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Circular Economy — Recycling of Container Glass Waste and Cullet

الاقتصاد الدائري – إعادة تدوير نفايات عبوات الزجاج

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Foreword

The national Circular Economy technical Committee of Saudi Standards, Metrology and Quality Organization (SASO) has prepared the Saudi Standard *Circular Economy — Recycling of Container Glass Waste and Cullet*" based on relevant ADMO, International and National foreign Standards and references.

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Introduction:

The transition toward a circular economy represents a fundamental enabler for achieving environmental sustainability and optimizing resource efficiency within the Kingdom of Saudi Arabia. In alignment with national directives for integrated waste management and the strategic objectives of the National Waste Strategy, this standard strengthens the principles of circularity by promoting the recovery, recycling, and valorization waste and scrap.

Accordingly, the National Technical Committee for the Circular Economy plays a pivotal role in advancing Saudi Arabia's shift toward a more sustainable and resource-efficient future. Through its initiatives, the committee seeks to develop and adopt internationally aligned standards that foster responsible production, minimize waste generation, and drive innovation across industrial sectors.

In conclusion, the committee's objective is to establish a comprehensive framework for the sustainable management of container glass waste and cullet through systematic recycling practices that enhance material recovery, reduce reliance on primary raw resources, and mitigate environmental impacts. It underscores the importance of adopting efficient collection, sorting, and processing methods that ensure product quality, traceability, and adherence to environmental and safety requirements.

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1. Scope

This document specifies the recycling standards to be applied in the Kingdom of Saudi Arabia in relation to container glass waste and cullet from various sources, including packaging materials (such as beverage bottles, food jars, and other glass containers), discarded or unsold products from retail and grocery stores, glass container waste from restaurants, bars, and hospitality venues, and defective or broken containers from manufacturing facilities.

The scope of this standard includes the segregation, processing, and recycling of container glass cullet to ensure environmentally sound practices and compliance with National Waste Strategy Targets. These standards apply to recycling facilities, waste management companies, and industrial entities involved in the generation and recycling of container glass waste and cullet, ensuring that they meet the required criteria for safe handling, recovery, and recycling.

Note: This standard applies to Recyclers producing container glass cullet.

Recovered glass must comply with the quality standards listed in Annex I and Annex VII of this document and be processed either domestically or internationally. Recovered container glass is transported in clean, labeled containers with batch and grade details to avoid contamination. Output materials must meet contamination limits, and external quality monitoring is required regularly, with records kept for five years. A sampling protocol is also mandatory, and customer feedback must be solicited from the recycling facilities to ensure product quality. A quality management system covering input acceptance, process monitoring, product sampling, and feedback from the recycling facilities must be in place to ensure consistent quality.

1.1 Acceptable Waste Types

Two separate standards have been developed for glass recycling. This standard applies only to recycling of glass from containers and glass cullet, for the recycling of flat glass please refer to SASO 017:2025. This addresses the fact that container glass has a lower magnesium oxide and sodium oxide content than flat glass but has a higher silica, calcium oxide and aluminium oxide content. This may have implications in relation to the recycling process applied and the specifications of the final recycled product. However, waste glass falls under the same broad HS code definition in both cases. It is important, therefore, to consider the materials from which container cullet can be generated that are presented alongside the general cullet definition.

To clarify the full scope of the wastes covered by this standard, the following key World Customs Organization (WCO) Harmonized System (HS) codes for container glass are adopted.

Heading	H.S. Code ¹	Description
70.01	7001.00	Cullet and other waste and scrap of glass, excluding glass from cathode-ray tubes or other activated glass of heading 85.49 (Electrical and electronic waste and scrap); glass in the mass.

Container glass waste can be generated from the following HS Code materials.

Heading	H.S. Code	Description
70.10	7010.0	Carboys, bottles, flasks, jars, pots, phials, ampoules and other containers, of glass, of a kind used for the conveyance or packing of goods; preserving jars of glass; stoppers, lids and other closures, of glass.
70.10	Carboys, bottles, flasks, jars, pots, phials, ampoules and other containers, of glass, of a kind used for the conveyance or packing of goods; preserving jars of glass; stoppers, lids and other closures, of glass.	
	7010.10	• Ampoules
	7010.20	1. Stoppers, lids and other closures
	7010.90	• Other

2. Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

- National Waste Management Law and Implementing Regulations.
- Royal Decree No. M/10 Dated 1392-03-03 for The Saudi Standards, Metrology and Quality Organization (SASO) establishment.
- Council of Ministers order No. 457, date 11/8/1440 AH for The National Center for Waste Management establishment.
- Commission Decision of 3 May 2000 establishing a list of wastes (2000/532/EC); (EU 2023).
- ISRI Scrap Specifications Circular 2024; (ISRI SPECS 2022).

¹ HS (Harmonized system) codes (export/import codes), Glass and glassware, World Customs Organization, 1370-2022E

- COMMISSION REGULATION (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council.
- Australian Council of Recycling (ACOR), 2023: Beneficiated Cullet Specifications; ([ACOR 2023](#)).
- ASTM C162-05 (Reapproved 2010) Standard Terminology of Glass and Glass Products; ([ASTM C162-05DD](#)).

3. Terms and Definitions

For the purpose of this standard, the definitions set out in the National Waste Management Law and Implementing Regulations must be considered.

