EPRI

INDUSTRY SEGMENT PROFILE

SIC 3411

Metal Cans

EPRI Center for Materials Fabrication

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Thumbnail Sketch of Typical Establishment (1995)

	SIC 3411 Metal Can Manufacturers
Average No. of Employees*	90.0
Annual Shipments	$38 Million
Annual Electricity Consumption	9.1 Million kWh
Electricity Opportunities	Infrared (IR) and Ultraviolet (UV) drying and curing of coatings. Energy efficient motors for conveyors and presses. Side seam welders.
Technology Trend	Reduce weight of metal can, more efficient designs. Improved easy open top designs. Die necking to reduce can diameters. Improved can decoration and thinner tin coatings on tin plate stock.
Industry Issues	Productivity, quality, recycling, and environmental issues.

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Industry Characteristics

This industry is made up of companies manufacturing the following products:

- Steel cans and tinware products.
  - Steel, (including lids, ends, and parts shipped separately).
  - Tinware end products (including ice cream cans, but excluding cooking and kitchen utensils).
  - Steel Drawn &Ironed (D&I), Draw-Redraw (DRD), three-piece cans and tinware products.
- Aluminum cans.
  - Aluminum (including lids, ends, and parts shipped separately).
- Other metal cans.

The sales volume of the U.S. metal can industry is concentrated among a few national companies having manufacturing facilities located throughout the country.

- Five companies (American National Can, Ball Corp, Crown Cork & Seal, Reynolds and U.S. Can) control 84% of the market.
  - Shipment value for the top three companies represented 68% of the industry total.
- Sales figures for captive can producing companies such as Metal Container Corp (Anheuser-Busch) and Coors are not included in SIC 3411, but make up a significant percentage of beverage can production.
- The total value of industry shipments of metal cans for 1997 is $12 billion from 272 establishments represented by 108 companies in the U.S.
- Metal can manufacturers employ over 27,000 in the U.S.

Over 47% of all establishments employ more than 100 employees.

Establishments in this industry purchased 2.95 billion kWh of electricity in 1996.

- The SIC 34 industry group (Fabricated Metal Products) ranks ninth out of twenty in total electricity consumption among all manufacturing and process industries.
- 50% of electricity is for machine drive.
- Manufacturers consume 0.81 kWh per dollar of value added, which is 70% higher than that for the metal working industries at 0.48kWh per dollar of value added.

Metal can manufacturers are located throughout the country to be near their content sources. Outside of California and Texas, the majority of these plants are located east of the Mississippi River.

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- California and Ohio together account for over 25% of all metal can shipments.
- The top ten states account for 60% of all metal can shipments.

The average wage rate for production workers manufacturing metal cans ($19.85 per hour) is over 50% higher than the average wage rate for all hourly manufacturing plant workers ($12.97 per hour) in the U.S.

There were 139 billion metal cans shipped in 1998. Aluminum beverage cans accounted for 74% of these shipments. Food cans (primarily tin coated steel) comprised 23% of this market, and steel cans for general packaging purposes occupied the remaining 3%.

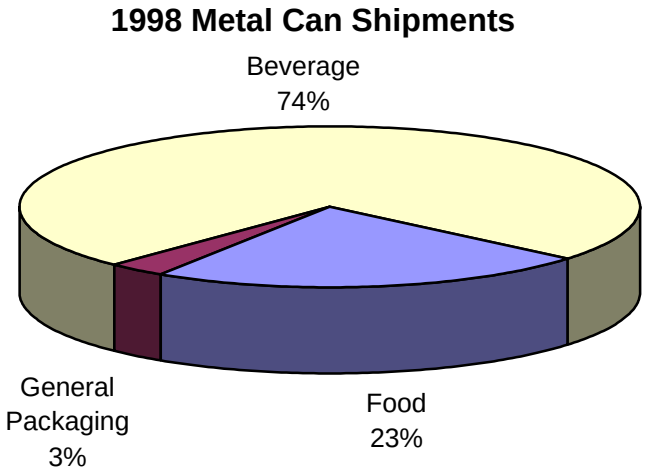

Figure 1. 1998 Metal Can Shipments

- In the beverage segment, soft drink can shipments (67%) were more than double beer can shipments (33%). Shipments in this segment broke through 100 billion cans in 1994 but fell back to 98 billion cans in 1995. 1998 shipments were 103 billion cans.
- Nearly 70% of the cans manufactured for the food segment were used for soups, vegetables, vegetable juices and pet foods.
- Steel aerosol cans made up 70% of the general packaging segment.
- Over 17% of all metal cans are produced by manufacturers for their own use.

Demand for metal cans is somewhat sensitive to price.

- Price increases in aluminum in 1995 contributed to a nearly 5% decrease in demand for aluminum cans.
- The overall market for metal cans is mature and expected to decline slowly.
- Substitute products such as plastic bottles are increasing their market share.

Steel beverage cans in the U.S. declined from 28 billion in 1975 to zero today.

Metal cans are manufactured using a two piece construction (D&I or Draw-Redraw) or a three piece construction.

- Beverage cans use a two piece construction and are made by the D&I process.
- Over 55% of food cans and 99% of general packaging cans use a three piece construction.
- Three piece constructions require a lacquer coating applied to the seams (side seam stripe) to complete the interior coating.
- Sealants are cured using either gas or electrotechnologies.

