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Standard Guide for Source Reduction Reuse, Recycling, or Disposal of Steel Cans[1]

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1. Scope

1.1 This guide provides general information to public officials and business and industry managers regarding the source reduction, reuse, recycling, or disposal of steel cans under 5-gal (wet) or 40-lb (dry) capacity. It presents a comprehensive overview of the steel can life cycle. Fivegallon pails and larger containers, up to 55-gal drums, will be in a separate guide due to their inherently different use and management when empty.

1.2 *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:*[2]

A623 Specification for Tin Mill Products, General Requirements

D5488 Terminology of Environmental Labeling of Packaging Materials and Packages (Withdrawn 2002)[3]

E701 Test Methods for Municipal Ferrous Scrap

E702 Specification for Municipal Ferrous Scrap

E1134 Specification for Source-Separated Steel Cans (Withdrawn 2001)[3]

3. Summary of Guide

3.1 Steel can container applications are described, including food, beverage, and general purpose. The processes for steelmaking, steel sheet production, and steel can manufacturing are discussed. The methods of source reduction, reuse, recycling, or disposal of steel cans are explained.

4. Significance and Use

4.1 This guide will familiarize public officials and business and industry managers with source reduction, reuse, recycling, or disposal of steel cans.

5. Typical Steel Can Container Applications

5.1 *Food Cans*—More than 90 % of metal food containers, also known as sanitary cans, are made of steel (**1**).[4] While they have been commonly called "tin" cans, the tin coating on steel sheet has become extremely thin as technology advanced. It has been supplemented or replaced by other alternative coatings and treatments so that about one third of all steel cans are now made with tin-free steel (**2**). Steel food cans contain many types of food products, such as meat, fruit, vegetables, soup, infant formula, and pet food. (See Fig. 1.)

5.1.1 *Single-Serving or Home-Use Container*—Steel food cans vary in size and style, in accordance with product and consumer requirements. Can size may range from a few ounces to the typical one-pound net weight container used in the home. They are normally opened with an ordinary manual or electric can opener, but some have aluminum or steel easy-open lids for greater convenience to the consumer.

5.1.2 *Multi-Serving or Commercial/Institutional Container*—Steel food cans are widely used in business and institutional food service facilities and food manufacturing plants. This includes 1-gal (#10) cans and oblong cans, such as for olive oil.

5.2 *Beverage Cans*—Steel cans are widely used for juices and other non-carbonated beverage applications. They may also be used for beer or soft drinks. (See Fig. 1)

5.2.1 *Single-Serving Container*—Steel beverage cans vary in size and style. The 6-oz juice can, commonly used for school lunches, has a foil peel-off closure on the lid, although some now have an all-steel stay-on tab.

5.2.2 *Multi-Serving or Commercial/Institutional Container*—Larger beverage containers, from 46 oz (#5) to 1 gal (#10), are used for home, business, institutions, and food manufacturing.

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[1] This guide is under the jurisdiction of ASTM Committee D10 on Packagingand is the direct responsibility of Subcommittee D10.19 on Sustainability & Recycling.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] The boldface numbers in parentheses refer to the list of references at the end of this guide.

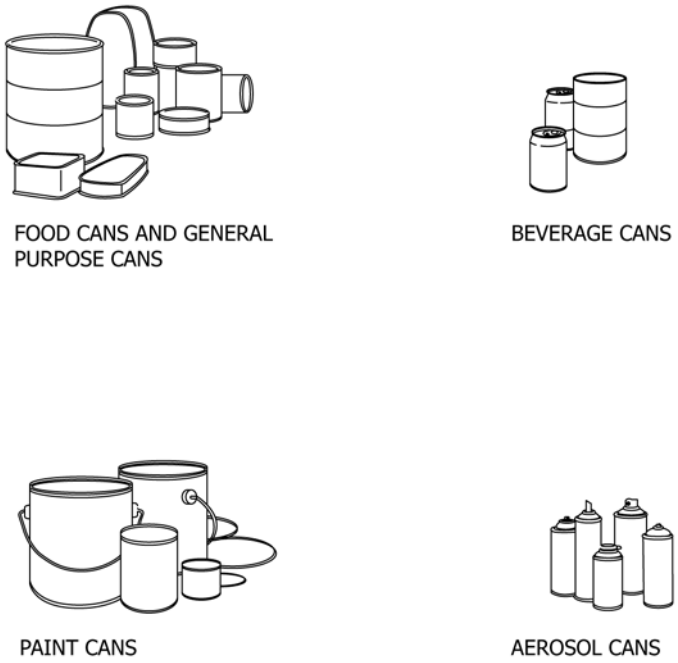

FIG. 1 Steel Container Applications

5.3 *General Purpose Cans*—Steel cans have many non-food and non-beverage applications, wet or dry, for the household, business, and industry. (See Fig. 1)

5.3.1 *Single-Serving or Home-Use Container*—Smaller cans up to 1 gal are typical. Numerous styles and sizes of cans are required because of the wide array of products and applications, including liquid products (such as paint), powders (such as talc), semisolids (such as paste wax), aerosols (such as hair spray), and dry goods (such as adhesive bandages or roller bearings). Many have replaceable lids that are pried off to open the container. Aerosol cans are sealed and release product through a spray valve until empty.