In addition, the following definitions apply in this standard and do not replace the definitions in the National Waste Management Law and Implementing Regulations:

Term	Definition
By product	As specified and detailed by the MWAN and relevant competent authorities
Center	The National Center for Waste Management
Collection	Collecting waste from designated storage containers of various sizes and types using trucks and machinery designated for such purpose.
Collectors	Entities that are responsible for collecting waste from designated storage containers of various sizes and types using trucks and machinery designated for such purpose.
Consignment	Refers to a batch of the waste concerned which is intended for delivery from a producer to another holder and may be contained in either one or several transport units, such as containers
Container glass waste	Refers to discarded glass containers, such as bottles and jars, that are suitable for recycling and reprocessing into new glass products in compliance with recycling standards.
Converters	Converters take recycled materials and transform them into new products. This step often involves significant manufacturing processes.
End of Waste	As specified and detailed by the MWAN and relevant competent authorities
European Waste Catalogue (EWC)	Refers to a comprehensive list of codes and descriptions for wastes based on their source and type
Generators	A person who produces the waste classified under MWAN Waste Management Law.
Hazardous waste	Waste that is classified as hazardous under this Law and the Regulations, and generated from industrial or non-industrial activities which contain toxic, flammable, reactive, or corrosive materials, or solvents, degreasers, oils, dyes and pigments, pasty residue, or acids and alkalis
Holder	Refers to the natural or legal person who is in possession of the waste material.

Term	Definition
Importer of waste	Refers to any natural or legal person established within the Kingdom of Saudi Arabia who introduces waste into the customs territory of the Kingdom
Inspector and/or inspectors	Persons designated by a decision of the Minister to take charge of detecting, proving and investigating violations of the provisions of the Law and the Regulations, jointly or individually
ISRI	Refers to The US trade association 'Institute of Scrap Recycling Industries' (ISRI) publishes yearly a so-called scrap specification circular.
Law	Waste Management law
License	A written permission issued by the Center to carry out any activity related to waste management, as specified in this Law and the Regulations.
Minister	Ministry of Environment, Water and Agriculture
Non-hazardous waste	Waste that does not formulate a threat to public health or the environment, and which cannot be classified under any circumstances as hazardous waste
Permit	A document issued to waste recycling facilities by the Center to verify their compliance with the Center's controls and requirements prior to obtaining the licenses issued by the competent agencies in accordance with their regulations.
Qualified staff	Refers to staff which is qualified by experience or training to monitor and assess the properties of the waste concerned
Recycled container glass	Refers to glass produced from discarded containers, such as bottles and jars, processed in compliance with recycling standards.
Recycler	Entities that are responsible for the process of transforming specific waste components into usable materials for the purpose of recovering such components or using them as raw materials in manufacturing processes
Recycling	The process of transforming specific waste components into usable materials for the purpose of recovering such components or using them as raw materials in manufacturing processes
Regulations	Implementing Regulations of this Law.
Resource Recovery	The process of recovering energy, raw materials, or any other product from waste for reuse.
Retailers	Retailers are businesses that sell products directly to consumers. They play a crucial role in the recycling chain by influencing consumer behaviour, offering sustainable products, and facilitating recycling initiatives.
Service Provider	A person authorized to engage in a waste management activity
Sorters	Entities that are responsible for manually or automatically separating waste components, such as paper, glass, metals, and the like, in transfer stations or sorting and treatment facilities for the purpose of recycling or treatment

Term	Definition
Sorting	Manually or automatically separating waste components, such as paper, glass, metals, and the like, in transfer stations or sorting and treatment facilities for the purpose of recycling or treatment.
Storage	Temporarily storing all or part of the components of waste for transportation or future use
Transportation	Transporting waste using approved means of transportation to transfer stations, treatment or sorting facilities, or designated landfills
Treatment	The use of physical, biological, or chemical means; a combination of such means; or other means to change the properties of waste in order to reduce its size, make it easier to reuse or recycle, extract certain products therefrom, or remove organic pollutants and other pollutants, for the purpose of reducing particular waste components or benefiting therefrom, or eliminating their potential harm to humans or the environment.
User	Refers to the glass packaging industry (for producing new bottles and jars), construction sector (using glass cullet in concrete, asphalt, and road aggregate), and landscaping applications (as decorative mulch and glass sand).
Visual inspection	Refers to inspection of the waste concerned covering all parts of a consignment and using human senses or any non-specialized equipment
Waste	All discarded or disposed of materials that have a direct or indirect impact on public health or the environment.
Waste Management	Managing any activity or practice related to waste, such as waste collection, transportation, sorting, storage, treatment, recycling, import, export, and safe disposal, including the aftercare of waste disposal sites
Waste Processor	Any individual, organization, or entity responsible for managing waste. This includes the collection, transportation, treatment, recycling, recovery, or disposal of waste materials. Waste processors ensure that waste is handled in compliance with relevant environmental, health, and safety regulations
Waste Producer	A person who produces the waste classified under MWAN Waste Management Law.

4. General Requirements

4.1 General Application Of The Waste Hierarchy

Article 11, chapter 3 of the waste management law provides the following waste hierarchy shall apply as a priority order in waste prevention and management for the waste concerned:



Figure 1 Waste Hierarchy

- (a) the use of materials and natural resources will be rationalized;
- (b) wherever possible the waste will be re-used;
- (c) wherever rational use of materials and reuse is not possible, the waste will be minimized;
- (d) waste will be stored at the designated locations, in accordance with the requirements specified by the Regulation;
- (e) the waste that can be reused or recycled will be sorted and placed in designated locations.