Metal can shipments have not increased significantly since 1994 as shown in Table 1.

- The decrease in can shipments in 1995 was due in part to an increase in aluminum prices and increased competition from PET, glass, and other packaging products (pouches).
  - Glass is the most efficient package for small run products such as micro-brewed beer.
  - Although more beer is still sold in cans than bottles, the gap has narrowed.
  - Beer in uniquely designed plastic bottles is now being tested.

Table 1. Metal Can Shipments, 1993-1998 (Million Cans)

	1993	1994	1995	1996	1997	1998
Total Metal Cans Shipped	**132,142**	**139,254**	**133,704**	**135,468**	**137,137**	**138,988**
By Market						
Beverage	97,605	103,119	98,116	99,136	100,680	102,800
Food	30,465	31,907	31,313	31,971	32,082	31,784
General Packaging	4,072	4,228	4,275	4,361	4,375	4,044

Source: Can Manufacturers Institute

Table 2 describes can shipments by product type.

Table 2. 1995 Metal Can Shipments, Material/Technology (Million Cans)

	Total Cans	By Material		By Technology	
		Steel	Aluminum	2-Piece	3-Piece
Total Metal Cans Shipped	**133,704**	**32,419**	**101,285**	**111,664**	**22,040**
Beverage	98,116	1	98,115	98,116	0
Beer	35,487	0	35,487	35,487	0
Soft Drink	62,629	1	62,628	62,629	0
Food	31,313	28,157	3,156	13,528	17,785
Baby Foods	972	*	*	405	567
Coffee	580	*	*	0	580
Dairy Products	967	*	*	96	871
Fruit/Fruit Juices	2,301	*	*	61	2,240
Meat & Poultry	1,700	*	*	1,151	549
Seafoods	2,027	*	*	1,732	295
Vegetables/Vegetable Juices	9,266	*	*	1,665	7,601
Other Foods, including soups	6,303	*	*	3,061	3,242
Pet Foods	7,197	*	*	5,357	1,840
General Packaging	4,275	4,261	14	20	4,255
Aerosol	2,879	2,879	0	0	2,879
Paint and Varnish	827	827	0	0	827
Automotive Products	94	94	0	0	94
Other Non-foods	475	461	14	20	455

Source: Can Manufacturers Institute

The value added component per dollar value of shipments averages 28% for metal can manufacturers.

- 28% value added per dollar for Metal Container (SIC 341) shipments compares to 60% for Metalworking Machinery (SIC 354).
- Cost of materials comprises 70% to 75% of shipment value.
- Labor makes up about 10% of dollar value of shipments for metal can manufacturers.

Metal can manufacturers generally perform four highly automated operations.

- Metal deformation (can bodymaking)

- Assembling (3-piece can assembly)
- Pre-finishing (metal preparation, washing, drying)
- Finishing operations (can decoration, curing, testing)

National Statistics

Table 3. National Statistics - SIC 3411 Metal Cans

	1992	1993	1994	1995	1996
Industry Shipments ($Billion)	12.1	11.5	11.6	12.3	12.3
Value Added ($Billion)	3.3	3.0	3.2	3.4	3.6
Employment (1000s)	32.3	30.5	30.9	29.3	27.2
New Capital Expenditures ($Million)	351	455	411	471	526
Electricity Purchased (Million kWh)	2721	2703	2857	2923	2952
Full Production Capacity Utilization Rate (%)	82	88	89	82	87

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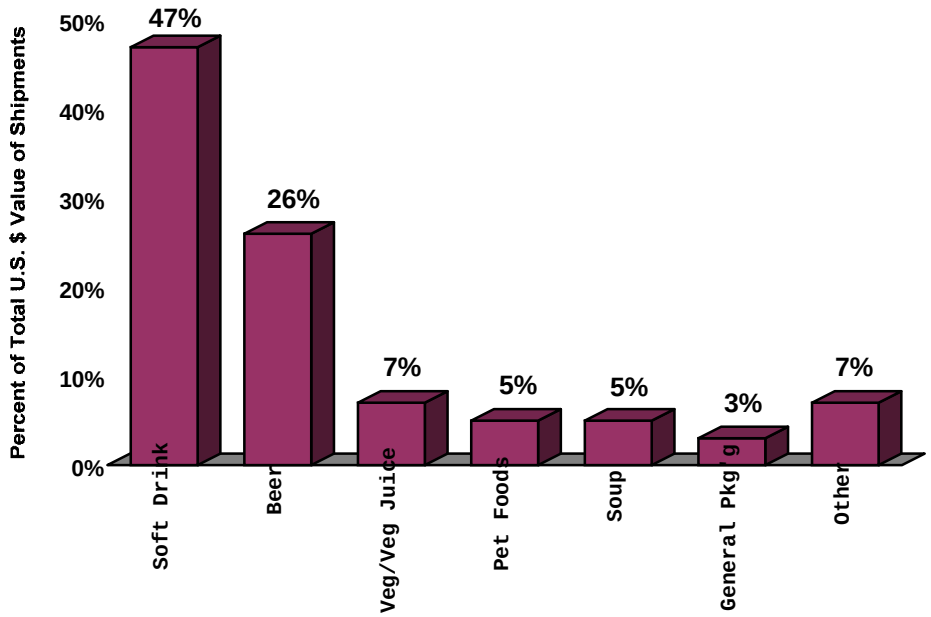