5.3.2 *Industrial or Commercial/Institutional Container*—Larger general purpose containers, including 5-gal pails and steel drums of various capacities will be covered in a separate guide.

6. Manufacture of Steel and Can Sheet for Steel Cans

6.1 Scrap steel is used in making new steel in the basic oxygen furnace, electric arc furnace, and foundry. Scrap steel is categorized as "home," "prompt," or "obsolete" scrap. Home scrap is unsalable steel scrap generated from the steelmaking process. It is "run-around" in the mill to be used as part of the scrap charge for future production. Prompt scrap is leftover or unused scrap material from industrial fabricating processes, such as trimmings from steel can manufacturing. Obsolete scrap is any product collected for scrap metal at the end of its useful life, such as major appliances, tools, automobiles, construction and demolition salvage, and steel cans. Steel scrap is collected, processed, and shipped to the closest melting location.

6.2 *Basic Oxygen-Furnace Production*—About 60 % of the steel produced in the United States in 1994 was made in the basic oxygen furnace by the integrated mills (**3**). This highest-quality steel is required for cans, appliances, automobiles, and other flat-rolled steel products. Domestic mills use an average of 75 % molten iron and 25 % scrap steel in the furnace charge. Thus, this steel has about 25 % recycled content.

6.2.1 The basic oxygen process is very large in scale, making 200 to 300 tons of steel per melt (batch) (**4**). Hot metal (or molten iron) is first made separately in the blast furnace, using iron ore, coke, and limestone. Then the basic oxygen furnace is loaded with a charge of steel scrap and molten iron. Limestone is also added as flux. An oxygen lance is lowered into the furnace to blow oxygen onto the surface of the molten iron. The blow of oxygen continues until the impurities and a certain amount of carbon in the molten iron have been reduced through oxidation and the desired composition of steel has been made. These chemical reactions take place very rapidly so the process is completed in about 20 min.

6.2.2 Due to technological limitations, the maximum amount of scrap used relative to the hot metal is approximately 30 % in the basic oxygen furnace. Any higher percentage of scrap would require supplemental energy to the chemical reaction process (**5**). In 1994, the North American integrated steel producers averaged more than 25 % total scrap steel use, with about 10 to 15 % being obsolete scrap and the balance from home scrap and prompt scrap.

6.2.3 The modern method of continuous casting transforms the liquid steel into solidified semifinished steel. This is done by delivering the liquid steel in a ladle to the casting floor, where it is poured into a special mold arrangement that allows the steel to flow and form directly into a red-hot continuous ribbon of solidified steel which is cut automatically into specified slab lengths.

6.3 *Manufacture of Can Sheet:*

6.3.1 Steel slab destined for steel can application is rolled or flattened into an intermediate gage in the hot strip mill (**6**). The hot band is then cleaned before going through a cold reduction mill to strengthen and form it into the desired sheet gage. It then passes through an annealing furnace, which softens it in preparation for other processing. The sheet steel, in the form of very large coils (rolls), goes either to a temper mill for final finish or to a double cold-reduction mill, where it becomes even thinner and stronger. Called" black plate" up to now, the single- or double-reduced product is ready for coating with tin or chromium.

6.3.2 As the steel goes through the coating line, it is washed and cleaned. It is electroplated in a bath employing soluble tin anodes. If coated with tin, the steel sometimes is passed through a high-frequency induction or resistance heater. There, the tin melts and flows to form a lustrous coating that is cooled in water, treated electrochemically, rinsed, then electrostatically coated with oil. Alternatively, the steel is electroplated in a chromium bath, producing a burnished, darker finish, as with a tuna can. Finally, the steel, tin-coated or tin-free, as described in Specification A623, is inspected, packaged, and shipped as coils or flat cut sheets to the canmaking facility (**7**).

6.4 *Electric Arc-Furnace Production*—In 1994, the remaining 40 % of domestic steel was produced in the electric arc furnace by the so-called mini-mills (**3**). This steel is for heavy shapes, such as I-beam, channel, billet, rod, reinforcing bar,