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Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber[1]

This standard is issued under the fixed designation D5359; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification describes glass cullet recovered from municipal waste destined for disposal. The recovered cullet is intended for use in the manufacture of glass fiber used for insulation-type products.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C162 Terminology of Glass and Glass Products

D4129 Test Method for Total and Organic Carbon in Water by High Temperature Oxidation and by Coulometric Detection

E688 Test Methods for Waste Glass as a Raw Material for Glass Manufacturing

3. Terminology

3.1 For definitions of terms used in this specification, refer to Terminology C162.

4. General Requirements

4.1 Glass cullet from municipal waste is primarily soda-lime bottle glass and shall be one of three grades depending upon the total usage rate requirement of the user. The three grades shall satisfy the following chemical composition, color mix, contamination, and particle size requirements as listed in Section 4:

4.2 *Chemical Composition*—See Table 1.

4.3 *Color Mix*—Color is an indicator of the oxidation state of container cullet. SO_3 gas solubility in the glass melt is a function of the glass oxidation state. Changes in the oxidation state of cullet added to the fiberglass batch can shift the glass oxidation state causing the release of dissolved SO_3 gas, which can upset the furnace. A change in the glass oxidation state also means a change in the glass FeO content. This affects the heat transfer in the melt and can affect furnace efficiency and glass quality. See Table 2.

4.4 *Contaminants*—Free metals, magnetic or nonmagnetic, are not oxidized in the glass melting process and, therefore, are insoluble. Metals will pool on the furnace floor and leak through joints causing premature wear of refractories and electrical shorts, which can lead to glass leaks. Some metals will attack and destroy precious metal skimmers and thermocouples and molybdenum electrodes. Examples are silver, tin, lead, and aluminum.

4.4.1 Other inorganic materials and refractories will not melt in the glass melting process. Other inorganics can be porcelains, ceramics, or high-temperature glasses. Refractories can be remnants of furnace construction materials or minerals contained as unmelted inclusions in the cullet. See Table 3.

4.4.1.1 The container cullet mixture must not contain glass types or other materials whose composition contains anything that is either harmful to the fiberglass production process or which affects the user's ability to meet Federal or state environmental, safety, or health laws. Examples of such materials are anything which contains elements or oxides of phosphorus, arsenic, antimony, and chlorides.

4.5 *Particle Size*—For all grades of cullet, the particle size shall be 100 % < ¼ in. and <15 % < 200 mesh. The specification for the particle size distribution between these two end points shall be agreed to on an individual basis between the cullet supplier and the cullet user.

5. Sampling and Testing

5.1 Sampling and testing shall be in accordance with Test Methods E688.

6. Keywords

6.1 fiberglass; glass cullet; insulation; municipal solid waste; recycled glass

[1] This specification is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.03 on Treatment, Recovery and Reuse.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Chemical Composition

Grade	1		2		3	
Use Range	0 to 5 % in batch		5 to 15 % in batch		>15 % in batch	
Oxide	Weight %	±Range %	Weight %	±Range %	Weight %	±Range %
SiO_2	68–77	NA	68–77	1.00	68–77	1.00
Al_2O_3	0–7	NA	0–7	0.50	0–7	0.50
CaO	5–15	NA	5–15	0.50	5–15	0.50
MgO	0–5	NA	0–5	0.50	0–5	0.50
Na_2O	8–18	NA	8–18	0.50	8–18	0.50
K_2O	0–4	NA	0–4	0.50	0–4	0.50
Fe_2O_3	<0.5	NA	<0.5	0.05	<0.5	0.05
Cr_2O_3	<0.2	NA	<0.15	0.03	<0.1	0.02
SO_3	<0.4	NA	<0.3	0.03	<0.2	0.02
All other oxides	<0.5	NA	<0.3	0.05	<0.1	0.02
C[A]	<0.15	NA	<0.10	0.02	<0.05	0.01
H_2O	<0.5	NA	<0.5	0.05	<0.5	0.05
LOI	<0.45	NA	<0.30	0.05	<0.15	0.03

[A] Carbon is determined directly by instrumental method such as Coulometrics, Inc. Model 5010 Coulometer. Test Method D4129 uses this instrumentation for total and organic carbon in water. The instrument can be readily adapted to solid materials such as cullet.

TABLE 2 Color Mix Ratio

Grade	1		2		3	
Use Range	0 to 5 % in batch		5 to 15 % in batch		>15 % in batch	
Color	Weight %	±Range %	Weight %	±Range %	Weight %	±Range %
Flint	0–100	NA	0–100	5	0–100	3
dGreen	0–100	NA	0–100	5	0–100	3
Amber	<50	NA	<30	5	<25	3

TABLE 3 Contaminants

Grade	1	2	3
Use Range	0 to 5 % in batch	5 to 15 % in batch	>15 % in batch
Contaminant Type	Weight %	Weight %	Weight %
Magnetic Material	<0.3	<0.2	<0.1
Nonmagnetic Metals	<0.01	<0.005	<0.005
Other Inorganic Material			
+ 12 Mesh	NA	0.0	0.0
+ 20 Mesh	NA	<0.2	<0.1
–20 Mesh	NA	<0.3	<0.2
Refractories			
+ 12 Mesh	NA	0.0	0.0
+ 20 Mesh	NA	<0.2	<0.1
–20 Mesh	NA	<0.3	<0.2