Figure 2. National Data of End-Product Classifications, 1995 - SIC 3411 Metal Cans

Industry Data by State (1997)

Table 4. Industry Data by State (1997) - SIC 3411 Metal Cans

State	Number of Establishments	Value of Shipments ($Million)	% of U.S. Shipments
California	42	1,916	16.0
Ohio	21	1,212	10.0
Illinois	24	652	5.4
Wisconsin	14	652	5.4
Texas	16	649	5.4
Florida	15	573	4.8
Georgia	6	527	4.4
Pennsylvania	14	464	3.9
North Carolina	5	451	3.8
New York	7	447	3.8
Total	164	7,543	62.9

Table 5. Top Five U.S. Companies Ranked by Revenues

2000 U.S. Metal Can Shipments (Millions of Dollars)			
Company	**Total**	**Headquarters Location**	**% of Total Market**
American National Can	2,900	Chicago, IL	24%
Ball Corporation	2,900	Muncie, IN	24%
Crown Cork and Seal	2,500	Philadelphia, PA	21%
Reynolds Metals	1,200	Richmond, VA	10%
U.S. Can Corporation	740	Oak Brook, IL	6%
Total Sales of Top Five	10,240		85%
Total Industry Sales	12,000		100%

Source: Ward's Business Directory of US Private and Public Companies 2000, Volume 5. Note that the sales of Metal Container Corp (Anheuser-Busch) and Coors are not directly reported under SIC 3411.

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Competitive Threats

The substantial capital cost associated with these high speed, highly automated can production lines provide a significant barrier for new entrants into this market.

Competition in the beverage packaging segment comes primarily from plastic and glass. According to a 1996 A.C. Nielsen market study, soft drink cans held nearly 75% of the retail packaging market for soft drink beverages sold in supermarkets, convenience stores, drug stores and mass merchandisers.

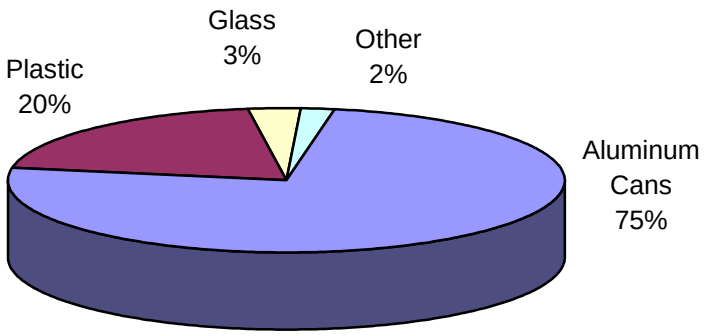

Figure 3. Retail Market Share for Soft Drink Beverages

Polyethylene terephthalate (PET) containers are the fastest growing plastic bottle segment.

- The biggest hurdle to future growth continues to be shelf life. Since plastic is porous, CO2 leaks out of carbonated beverages over time.
- Work is continuing on the development of new coatings to overcome this problem.
- Plastics dominate the larger container sizes, where the surface area to volume ratio is lower. The 16 to 20oz PET bottles are capturing share from metal cans.
- Plastic bottles with unique shapes are being used for beer and other beverages.

Other substitute products include paperboard packaging, composite cans, and flexible packaging.

As aluminum and steel prices increase, these substitute products become more of a threat.

International competition is a threat only from US based manufacturers. The plants have to be close to their content sources in order to compete.

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Investment Issues

The $12 billion metal can industry is highly automated and capital intensive.

- Over $4 billion invested in machinery and equipment assets.
- Roughly $650 million invested in buildings and structures.
- New capital expenditures averaged about $450 million annually from 1992 to 1996.
  - New capital spending has steadily increased since 1994.

Two of the largest U.S. manufacturers are heavily invested in overseas production facilities.

- Crown Cork & Seal operates 275 plants located in 53 countries.
- American National Can produces 29 billion cans in the U.S., and 10 billion cans in eleven other countries.

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National Trends

Current conditions in the U.S. metal can industry typify those of a mature market; i.e., relatively slow growth, increased price competition, and consolidation.

- The aluminum beverage can segment is predicted to remain flat at 102 billion cans through the near future.
  - Substantial growth occurred from 1985 (52 billion cans) to 1994 (103 billion cans)
  - The 1994 50% price increase in aluminum sheet resulted in the market pullback in 1995 to 98 billion cans.
- Steel beverage cans in the US market declined from 28 billion in 1975 to zero today.
  - This is contrary to the European market, where steel can technology kept pace with aluminum developments, and steel cans still have a majority 55% share of the beverage can market. The price differential of aluminum can stock versus steel can stock is greater in Europe than the U.S.
- A capital investment of $1 to $3.5 million is required to convert aluminum can production lines to handle steel cans.
  - Payback periods are less than one year for a 1 billion can production line when aluminum prices for a can body are 20% higher than for a steel can body. Differences in convey systems and lacquer finishing account for most of the conversion costs.
  - No U.S. aluminum can lines have been converted back to steel even with premiums for aluminum cans in the range of 10 to 20%. The higher prices for aluminum scrap also impacts the decision.
  - Aluminum can aesthetics are perceived as higher value than steel.
  - Steel producers are aggressively trying to regain market share.

Canmakers are differentiating their products to gain market share.