4.2 Requirement To Hold A Permit To Manage Wastes

All parties that undertake activities involving treatment, recovery, or recycling of waste must hold the necessary permit(s) and/or license(s) from the MWAN and other relevant competent authorities to undertake the relevant activity for the waste concerned.

5. Input Requirements

5.1 Specified Input Materials

Container glass cullet can be categorized in multiple ways based on its origin. Within this standard, container glass cullet is distinguished as follows:

- **Pre-consumer** cullet is waste glass resulting from the manufacturing of products that contain glass as one of their components, and which leaves the specific facility where it was generated, becoming waste but not reaching the consumer market.
- **Post-consumer** cullet is waste glass that originates from glass products after they have completed their intended use in the consumer market. It refers specifically to separately collected glass, ensuring suitability for recycling. Only the non-hazardous part of glass derived from healthcare waste is included, while the hazardous portion is excluded to maintain the quality and recyclability of the material.

This distinction helps recyclers to manage and process glass waste efficiently, considering the differences in contamination levels and recycling requirements between new and old container glass cullet. The main sources of container glass waste and cullet are listed as follows:

- Manufacturing facilities
- Packaging materials
- Household and commercial sources
- Non-hazardous section of pharmaceutical and health-care sectors

Note: The acceptable waste types specified in Section 1.2 are the only materials to be considered under this standard.

Container glass waste and cullet to be used as input material in the recycling operation must meet the criteria of acceptable container glass waste and cullet set out in Annex I and the quality of waste used as input for the recovery operation.

5.2 Incoming Inspections

Parties that carry out waste treatment to recover materials suitable for recycling must check, as part of an incoming delivery inspection, whether the materials they receive meet the requirements for producing recovered material. In particular, incoming inspections must be made in compliance with the requirements with Annex I. Details including their origin, producer/importer of original waste information, type of waste, and quantity of the consignment in tonnes, reason of noncompliance, as well as their whereabouts must be recorded separately.

5.3 Input Record Keeping

A record of all consignments shall be maintained by the waste recycler for a period of five years and made available for inspection upon request by the MWAN and other relevant

competent authority. The records shall specify the origin, type, and quantity of each consignment.

5.4 Storage Of Input Materials

The incoming waste shall be stored in a covered area and under dry conditions and stored separately from any other waste streams that may be managed on the same site. Storage should prevent access by pests, should prevent ingress by climatic conditions that may affect the materials stored and storage time should be minimized as much as possible.

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6. Processing Requirements

6.1 Separation Of Contaminants

Where consignments are contaminated with separable amounts of ‘non-target materials or pollutants, a separation must be carried out in order to fulfill the requirements in Annex I and to achieve the highest possible recovered product quality. If the requirements cannot be achieved using the equipment and techniques available on site, these consignments must be separated and sent to alternative waste treatment to achieve the requirements or alternatively be disposed.

The origin, type, quantity, and whereabouts of the impermissible separated or discarded materials must be recorded separately.

6.2 Recycling Processes and Techniques

6.2.1 Specified Production Processes And Techniques

Material must be treated:

- In accordance with the conditions of the license or permit.
- To ensure the output material meets the requirements of the designated market and intended application, including the appropriate construction or container glass standard and any additional customer requirements.
- To the point that it requires no further processing before it can be used as intended

This standard does not specify the treatment process to be applied. Common treatment stages are given below:

