*—The multilaboratory standard deviation of a single test result for average NaCl composition less than 95.0 % and greater than 90.0 % has been found to be 0.711 %.[3] Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 2.00 %.[3]

A1.7.6 *Bias*—No justifiable statement can be made on the bias of this test method because the data are not available.

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[2] Supporting date have been filed at ASTM Headquarters. Request RR:D04-1016.

[3] These numbers represent, respectively, the (1s %) and (d2s %) limits, as described in Practice C 670C670.

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