- New can shapes are being introduced. Coke and Pepsi/Frito Lay are test marketing contour cans to compete with shapes offered by PET and glass bottles.
- Cause related marketing featured on the can design is more common. As an example, Coors' features John Wayne and a recycling message on its beer cans.
- Talking or musical cans, with electronic chips on the easy-open can ends, have been introduced.

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Market Structure

Over 47% of all metal can manufacturers employ more than 100 people.

Table 6. Number of Establishments by Employment (1997)

Average Number of Employees	SIC 3411
1 to 19 employees	74
20 to 99 employees	69
100 employees or more	129
Total Establishments	**272**

The top five metal can manufacturers account for over 90% of the dollar value of total shipments in SIC 3411.

The top metal can manufacturers are becoming more diversified to offset the flat growth of the metal can market.

- Crown, Cork & Seal has added metal and plastic containers for beverage, processed food, and health and beauty care applications such as cosmetics. They also produce a wide variety of caps, closures, pumps, dispensing systems, and composite containers.
- American National Can was purchased by the Paris-based Pechiney Group, a $14 billion diverse French metals company.
- Ball Corporation provides a full range of metal sheeting, specialty coating and decorating services. They also produce PET plastic food and beverage containers.

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Summary of Industry Issues

There have been a number of principal industry challenges facing metal can producers over the past 15 years.

- Reduce the amount of material to produce a can.
- Reduce the energy consumption.
- Reduce the coating thickness on steel tin plate.
- Reduce VOC emissions.
- Improve the quality of the container.
- Lower the cost of the easy open end.

Metal can manufacturers have made significant gains in the last several years with respect to these goals.

- The amount of aluminum to produce a beverage can has dropped 25% in about 8 years.
- In just 25 years, the amount of steel needed to make a can has decreased by 50%.
- Steel cans are recycled at a rate exceeding 58 percent.
- Aluminum cans are recycled at a rate exceeding 63 percent.
- Water base coatings for can interiors are applied by a new wash coat method at an estimated annual energy savings of 700 million cubic feet of natural gas.

Productivity gains have not kept pace with rising material costs.

- From 1987 to 1995, the cost of materials rose over 26% and the value of industry shipments rose by only 12 percent.
  - Aluminum price increases in 1995 contributed to this trend.
- Manufacturing costs were reduced by 11% through productivity improvements during this same period.
- Profit margins fell by more than 3% as a result.

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National Energy Consumption Patterns

The metal working industries (SIC 34) consume almost twice their energy requirements using gas as compared to electricity as shown below:

Table 7. Total Energy Consumption, 365 Trillion BTU (1994)

Total Energy Consumption 365 Trillion BTU (1994)	
Natural Gas	60%
Electricity	32%
Other (Fuel Oil, LPG)	8%

Less than 2% of electricity is switchable to alternative energy sources.

Typical Electricity Requirements

In 1996, the $12.3 billion metal can industry purchased 2.95 billion kWh of electricity at a cost of $156 million.

- Electricity accounts for nearly 75% of total purchased energy costs.
- Total energy costs amounts to just over 1% of shipment revenues.

Manufacturers of metal cans use considerably more electricity for their size compared to other metal working manufacturers, Table 8.

- Electricity consumed per dollar of value added (VA) by metal can manufacturers is more than twice that of motor vehicle manufacturers.
- The dollar value of machine and equipment assets invested per dollar of value added output is more than twice that of motor vehicle manufacturers (SIC 3711).

Table 8. Comparison of Industry Statistics for Metal Can Producers

Industry SIC Code	Number of Estab.	1997 Value Added ($ Billion)	Electricity Purchased (kWh Billion)	kWh/ $ VA	Mach/Equip Assets ($ Billion)	Mach & Equip Assets/ $ VA
3411	272	$3.6	2.9	0.86	$3.8	1.12
3711	194	$55.3	9.7	0.35	$21.1	0.47

As shown in Table 9, nearly half of electricity end-use is for machine drive.

Table 9. Major Electricity End Uses (1994)

Machine Drive	49%
HVAC	10%
Facility Lighting	11%
Process Heating	13%
Process Cooling	2%
Facility Support, Other	15%