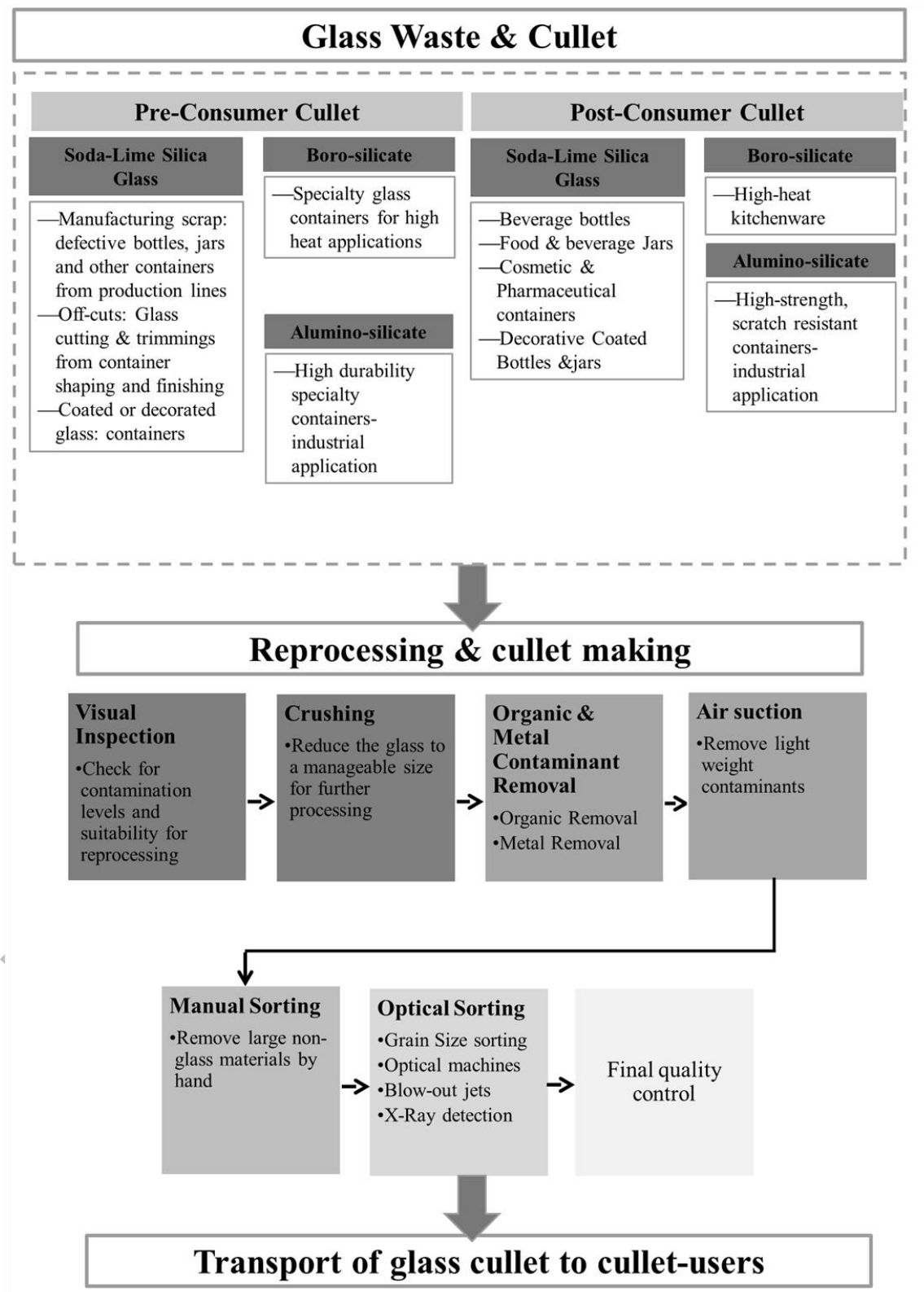


Figure 2 Common Treatment Stages

- **Visual Inspection:** Experienced staff perform a visual inspection of the glass load upon arrival, assessing contamination levels and processing needs. Highly contaminated loads may be rejected for economic reasons and disposed of without treatment.
- **Crushing:** If the load is accepted, the glass is crushed to reduce it to smaller, uniform pieces suitable for further sorting and cleaning. This step improves handling and prepares the glass for efficient separation of contaminants.
- **Organic & Metal Contaminant removal:** The crushed glass passes through sieves to reduce organic content, followed by magnetic and Eddy current separators to remove ferrous and non-ferrous metals. Highly contaminated materials may go through multiple rounds of sieving and magnetic separation until clean enough for optical sorting.
- **Suction:** Throughout the process, suction is used to remove lighter contaminants, such as paper and plastics.
- **Manual Sorting/Hand Picking:** Manual sorting involves workers handpicking large contaminants like plastics, paper, textiles, ceramics, and stone. A growing issue in container glass recycling is the use of transparent thin foils instead of paper labels, which are difficult to remove due to adhesive residue. Additionally, the use of RFID tags on glass may complicate recycling, as they are hard to detect and separate, leading to potential contamination in the recycling stream.
- **Optical Sorting:** The most complex step is optical sorting, where glass pieces are first sorted by grain size. The material then passes through optical sorting machines equipped with cameras and sensors that use white light, laser light, and infrared backlight to detect non-glass impurities and identify different glass colors. Detection triggers blowout jets that eject unwanted materials at the right moment. This process improves color separation but does not fully separate glass by color. In recent years, fast X-ray fluorescence systems combined with blowout technology have been introduced to identify and separate specific glass types, such as lead glass and ceramics, which infrared cannot detect.
- **Final Quality Control:** Finally, automatic quality control is complemented by manual inspection to ensure the final cullet meets the required quality standards.

6.3 Monitoring Of The Treatment Processes And Techniques Applied

Qualified staff shall carry out inspections of the treatment processes and techniques applied on site. Such inspections must continuously be monitored.

Where an inspection identifies a problem in the treatment processes and techniques applied a corrective action will be specified and enacted at the earliest opportunity.

Where an inspection identifies a problem that may result in a failure to meet the output specifications included in this standard the treatment processes and/or techniques applied must cease to operate until corrective action has been taken.

Records of all inspections and corrective action employed shall be kept for a period of at least five years and made available for inspection upon request by the MWAN and the relevant competent authority.

7. End Requirements

7.1 End-Product Specifications And Statement Of Conformity

The product specification(s) to which the recovered container glass complies will be specified. The recovered glass resulting from the recovery operation must comply with the criteria set out in Annex I; Annex VII shows the different categories of container glass waste and cullet.

Each batch of product from the recovery process shall be accompanied by a statement of conformity in accordance with the model set out in Annex IV.

7.2 End Product Record Keeping

A record of all product batches shall be maintained for five years and made available for inspection upon request by the MWAN and the relevant competent authority. The records shall specify the destinations, type, and quantity of each consignment as well as copies of the statements of conformity accompanying each batch in accordance with the model set out in Annex IV.

7.3 End Use Restrictions

All glass cullet must comply with the quality requirements specified in this standard and is intended solely for recycling in glass container applications—not for fiber glass production. Consequently, the output from this process needs to be further purified, melted, and refined in glass furnaces, either domestically or internationally, to meet industry and quality standards before being used in the production of new containers or other glass products. Recovered glass that is suitable for recycling applications must be produced from the input materials specified in Annex VII and comply with the criteria of acceptable container glass waste and cullet contained in Annex I.

