



Support Document

# Aluminum and Steel

## Recycling

### Fact Sheet

#### Identification and local recycling

<u>Aluminum</u>	<u>Tin(99% Steel)</u>
Not magnetic	Magnetic
Bottom does not have rim	Bottom has rim
Brushed, polished appearance	Shiny, silver appearance
Body is shiny, silver, and smooth	Body has rings or ribbing
No seams on body	Always has seam on body
Label usually sprayed on	Label is usually paper, glued on
Lighter in weight	Heavier in weight
Curbside pickup	Curbside pickup
Transfer station drop off	Transfer station drop off

You can include any other observations that the students suggest.

### Vocabulary

**Recycling rate:** according to the EPA the formula for determining the recycling rate = (MSW recycled / MSW generated) \* 100

**Magnet:** according to Merriam-Webster a magnet is a body having the property of attracting iron and producing a **magnetic** field external to itself; *specifically* : a mass of iron, steel, or alloy that has this property artificially imparted.

**Alloy:** is a mixture of metals.

- There are 365 days in one year.
- There are 7 days in one week and 24 hours in one day.
- There are 52 weeks in one year.
- There are 12 months in one year.
- There are 16 cups in one gallon.
- Recycling one aluminum can saves the energy equivalent of one cup of gasoline.
- Recycling one aluminum can saves enough energy to light a 100-watt light bulb for 3.5 hours (210 minutes).
- Each person generates about 5 pounds of garbage per day.
- Each pound of aluminum makes 32 cans.

Taken From: <http://www.cancentral.com/canc//text/15w.htm>

## **The Can: A Brief History Lesson**

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The story of the can begins in 1795 when the French Directoire offered a prize of 12,000 francs to anyone who could present the government with a new, effective means of preserving food. Nicholas Appert, a Parisian who had worked as a candy maker, chef, brewer, pickle maker and vintner, had an idea: Why not pack food in bottles like wine?

For the next 15 years, he researched and tested his idea. Finally, after partially cooking food, sealing it in bottles with cork stoppers, and immersing the bottles in boiling water, he arrived at his theory: If food is sufficiently heated and sealed in an airtight container, it will not spoil.

Appert demonstrated his theory to Emperor Napoleon Bonaparte by sending samples of preserved foods to his army. Napoleon had said, "An army marches on its stomach." Looking at his military career, we know that he had learned through hard experience that it does: Scurvy and hunger disabled many more of Napoleon's soldiers than combat itself. Appert's samples, including partridges, vegetables and gravy, were sent with soldiers to sea for more than four months. "When opened, 18 different kinds of preserved foods were tasted," Appert wrote, "every one of which had retained its freshness, and not a single substance had undergone the least change at sea." Appert was awarded the 12,000 francs by Emperor Napoleon Bonaparte himself.

The British responded directly to this development. If Napoleon's troops were able to extend their marches by carrying preserved nutritious supplies, His Majesty's forces must be prepared to do likewise. In 1810, King George III granted Peter Durand a patent for his idea of preserving food in "vessels of glass, pottery, tin, or other metals or fit materials." Durand wanted to surpass Appert's invention, so he elected to try tin instead of glass. Like glass, tin could be sealed airtight. But, tin was not breakable and was much easier to handle. Thus, he replaced the breakable glass bottle and less than dependable cork stopper with a cylindrical tin canister that was fashioned out of tin plate, which is simply iron coated with tin to prevent rusting and corrosion.

Durand himself did no canning, but two other Englishmen, Bryan Donkin and John Hall, used Durand's patent. After experimenting for more than a year, they set up a commercial canning factory and by 1813 were sending tins of food to British army and navy authorities for trial. Included on the list of military bases, ironically, was the island of St. Helena, to which Napoleon Bonaparte was eventually exiled.

## **Expansion of the Industry**

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Perhaps the greatest encouragement to the newborn canning industry was the explosion of new colonial territories. Explorers in search of the elusive Northwest Passage were eager to use canned foods. Russian explorer Otto von Kotzebue heard of a "discovery lately made in England" that seemed "too important not to be made use of" and took some preserved meats with him on his voyage. When Sir William Edward Parry sailed for the Northwest Passage in 1819, he carried Donkin's provisions, which again proved eminently satisfactory.