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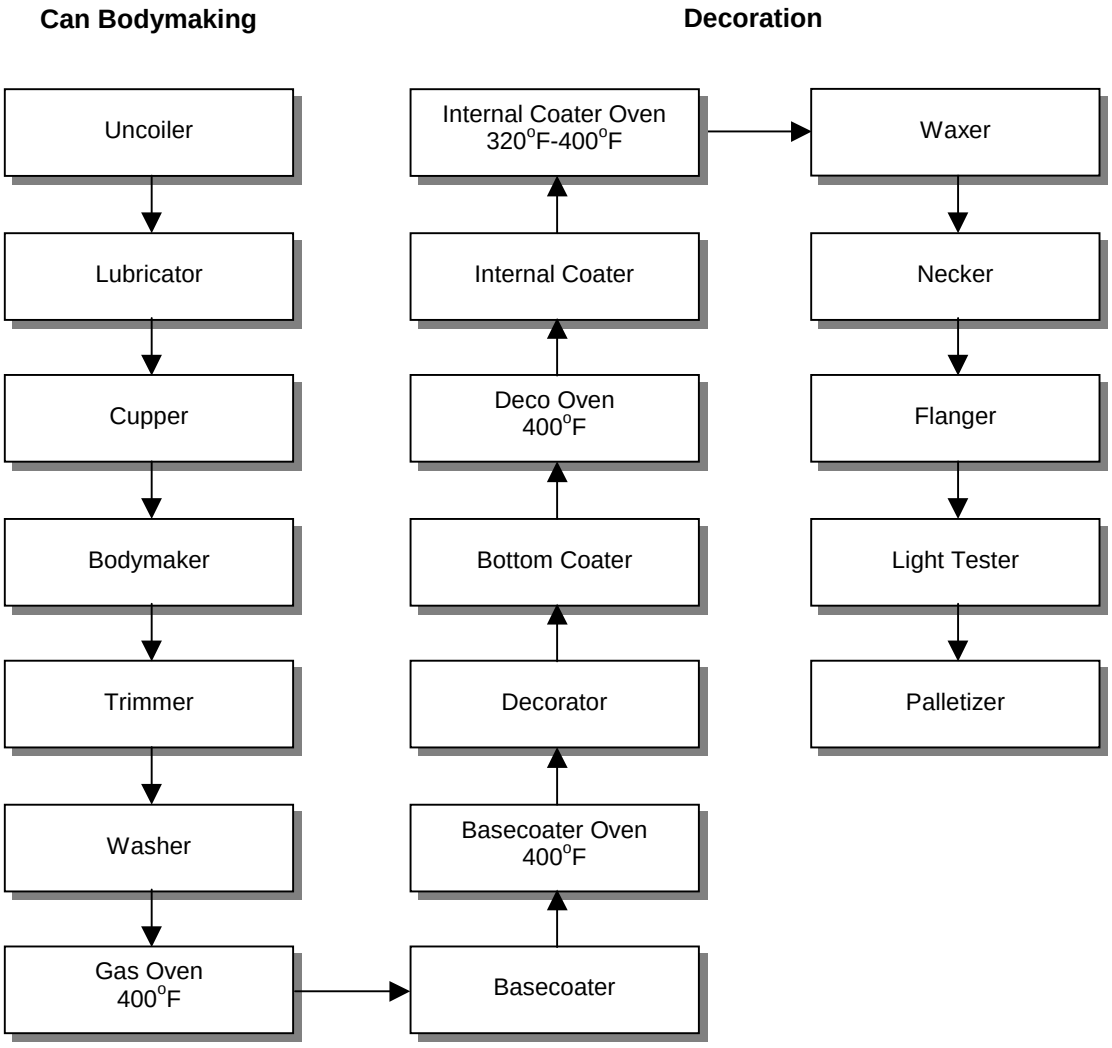