7.3.1 Transport Of Output Materials

Final recovered glass (being graded) will be transported in separate containers for each grade to those used for input materials to avoid their contamination by other objects or substances including waste unless those containers have been subject to cleaning operations to prevent such contamination prior to transport of the final output materials offsite for further processing. The transport will take place accompanied by the statements of conformity of all product batches on that vehicle.

7.3.2 Labelling

Where end-use restrictions apply for the recovered container glass, they must be communicated and explained on the labelling of the product in a way that is clear and

understandable to the end-user. Labelling must include batch number, size of the container, grade, end use restrictions etc.

7.3.3 Defined List Of Levels Of Contamination Of Output Materials

Final outputs must meet the general requirements for quality specified in Annex I in terms of the levels of contamination that must not be exceeded. Any batch that exceeds those levels must be treated as a waste and recycled or disposed of in keeping with the waste hierarchy.

7.3.4 External Quality Monitoring

The recycler must have external quality monitoring of the end products produced that is carried out at regular intervals in accordance with Annex VI by an authorized specialist or specialist institute. The results of the external quality monitoring must be kept in the form of a product assessment by the authorized specialist or specialist institute held on the site of the recycler for a period of at least five years and made available to the MWAN and the relevant competent authority upon request.

7.3.5 Sampling Protocol

In addition to the external quality monitoring referred to above the recycler must perform their own sampling according to the provisions listed in Annex VI. Where such sampling is undertaken by a third party that third party must not be the same as the external quality monitoring organization referred to above.

7.3.6 Customer Feedback

The recycler will provide a facility for customer feedback on the quality of the output made available. Feedback provided will be assessed and, if necessary, changes to the treatment processes applied will be made to address any substantiated negative feedback received in respect to output quality.

7.3.7 Quality Management System

A suitable quality management system for recovered container glass waste and cullet is expected to include:

- Procedures to decide about the acceptance of input materials
- Monitoring of processes to ensure they are effective at all times
- Procedures for monitoring product quality (including sampling and analysis) that are adjusted to the process and product specifics according to good practice
- Actively soliciting feedback from customers in order to confirm compliance with product documentation
- Record keeping of main quality control parameters
- Measures for the review and improvement of the quality management system
- Training of staff

ANNEXES I (Normative)

Annex I. Criteria for Acceptable Container Glass Waste and Cullet

Criteria for Acceptable Container Glass Waste and Scrap ²		
	Criteria	Self-monitoring requirements
1.1	The glass cullet shall comply with a customer specification, an industry specification or a standard for direct use in the production of glass substances or objects by re-melting in glass manufacturing facilities.	Qualified staff shall verify that each consignment complies with the appropriate specification.
1.2	The content of the following non-glass components shall be: a) Ferrous metals: ≤ 50 ppm b) Non-ferrous metals: ≤ 60 ppm c) Nickel-containing steels: no particles d) Non-metal non-glass inorganics: e) < 100 ppm for glass cullet size > 1 mm; f) $< 1\,500$ ppm for glass cullet size ≤ 1 mm g) Organics: $\leq 2\,000$ ppm. Examples of non-metal non-glass inorganics are: ceramics, stones, porcelain, pyro-ceramics. Examples of organics are: paper, rubber, plastic, fabrics, wood.	Qualified staff shall carry out a visual inspection of each consignment. At appropriate intervals and subject to review if significant changes in the operating process are made, representative samples of glass cullet shall be analysed gravimetrically to measure the total non-glass components. The non-glass component content shall be analysed by weighing after mechanical or manual (as appropriate) separation of materials under careful visual inspection. 2. The appropriate frequencies of monitoring by sampling shall be established considering the following factors: a) The expected pattern of variability (for example as shown by historical results). 3. The inherent risk of variability in the quality of waste glass used as input for the recovery operation and any subsequent processing. Pre-consumer waste glass with a highly predictable composition needs likely less frequent

² COMMISSION REGULATION (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council

Criteria for Acceptable Container Glass Waste and Scrap ²		
Criteria		Self-monitoring requirements
		monitoring. Waste glass from multi-material collection may need more frequent monitoring. b) The inherent precision of the monitoring method. 4. The proximity of results of the non-glass component content to the limits indicated above. The process of determining monitoring frequencies should be documented as part of the management system and should be available for auditing.
1.3	The glass cullet shall not display any of the hazardous properties listed in Annex VIII.	Qualified staff shall carry out a visual inspection of each consignment. Where visual inspection raises any suspicion of possible hazardous properties, further appropriate monitoring measures shall be taken, such as sampling and testing where appropriate. The staff shall be trained on potential hazardous properties that may be associated with cullet and on material components or features that allow recognising the hazardous properties. The procedure of recognising hazardous materials shall be documented under the quality management system.

ANNEXES Ii (Normative)

Annex Ii. Quality Of Waste Used As Input Materials

Quality of waste used as input for the recovery operation ³		
Criteria		Self-monitoring requirements
2.1	Only waste from the collection of recoverable container glass may be used as input. The collected waste glass may unintentionally contain minor amounts of other glass types	Acceptance control of all glass-containing waste received (by visual inspection) and of the accompanying documentation shall be carried out by qualified staff who are trained on how to recognize glass-containing waste that does not meet the criteria set out in this section.
2.2	Glass-containing waste from mixed municipal solid waste or healthcare waste shall not be used as an input. However, the non-hazardous glass scrap from healthcare and pharmaceutical sectors is included.	
2.3	Hazardous waste shall not be used as an input.	