As people and goods were being transported across all parts of the world, the can industry itself was growing in new territories. Englishmen who immigrated to America brought their newfound knowledge with them. One of these was Thomas Kensett, who might fairly be called the father of the can manufacturing industry in the United States. In 1812 he set up a small plant on the New York waterfront to can the first hermetically sealed oysters, meats, fruits and vegetables in the United States. (The word "hermetic" comes from Hermes, the Greek god of invention. It means airtight.)

The American Gold Rush of 1849 created an urgent need for food that could be preserved for long periods of time and transported over great distances. Travelers heading west to open new settlements carried food packed in metal cans by canners in the East. Settlers in rugged and remote parts of the country began to see the advantages of having canned foods on hand for nutrition and variety in their diets, as did frontiersmen on scouting trips and fortune hunters panning for gold. Canned seafood, fruits and pickles were just a few of the foodstuffs these migrants brought with them.

## **Technical Breakthroughs**

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Just before the Civil War, a technical advance by canners enabled them to speed up production. Adding calcium chloride (a salt) to the water in which cans were cooked raised the water temperature, speeding up the canning process. During the Civil War, metal cans filled with wholesome foods ensured dependable rations for men on the battlefronts. At war's end, soldiers and sailors returned home with praise for the safe, portable and preserved foods. The canning business boomed from a prewar annual output of five million cans to 30 million annually in postwar years.

For almost 100 years, tin cans were made by hand. It was a laborious process, requiring considerable skill and muscle. Artisans cut the rectangular body and round ends from a tin sheet, bent the body around a cylindrical mold, and then soldered the seams along the sides and ends. A small circular hole was left in one end through which the food was forced. Finally, the artisans closed the hole with a soldered metal cap.

As the industrial revolution took hold in the United States, the demand for cans increased, and machines began to replace the artisans' handiwork. A good artisan could make only 10 cans a day. Mechanical end seaming and other improvements increased that number to as many as 60.

In 1900, the "sanitary" can was developed in Europe. Its ends were attached using what is called a double seam. This meant that the edges of the can walls (or body) and end were folded together, then folded again to form a strong seal. The double seam permitted greatly increased manufacturing speeds and removed the soot of soldering from can making and packaging plants.

True production progress in can making began in the early 1920s, when American engineers perfected the body making process. New methods soon increased production of cans to as many as 250 a minute.

## **Beverage Canning**

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As early as 1940, can manufacturers began to explore adapting cans to package carbonated soft drinks. The can had to be strengthened to accommodate higher internal can pressures created by carbonation (especially during warm summer months), which meant increasing the thickness of the metal used in the can ends. Otherwise, distortion of the end would strain the seal, creating potential leaks or making cans unstackable for storage and transit.

Another concern for the new beverage can was its shelf life. Even small amounts of dissolved tin or iron from the can could impair the drinking quality of both beer and soft drinks. Fortunately, beer, which is only mildly acidic, is relatively noncorrosive. In addition, beer ages naturally, so it has a limited shelf life of about three months in any package. In contrast, the food acids, including carbonic, citric and phosphoric, in soft drinks present a risk for rapid corrosion of exposed tin and iron in the can. The consequences of off-flavors, color changes and leakage through the metal needed to be addressed. At this point, the can was upgraded by improving the organic coatings used to line the inside, making cans heavier and more encasing.

The use of cans for carbonated beverages was delayed because of wartime material limitations mandated by the U.S. government. When the restriction ended in 1953 after the Korean War, the improved can was introduced and marketed nationwide. The can manufacturers then embarked on a program of material and cost savings by reducing both the amount of steel and the amount of coatings used in can making. These efforts were in part inspired by a new competitor — aluminum.

## **The Invention of the Aluminum Can**

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Beverage cans made from aluminum were first introduced in 1965. This was an exciting innovation for the packaging industry because the aluminum can was made with only two pieces — a body and an end. This made 360-degree printing possible on the body of the can, enhancing store display appeal. A can could now advertise its contents completely by drawing the consumer's eye to the

package and creating a visual appeal to spur purchases of one brand over another. The steel industry followed with its own two-piece can, but it was never fully accepted by brewers and soft drink bottlers. By 1985, the aluminum can dominated the beverage market.