Figure 4. Process Flow Chart: Two-piece Draw & Iron Can Making Process

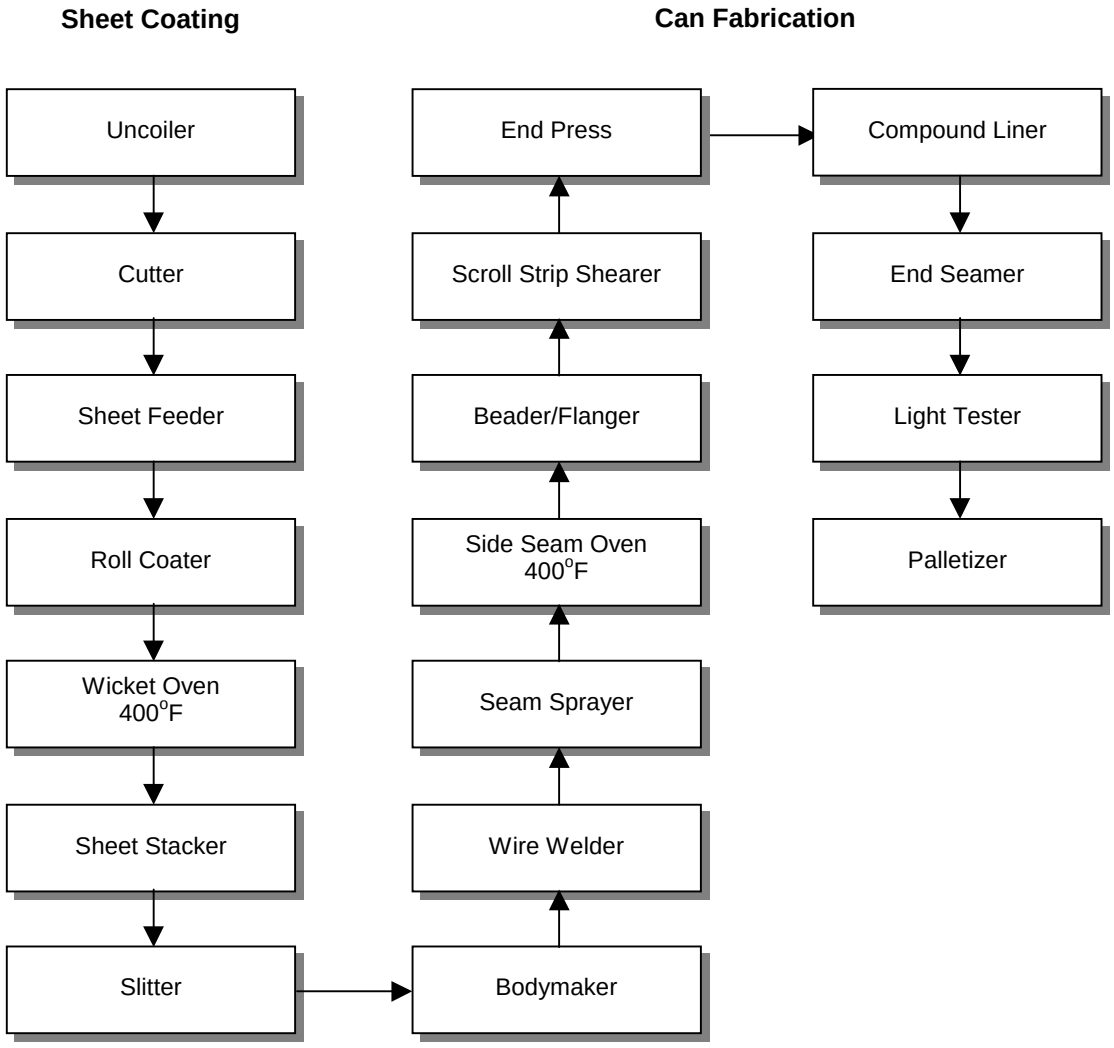

Figure 5. Process Flow Chart: Three-piece Can Making Process

Manufacturing Process Issues

Processes Overview

There are three distinct processes used to manufacture cans.

- The Two Piece Draw and Iron (D&I) process is typically used for aluminum beverage cans.
  - The D&I manufacturer applies the interior and exterior coatings and prints the label directly on the exterior surface of the can.
- The Two Piece Draw Redraw (DRD) process is used for short food cans such as those used for tuna cans.
  - The DRD manufacturer uses pre-coated steel, and applies a paper or film label to the exterior of the can.
- The Three Piece manufacturing process is typically used for soup can size steel food cans.
  - The three piece can manufacturer uses pre-coated steel, welds the can at the seam, and applies a paper or film label to the exterior of the can.

The *Two Piece Draw and Iron* process consists of can bodymaking and decoration.

- Initially, a three to five ton coil of aluminum is placed on the arm of the uncoiler.
- Lubricant is used to prevent the aluminum from oxidizing.
- The cupper then punches circular blanks of aluminum and draws them into cups.
- The cups are run through a series of tooling dies, stretched and formed into cans.
- The wall thickness of a finished can is approximately 0.0035 inches.
- The bodymaker leaves the can slightly thicker at their tops because they will later be necked and flanged.
- The decoration section of a D&I line includes a basecoater, a basecoater oven, bottom coater, deco oven, internal coater, internal coater oven, waxer, necker, and flanger.
- Nearly all major two piece manufacturers use water based inks and overvarnish for the decorating process.
- Many plants do not have a basecoater or basecoater oven because many cans do not require basecoats.
- Larger can plants typically have a representative on site to mix inks.
- Typical line speeds range from 1,400 to 2,000 cans per minute.

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- Most two piece can manufacturing plants have more than one line. The larger facilities have three to four lines, one of which is normally dedicated to the manufacture of 16 ounce cans and the remaining lines to 12 ounce cans.
- The ovens are gas convection ovens that operate in the 325 to 4000F range, typically having a 35 to 45 second dwell time.
- Pin chain ovens are used to move the cans through the curing cycles at high rates of speed.
- Prior to shipping, the cans are light tested for leaks and palletized.

The *Draw Redraw (DRD)* process consists of blanking, drawing, bottom profiling, flanging and trimming in a single press.

- The basic difference between a DRD can and a D&I can is that the sidewall of the DRD can is not substantially thinned.
  - The area of the DRD final can shell is about the same as the initial blank, in contrast to the D&I can which has an area substantially greater than its blank.
  - A hybrid process is called the *Draw-Thin-Redraw (DTR)* process. The DTR process involves some sidewall thinning by stretching during forming, but this is very demanding of material quality and is not widely used.
- For taller cans, one or more redraw operations may be used which progressively reduces the diameter of the can and increases its height.
  - Beading and flanging is done in separate machines.
  - Multiple draws are very demanding of lacquer performance and sometimes require repair.
- The DRD process is also capable of yielding tapered cans, which nest when empty for significant savings of shipping costs.

The *Three Piece* welded process consists of sheet coating and can fabricating.

- Large coils of uncoated tin plate steel are cut into sheets and fed through a direct roll coater, where a water based enamel coating is applied to the top side. This coating will eventually become the interior of the can.
- These coated sheets are dried in a 4000F six zone oven for 15 minutes. They are transported through the oven on wickets or moving grates.
- A slitter cuts body blanks from the sheets and wraps them around a rod to form a cylinder.
- Side seams are welded or cemented, then coated with a water based enamel coating, and cured in a 4000F oven.
- A beader/flanger adds ribs into the cylinder bodies for strength and curves the rims of the cylinders to form a flange.
- Can ends are punched and formed on a separate manufacturing line.