³ COMMISSION REGULATION (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council

ANNEXES Iii (Normative)

Annex Iii. Treatment Processes And Techniques

Criteria for treatment processes and techniques⁴

	Criteria
1.1	The glass-containing waste shall have been collected, separated and processed, and from that moment shall permanently have been kept separate from any other waste.
1.2	All treatments such as: crushing, sorting, separating, or cleaning, needed to prepare the cullet for direct use (via re-melting) in the production of glass substances or objects shall have been completed.

⁴ COMMISSION REGULATION (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council

ANNEXES Iv (Normative)

Annex Iv. Statement Of Conformity⁵

1.	Producer/importer of original waste: Name: Address: Contact person: Tel. Fax E-mail:
2.	(a) Name or code of the glass cullet category in accordance with an industry specification or standard: (b) Main technical provisions of the industry specification or standard, including compliance with EoW product quality requirements for non-glass components, i.e. content of ferrous metals, non-ferrous metals, non-metal/non-glass inorganics and organics:
3.	The glass cullet consignment complies with the industry specification or standard referred to in point 2
4.	Quantity of the consignment in tonnes:
5.	The producer of the product applies a quality management system which has been verified by an accredited verifier.
6.	The material in this consignment is intended exclusively for direct use in the production of glass substances or objects in re-melting processes.
7.	Declaration of the producer/importer of the final product. I certify that the above information is complete and correct to my best knowledge. Name: Date: Signature:

⁵ COMMISSION REGULATION (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council

ANNEXES V (Normative)

Annex V. General Quality Requirements

The general quality requirements for recovered container glass output materials typically focus on purity, contamination levels, and physical properties. Here are some key points:

Contamination Limits

Contamination limits are critical in determining the usability of recovered container glass. Contaminants can include other metals, non-metallic impurities, or organic materials.

1. **Ferrous Metals:** ≤ 50 ppm
2. **Non-Ferrous Metals:** ≤ 60 ppm
3. **Nickel-containing steels:** no particles
4. **Organics:** Limit 2,000 ppm
5. **Moisture:** Should show no drainage.
6. **Particle Size:** Should be <50 mm.

Quality Specifications

In the recycling of container glass cullet, quality specifications are tailored to the intended application of the recovered glass. For high-quality applications, such as manufacturing new glass containers, a high level of purity and precise color sorting is crucial. In contrast, for less demanding uses, such as construction aggregates or insulation materials, slightly lower purity may be acceptable. Thus, the quality of recovered container glass is carefully adjusted to meet specific end-use requirements, balancing effective recycling with functional material use.

1. **Purity:** Recovered glass should have a high purity level, typically aiming for minimal contamination. Foreign materials should not exceed 5% by weight or should allow a usable glass yield of 90% or more.
2. **Foreign Materials:** Other metals (ferrous, non-ferrous), non-metallics like stones, ceramics, and dust, Organic materials (e.g., plastics, wood, rubber), Large non-glass pieces (e.g., concrete, bricks, tires)
3. **Form:** Recovered container glass is processed into cullet (small glass fragments) suited for re-melting and forming new glass containers, varying in particle size based on end-use.
4. **Color Sorting:** Specific colors like clear, amber, and green are often separated, as the color composition affects the quality and market value of the recycled glass.

Physical Properties:

Recovered container glass should be free from excessive contamination and maintain consistent particle size and shape, which is essential for efficient processing and re-melting in manufacturing new glass products.

Standard Compliance

Compliance with industry standards such as those set by the Institute of Scrap Recycling Industries (ISRI) or the European Committee for Standardization (CEN) is often required.

Various standards organizations provide specifications and classifications for recycled container glass. These standards are used to ensure consistency and quality across the industry.

These standards ensure consistency and quality in the recycling and reuse of container glass across various applications.

ASTM Standards (American Society for Testing and Materials): ASTM provides specific standards for recycled container glass. For example:

- **ASTM C0224-78R20:** Standard Practice for Sampling Glass Containers – Provides guidelines for sampling and testing glass containers to ensure quality assurance, which is relevant to recycling by ensuring consistency in the recovered glass.

ISRI Specifications (Institute of Scrap Recycling Industries): ISRI provides a wide range of scrap specifications of different materials.

- **ISRI Scrap Specifications Circular 2024:** Scrap Specifications Circular

ANNEXES Vi (Normative)

Annex Vi. External Quality Monitoring

External quality monitoring must meet the following minimum requirements.

MONITORING FREQUENCY

The appropriate frequencies of monitoring shall be established by taking into account the following factors:

- (1) The expected pattern of variability (as shown by historical results)
- (2) The inherent risk of variability in the quality of waste used as input for the recovery operation and in the performance of the treatment processes
- (3) The inherent precision of the monitoring method
- (4) the proximity of results to the limit values for the total amount of foreign materials.

Monitoring frequency	Description
Routine Monitoring	Quality checks on every batch of container glass received or dispatched are the responsibility of the recycler. The frequency can be adjusted based on historical quality performance and supplier reliability for monitoring of the quality of container glass waste and cullet resulting from the recovery operation as set out in Annex I (including sampling and analysis);
Periodic Audits	Comprehensive quality audits should initially be conducted quarterly in the first year of operation to ensure compliance with quality standards as set out in Annex I (including sampling and analysis) by external parties. If all audits in the first year confirm compliance, the frequency may be reduced to twice yearly from the second year onward. In the event of a non-compliance finding, the audit frequency will return to quarterly until compliance is restored. Periodic audits represent the minimum timing for external monitoring.
Random Inspections	Unannounced random inspections should be conducted at least once every six months by external parties to verify ongoing adherence to Annex I and Annex V.