Some of the reasons for the aluminum can's acceptance were its ductility (ability to be molded), its support of carbonation pressure, its lighter weight and its resistance to corrosion (aluminum does not rust). Both steel and aluminum cans used an easy-open end (initially the pull-tab, now the stay-on tab), but the aluminum tab was much easier to make.

Perhaps the most critical element in the aluminum can's market success was its recycling value. Aluminum can recycling excelled economically in the competition with steel because of the efficiencies aluminum cans realized in making new cans from recycled materials versus 100 percent virgin aluminum. Steel did not realize similar economies in the recycling process. Aluminum can recycling became common and responded to the growing concerns of environmentally conscious consumers about the depletion of natural resources and the consequences of what was deemed "a throwaway society." The opportunity to market the all aluminum can as recyclable and environmentally friendly led to its growing acceptance as a product package.

## **Cans and the Environment**

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Prior to 1970, both steel and aluminum cans were made from virgin materials, with the exception of small amounts of scrap recycled from the manufacturing process. Can makers, customers and consumers alike were unaware of the impact that the mining and manufacturing of steel or aluminum had on the environment. The concept of natural resource preservation was not an issue of great importance and the low growth of population during these early years further de-emphasized concerns for resource depletion. Both industries, however, came to realize the importance of reducing their impact on the environment in the late 1960s and early 1970s, as a new environmentally conscious generation emerged, and began to develop solutions to address the problem.

There were incentives to initiate recycling. Problems with litter, which was duly noted by the consumer "Ban the Can" campaign in the late 1960s, offered additional reasons to remove cans from the waste stream. At the same time, manufacturers began to recognize the economics of recycling, namely lower manufacturing costs from using less material and less energy.

In 1970, when the nation was celebrating its first Earth Day, the aluminum can recycling infrastructure began to take hold. Can makers paid cash for empty cans to create value and incentive for consumers to bring back their used cans.

By the 1980s and 1990s, recycling had become a way of life. The recycling infrastructure had matured and aluminum cans became even more valuable as evidenced by the steady increases in the aluminum can recycling rate. Aluminum can recycling has become a billion-dollar business and one of the world's most successful environmental enterprises. Over the years, the aluminum can has come to be known as America's most recyclable package with over 60 percent of cans being recycled annually.

Aluminum can recycling is praised by environmentalists and government officials alike. Today, consumers are helping to divert more than two billion pounds of aluminum per year from the solid waste stream, keeping it out of landfills. What's more, making new cans from recycled aluminum saves 95 percent of the energy needed to make aluminum from virgin material. Energy savings in 1995 alone were enough to light a city the size of Pittsburgh for six years!

Thanks to developments in the can making process, manufacturing new cans from used aluminum cans makes good economic sense. An average of 54 percent of each new aluminum can is made from recycled aluminum, saving companies and consumers money compared with the use of virgin aluminum. Using recycled aluminum also saves precious natural resources by reducing the amount of bauxite mined to make aluminum. The aluminum beverage can returns to the grocer's shelf as a new, filled can in as few as 60 days after collection. That means that a consumer could purchase basically the same recycled can from a store every nine weeks, or almost six times a year.

Advances in can manufacturing technology have also brought us lighter aluminum cans. In 1972, one pound of aluminum yielded only 21.75 cans. Today, by using less material to make each can, one pound of aluminum makes approximately 32 cans — a 47 percent improvement. Even the can ends have been made lighter: The old ends weighed about 8.12 pounds per thousand; now they weigh a mere 6.07 pounds per thousand. It may not seem like much, but when you multiply the savings by the 100 billion cans that are made each year, the weight savings is phenomenal — over 200 million pounds of aluminum!

Each year, thousands of groups across the country turn cans into cash by collecting and recycling them. Many organizations, including schools, Boy and Girl Scout troops, 4-H clubs, and other nonprofit, charitable community groups are able to raise money to complete worthwhile projects that may otherwise have gone unfunded. This aluminum beverage can buy-back system has been in place since the early 1970s, and consumers have earned more than \$8.9 billion through recycling since then. A coast-to-coast network of more than 10,000 buy-back locations cooperating with more than 8,000 cities and counties with curbside collection makes recycling easy.

Taken From: <http://www.cancentral.com/canc//text/history.htm>