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- End sealer compound is applied to the can ends before they are attached to the flanged end of the can bodies.
- The end seamer double rolls the flanged end of cylinder with the can end and folds them together.
- Line speeds range from 350 to 800 cans per minute.
- Prior to shipping, the cans are light tested for leaks and palletized.
  - The water-wash spray booth is generally 100 to 150 feet long and applies the primer-surfacer in a constant air stream through which the automobile body moves.
  - A continuous stream of air, usually from ceiling to floor, is used to transport airborne particulates and solvents from primer-surfacer overspray.
- This primer coating is gelled, often in an (electric) IR oven, and cured in a convection oven.
- Application of the primary color coating is accomplished in a manner similar to the application of primer-surfacer except for the amount of pigments and solvents used in the application process.
  - VOC emissions from primary color coating operations can be double that released from primer-surfacer operations.
  - New water-based coatings are replacing solvent-based coatings.
  - In addition to the pigments and solvents, aluminum or mica flakes can be added to the primary color coating to create a finish with unique reflective qualities.
  - The water or solvent is “flashed off” in a black-wall or IR oven and the coating is subsequently cured in a gas-convection oven.
  - Again, the solvent is “flashed off” in a black-wall oven and the top coat is cured in a gas-convection oven for approximately 30 minutes.

D&I represents the highest capital costs, DRD intermediate, and three piece welded the lowest.

- D&I and DRD have limited flexibility, suitable for long production runs of one size can.
- DRD is best suited for short cans and three piece welded for taller cans.

Technology Trends

R&D efforts have been directed toward reducing the weight and material losses in can production, developing new uses for cans, improving quality and reducing manufacturing costs.

Both aluminum and steel can producers are continually trying to reduce the amount of metal in a can.

- Over the past 25 years, the steel canmakers have reduced the can weight by 50% while the aluminum canmakers have reduced the can weight by 40%.
- Manufacturers have reduced the wall thicknesses, fluted the top of the can and thinned the base while maintaining sufficient strength.
  - Can ends have been reduced from a 206 size (2 and 6/32") to a 202 size (2 and 2/32"). The larger sizes are still used in the beer can market.
- Developing less costly easy open end for the beverage can market.
- Steel cans trending toward thinner tin coatings and differential tin coatings.

More than 600 sizes, shapes, and styles of food and non-food cans are currently being manufactured.

New uses of beverage cans include non-carbonated foods such as snacks.

- Non-carbonated food cans would collapse without some other form of internal pressure. Nitrogen gas now provides sufficient internal pressure without affecting the food.

The contoured can shapes were first developed by Coca-Cola and American National Can to mimic the shape of Coca-Cola's contoured bottle.

UV coatings for the can exterior were developed and are used at the Coors facility, which is the largest can producing plant in the world.

- UV coatings reduce VOC emissions, which are the primary source of emissions in metal can manufacturing plants. Coatings cured by UV light consist of nearly 100% solids, which remain on the substrate during the coating process. Few, if any solvents are emitted by UV coatings.
- Other can manufacturing plants have not followed Coors' lead.
  - Considerable development in coatings is required to switch to UV coatings.
  - The additional cost of energy and pollution control for existing technology has not been high enough to warrant a switch to UV coatings.

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The steel industry continues to make a push for recapturing a share of the beverage can market. Better understanding has led to lighter gauge steel, thinner tin coatings and the continued push for a steel easy open end.

- When compared with its aluminum counterpart, the D&I steel beverage can is stronger and more dent-resistant, able to take more abuse in handling, filling and closing, and more suitable for mass storage and shipping.
- The European market is an easier target for taking away market share from aluminum beverage cans.
  - Steel can production lines are already in place there, not having been removed as they were from the US market.
- Capital investment in this flat growth industry is tight, making new production line investment for steel beverage cans in the US market more of a hurdle.

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Environmental Regulations and Issues

The Clean Air Act as amended in 1990 (CAAA) established the basis for the EPA to set new requirements for Hazardous Air Pollutants (HAPs) and to develop control techniques guidance (CTG) to reduce Volatile Organic Compounds (VOC) emissions.

- The EPA recently issued National Emission Standards for Hazardous Air Pollutants (NESHAPs) for both new and existing HAP sources based on "maximum achievable control technology" (MACT) to reduce air toxics by 60% over current levels.
- The CTG, although not a rule, will attempt to reduce emissions of VOCs at facilities located in ozone non-attainment areas or in the ozone transport region.
  - The reference technology used to establish CTG standards is known as “reasonably available control technologies” (RACT).

Compliance strategies for meeting NESHAP standards and CTG guidelines include reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals.

While there are solid waste and process wastewater implications for the metal can manufacturing industry, the vast majority of outputs from this industry are air emissions resulting from the solvent-intensive coating operations.

- Spending on pollution abatement amounted to $60 million in 1994, 85% of which was spent for air pollution abatement.
- Air emissions include HAPs and VOCs.
- The primary sources of emissions are the coating area and the curing ovens.
- Almost 90% of the HAP releases are ethylene glycol monobutyl ether (EGBE), an element of inside spray coatings used in manufacturing cans. The EPA reviewed the can manufacturers efforts to delist EGBE as a toxic substance within the Clean Air Act of 1990, and recognized the petition as complete in May, 1999. The Can Manufacturing Institute introduced the bill with 70 other co-sponsors in 1996.
  - This delisting applies specifically to two-piece beer/beverage can production facilities.
  - The conclusion was that two-piece beer/beverage can operations do not emit any HAP other than EGBE in amounts high enough to trigger a MACT (Maximum Allowable Control Technology) standard and therefore should not be regulated.
- The rate at which solvent vapors are emitted depends on the speed of the line, the size of the cans and the type of coating used.
- The largest can producing plant in the U.S. (Coors) has implemented UV coating and curing for the exterior decoration of its cans. This has substantially reduced overall VOC

emissions and the cure time compared to conventional gas convection ovens. However, this system was fully implemented in the early 1980's, and it is still the only UV coating and curing system in operation at any of the can producing plants in this country.