SAMPLING

- **Sample Collection:** Obtain a nominal 100 kg sample from six large increments taken from various points across the load to ensure it is representative.
- **Increment Processing:** Bulk and mix the increments thoroughly in large tubs to achieve a combined weight of approximately 100 kg.
- **Sample Weighing:** Weigh the combined sample to confirm accuracy for further analysis.
- **Whole Bottle Count:** Count the number of whole bottles present within the sample for further classification.
- **Colour Sorting:** Sort the whole bottles by color, identifying and classifying them as either correct or incorrect based on the intended color grouping.
- **Broken Glass Sizing:** Sieve the broken glass using 30 mm and 9.5 mm meshes to separate glass pieces based on size.
- **Detailed Examination of Fines:** Send the fraction smaller than 9.5 mm to the laboratory for a more detailed examination.
- **Inclusion Inspection:** Visually inspect the minus 9.5 mm fraction for inorganic inclusions, identifying any contaminants for further action.

SAMPLING PROTOCOL

The sampler must prepare a record (sampling protocol), which must contain in particular the following information:

1.	Date and time of sampling: Place of sampling (address, if not identical to that of the recycling facility):
2.	Name and address of the external sampling organization: Name of the sampler (natural person):
3.	Name (company name) of the recycler: Recycling facility address:
4.	Sample name for clear identification of the fresh original sample:
5.	Quality assurance data:
6.	Description of the location, cubature and dimensions of the assessment quantity: Description of the nature of the assessment quantity:
7.	Description of sampling: a) sampling method: b) number of sampling points or cuts:
8.	Signatures of the sampler and the recycler or his authorized representative:
9.	Other relevant comments if necessary:

ANNEXES Vii (Normative)

Annex Vii. Container Glass Waste And Cullet Categories According To Isri Specification

The US trade association 'Institute of Scrap Recycling Industries' (ISRI) publishes yearly a so-called scrap specification circular. The specifications refer to many sectors of the metals, paper stock, plastics, glass, and electronics industries and are constructed to represent the quality or composition of the materials bought and sold in the industry.

The specifications are internationally accepted and are used throughout the world to trade the various commodities. Parties to a transaction may specify particular variations or additions to these specifications as are suited for their specific transactions and for their individual convenience. Any deviation from the standard specifications, however, should be mutually agreed to and so stipulated in writing by the parties to the transactions.

Container glass related specifications are given in the section Guidelines for Glass Cullet: GC-2023 Container Glass Cullet Specifications. The following items are distinguished in the 2024 circular:

Container Glass Cullet	Description
UNPROCESSED FLINT CONTAINER GLASS CULLET SPECIFICATIONS	Composition: Soda-lime-silica beverage or food container glass. Cullet Colors Segregation: Flint Cullet Flint 95-100% Amber 0-5% Green 0-5% Other Colors 0-5% Size: Cullet may be broken but not pulverized. Moisture: Cullet should be free of excess moisture. Contaminant Listings: Outthrow Materials: Normal container labels; ring and metal closures where processing capabilities permit. Prohibitive Materials: Non-acceptable items include non-container glass (vision ware, light bulbs, crystal, windows, mirrors, drinking glasses, ceramic, milk glass, etc.) metals, ores, minerals, bricks, clay, grinding and refractory materials, rocks, clay and ceramic closures. General: The quality of the unprocessed flint container glass cullet must be such that after beneficiation with a conventional container glass cullet recycler it will be suitable for the production of glass containers
UNPROCESSED AMBER CONTAINER GLASS CULLET SPECIFICATIONS	Composition: Soda-lime-silica beverage or food container glass. Cullet Colors Segregation: Amber Cullet Amber 90-100% Flint 0-5% Green 0-5% Other Colors 0-5% Size: Cullet may be broken but not pulverized. Moisture: Cullet should be free of excess moisture.

	Contaminant Listings: Outthrow Materials: Normal container labels; ring and metal closures where processing capabilities permit. Prohibitive Materials: Non-acceptable items include non-container glass (vision ware, light bulbs, crystal, windows, mirrors, drinking glasses, ceramic, milk glass, etc.) metals, ores, minerals, bricks, clay, grinding and refractory materials, rocks, clay and ceramic closures. General: The quality of the unprocessed amber container glass cullet must be such that after beneficiation with a conventional container glass cullet recycler it will be suitable for the production of glass containers
UNPROCESSED GREEN CONTAINER GLASS CULLET SPECIFICATIONS	Composition: soda-lime-silica beverage or food container glass. Cullet Colors Segregation: Green Cullet Green 90-100% Flint 0-10% Amber 0-10% Other Colors 0-5% Size: Cullet may be broken but not pulverized. Moisture: Cullet should be free of excess moisture. Contaminant Listings: Outthrow Materials: Normal container labels; ring and metal closures where processing capabilities permit. Prohibitive Materials: Non-acceptable items include non-container glass (vision ware, light bulbs, crystal, windows, mirrors, drinking glasses, ceramic, milk glass, etc.) metals, ores, minerals, bricks, clay, grinding and refractory materials, rocks, clay and ceramic closures. General: The quality of the unprocessed green container glass cullet must be such that after beneficiation with a conventional container glass cullet recycler it will be suitable for the production of glass containers.
PROCESSED (FURNACE READY) FLINT CONTAINER GLASS CULLET SPECIFICATIONS	Composition: Soda-lime-silica container glass. Container Glass Cullet Colors Segregation: Flint Cullet Flint 95-100% Amber 0-5% Green 0-1% Other Colors 0-.5% Total NON-Flint Cullet = <5% Size: Various sizes from whole glass containers to -100 Mesh. However, the ideal material size is 3/8" to 3/4" with a 10% minimum of fine particles. Material size is based upon buyer and seller's agreement. Contaminant Listings: Outthrow Materials: Organic Matter, allowable percentage based upon buyer and seller's agreement.