- The large quantity of solvent release, both fugitive and point source can be attributed to the solvent-intensive finishing processes employed by the industry.
  - Point source emissions occur through confined air streams as found in stacks, ducts, or pipes.
  - Fugitive emissions include losses from equipment leaks, or evaporative losses from impoundments, spills, or leaks.
- In addition to being used to clean equipment and metal parts, solvents are a component found in many of the coatings and finishes applied to metal cans.
- There are two types of add-on control device technologies used to capture pollutants from point-source air emissions: combustion control devices such as thermal incineration or catalytic incineration and recovery devices.
  - Thermal incineration is a process by which waste gas is brought to adequate temperature, and held at that temperature for a sufficient time for the organic compounds in the waste gas to oxidize.
  - With catalytic incineration, the temperature required for oxidation is considerably lower than that required for thermal incineration because a catalyst (platinum or palladium) is used to promote oxidation of contaminants.
- One recovery device is carbon adsorption used in conjunction with regeneration of the carbon bed by steam or hot air.

Opportunities for Increased Electricity Use

The most significant performance improvement for metal can production involves the use of IR to reduce the curing time for the can base coating and decoration from 30 seconds in a typical gas convection system to 5 seconds with IR.

- This opportunity has already been proposed to the metal can manufacturers. The project did not lead to a prototype production line because of the high capital investment and some of the technical difficulties in handling an IR cure at high production line speeds.
  - The timing for this concept may be more appropriate in the near future when other factors more strongly favor the economics of a capital investment to reduce cure times.
  - Increased EPA standards for VOC emissions are in place for 2003. MACT regulations, if applied, require thermal oxidizers to destroy VOCs. Estimate costs for thermal oxidizers exceed $1 million per plant location.
  - Proposed IR curing systems for curing can coatings reduce plant VOC emissions by 80%.

UV curing of external can base coatings and metal decorations have been in operation at the Coors plant in Colorado since the late 1970's. UV coatings significantly reduce VOC emissions.

- With more than 20 years of experience in one of the largest can plants in the U.S., the success and quality of the UV curable can coatings has been proven.

Induction heating of seams in 3 piece construction for improved integrity of can sealing.

Induction preheating of metal cans to enhance coating rheology to reduce pinholes in the external metal decoration.

Switch from solvent cleaning to aqueous-based ultrasonic cleaning systems.

Areas of Decreased Electricity Use

Energy efficient motors and adjustable speed drives.

Energy efficient shop lighting.

Energy efficient air compressors.

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Opportunities for Electric Utilities

Help metal can manufacturers meet environmental regulations.

- Understanding of regulations and to whom they apply.
- Mock inspections to determine level of compliance.
- Identification of best shop practices.

Nearly half of the electricity used in this industry is for motors. HVAC, process heating and lighting account for just over 30% of the remaining electricity uses.

- Target replacing worn out equipment with new technology.
  - Automation of manual processes.
  - Improved welding equipment.
- Substitute processes that generate less hazardous waste.
  - Aqueous-based ultrasonic cleaning, electrostatic powder coating, and electric IR heating.
- Productivity analysis would support improving efficiencies in day-to-day operations that are often overlooked due to lack of process knowledge or analytical resources.
  - Reuse of secondary heat in other thermal processing within the can manufacturing plant.

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Industry Associations and Periodicals

The following trade associations are resources for industry information and possible collaborative efforts.

- **Can Manufacturers Institute,** 1625 Massachusetts Avenue NW, Washington, DC 20036, PH: (202) 232-4677, FAX: (202) 232-5756, www.cancentral.com
- **American Iron and Steel Institute,** 1101 17th Street NW, Suite 1300, Washington, DC 20036, PH: (202) 452-7100, www.steel.org
- **Packexpo.com,** 2760 Prosperity Avenue, Suite 220, Fairfax, VA 22031, PH: (703) 205-0923, FAX: (703) 205-6409, www.packexpo.com
- **The Aluminum Association,** 900 19th Street NW, Washington, DC 20006, PH: (202) 862-5100, FAX: (202) 862-5164 , www.aluminum.org

The following trade publications are resources for industry information.

- *Packaging Digest,* Cahners Publication, 2000 Clearwater Drive, Oak Brook, IL 60523, PH: (630) 320-7429, FAX: (630) 320-7457, www.packagingdigest.com
- *Packaging World,* Summit Publishing Company, One IBM Plaza, Suite 2401, 330 N. Wabash Avenue, Chicago, IL 60611, PH: (312) 222-1010, FAX: (312) 222-1310, www.packworld.com
- *The Canmaker,* Sayers Publishing Group, Durand House, Manor Royal, Crawley, West Sussex RH10 2PY, UK, PH: 44-1293-435100, FAX: 44-1293-619988 , www.spg-can.com
- *Food and Drug Packaging,* 210 S. Fifth Street, St. Charles, IL 60174, PH: (630) 377-0100, FAX: (630) 377-1678, www.packaginginfo.com

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