	Prohibitive Materials: Ferrous Metals, Nonferrous Metals, Ceramics (such as cups, saucers, dinnerware, pottery, etc.), Other Glass (for example, plate window glass, heat-resistant glass—such as Pyrex—and lead-based glass—such as crystal ware, television tubes, vision ware, etc.) Other Materials (such as bricks, rocks, etc.)
PROCESSED (FURNACE READY) AMBER CONTAINER GLASS CULLET SPECIFICATIONS	Composition: Soda-lime-silica container glass Container Glass Cullet Colors Segregation: Amber Cullet Amber 90-100% Flint 0-10% Green 0-10% Other Colors 0-5% Total NON-Amber Cullet= <10% Size: Various sizes from whole glass containers to -100 Mesh. However, the ideal material size is 3/8” to 3/4” with a 10% minimum of fine particles. Material size is based upon buyer and seller’s agreement. Contaminant Listings: Outthrow Materials: Organic Matter, allowable percentage based upon buyer and seller’s agreement. Prohibitive Materials: Ferrous Metals, Nonferrous Metals, Ceramics (such as cups, saucers, dinnerware, pottery, etc.) Other Glass (for example, plate window glass, heat-resistant glass—such as Pyrex—and lead-based glass—such as crystal ware, television tubes, vision ware, etc.) Other Materials (such as bricks, rocks, etc.)
PROCESSED (FURNACE READY) GREEN CONTAINER GLASS CULLET SPECIFICATIONS	Composition: Soda-lime-silica container glass Container Glass Cullet Colors Segregation: Green Cullet Green 70-100% Flint 0-15% Amber 0-15% Other Colors 0-10% Total NON-Green Cullet= <30% The color green typically consists of a variety of shades, for example: emerald green or lime green. Size: Various sizes from whole glass containers to -100 Mesh. However, the ideal material size is 3/8” to 3/4” with a 10% minimum of fine particles. Material size is based upon buyer and seller’s agreement. Contaminant Listings: Outthrow Materials: Organic Matter, allowable percentage based upon buyer and seller’s agreement. Prohibitive Materials: Ferrous Metals, Nonferrous Metals, Ceramics (such as cups, saucers, dinnerware, pottery, etc.)

	Other Glass (for example, plate window glass, heat-resistant glass—such as Pyrex—and lead based glass— such as crystal ware, television tubes, vision ware, etc.) Other Materials (such as bricks, rocks, etc.)
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ANNEXES Viii (Normative)

Annex Viii. Properties Of Waste That Render It Hazardous

List of Hazardous Characteristics⁶

Code	Characteristics
H1	Explosive
	An explosive substance or waste is a solid or liquid substance or waste (or mixture of substances or wastes) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.
H3	Flammable liquids
	The word “flammable” has the same meaning as “inflammable”. Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc., but not including substances or wastes otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60.5° C, closed-cup test, or not more than 65.6° C, open-cup test. (Since the results of open-cup tests and of closed-cup tests are not strictly comparable and even individual results by the same test are often variable, regulations varying from the above figures to make allowance for such differences would be within the spirit of this definition.)
H4.1	Flammable solids
	Solids, or waste solids, other than those classed as explosives, which under conditions encountered in transport are readily combustible, or may cause or contribute to fire through friction
H4.2	Substances or wastes liable to spontaneous combustion
	Substances or wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up on contact with air, and being then liable to catch fire
H4.3	Substances or wastes which, in contact with water emit flammable gases
	Substances or wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.
H5.1	Oxidizing
	Substances or wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen cause, or contribute to, the combustion of other materials.
H5.2	Organic Peroxides
	Organic substances or wastes which contain the bivalent-o-o-structure are thermally unstable substances which may undergo exothermic self-accelerating decomposition.
H6.1	Poisonous (Acute)

⁶ Annex III, Protocol on Liability and Compensation, The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)

Code	Characteristics
	Substances or wastes liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact.
H6.2	Infectious substances
	Substances or wastes containing viable micro-organisms or their toxins which are known or suspected to cause disease in animals or humans.
H8	Corrosives
	Substances or wastes which, by chemical action, will cause severe damage when in contact with living tissue, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport; they may also cause other hazards.
H10	Liberation of toxic gases in contact with air or water
	Substances or wastes which, by interaction with air or water, are liable to give off toxic gases in dangerous quantities.
H11	Toxic (Delayed or chronic)
	Substances or wastes which, if they are inhaled or ingested or if they penetrate the skin, may involve delayed or chronic effects, including carcinogenicity.
H12	Ecotoxic
	Substances or wastes which if released present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems.
H13	Capable, by any means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.