How food and drink cans are made

1. Introduction

Cans for food and drinks may be constructed out of either two or three pieces of metal.

Three-piece cans, which were the first to be developed in the middle of the 19th century, consist of a cylindrical body rolled from a piece of flat metal with a longitudinal seam (usually formed by welding) together with two can ends, which are seamed on to each end of the body. Three-piece cans may be made in almost any practical combination of height and diameter. This process is particularly suitable for making cans of mixed specifications as it is relatively simple to change the specification of can being made.

Two-piece cans are made from a disc of metal which is reformed into a cylinder with an integral end. To this is cylinder, an end is seamed to close the can. The operation of reforming sheet metal without changing its thickness is called “drawing”. The operation of reforming a two-piece can into one of smaller diameter, and therefore greater height, also without changing its thickness is called “redrawing”. The operation of thinning the walls of a two-piece can by passing through circular dies is called “ironing”. Drawn and ironed cans are referred to as “DWI” or “D&I” cans. The DWI process is used for making cans where the height is greater than the diameter and is particularly suited to making large volumes of cans of the same basic specification.

Lids for cans are called “can ends” or simply “ends”. For a ring-pull end, the main circular part of the end is called an “end shell” whilst the ring pull is called the “tab”.

Because of the large volumes in which cans are manufactured, statistical sampling techniques must be used for checking and controlling all quality aspects of the can and end making processes. However, video scanning, light or pressure testing may be applied to all finished components.

2. Raw materials for can making

Food and drinks cans may be constructed from either steel or aluminium depending on the precise method of container manufacture. The raw materials for both these materials occur naturally in large quantities throughout the world and this allows the finished materials for can making to be available at relatively low cost. Steel for can making is supplied either as tin plate, which is steel with a very thin layer of tin electro-deposited onto both sides or tin-free steel, where no tin is present. Both steel and aluminium are non-toxic materials and as such are ideal for packaging foodstuffs; they are both also very easy to recycle after use. For many food and drinks cans, it is necessary to coat the metal with an organic material to prevent chemical actions occurring between the product and the metal of the container and the product or the external environment. All metal is initially delivered to the can making factory in large coils.

3. How three-piece welded food cans are made

Three-piece welded food cans may only be constructed from steel, as aluminium is not suitable for welding by this particular process. Coils of steel, after delivery from the steel maker, are cut into sheets approximately one metre square. The cut sheets are then coated, and printed if necessary, to protect and decorate the surfaces. Areas where the weld will be made on the can body are left without coating or print to ensure the weld is always sound. The coatings and inks are dried by passing the sheets through a thermally heated oven where the temperature is in the range 150 - 205°C.

The large sheets are now slit into small sheets, one for each can body, each small sheet being rolled into a cylinder with the two longitudinal edges just overlapping. The two edges are welded by squeezing them together whilst passing an alternating electric current across the two thicknesses of metal. This heats up and softens the metal sufficiently for a sound joint to be made. If the sheets were originally coated on what would become the inside surface of the can, it is necessary to apply a narrow stripe of coating along the inside of the weld area to ensure the whole of the internal surface of welded part of the can body is coated. This coating stripe is then thermally dried.

The can body now passes through a flanging machine where the top and bottom of the can body are flanged outwards to accept the can ends. One can end, called the fixed end, is mechanically seamed on to the bottom of the can body to close one end of the cylinder. After seaming, the can is passed through a beading machine where circumferential beads are formed in the body walls, to give added strength to the can. All cans now pass through a pressure tester, which automatically rejects any cans with pinholes or fractures. At this stage the manufacture of the empty can is complete and it is packed on a pallet for shipment to the customer for filling. The end which ultimately becomes the top of the filled can is called the “loose end”, as it is supplied “loose” to the customer for seaming on after the can has been filled with product.

4. How two-piece drawn and ironed food cans are made

Two-piece drawn and ironed food cans are normally constructed from tinplate. For this process the coiled tinplate, as it is unwound, is covered with a thin film of water soluble synthetic lubricant before being fed continuously into a cupping press. This machine blanks and draws multiple shallow cups in each stroke of the press, and makes thousands of cups per minute. The cups are then fed to parallel bodymaking machines which convert the cups into tall cans. This is the drawing and ironing process where the cups are first redrawn to the final can diameter and then forced through a series of rings with tungsten carbide internal surfaces which thin (iron) the can walls whilst at the same time increasing the can height. During this process, the can body is flooded with the same type of lubricant used in the cupping operation. As well as assisting the ironing process, the lubricant cools the can body and flushes away any metallic debris. No heat is applied to the can during this process - the heat generated is from friction as the metal is thinned.
After the forming of the can body, the uneven top edge of the can is trimmed to leave a clean edge and a can of the correct overall height. Trimmed can bodies are passed through highly efficient washers and then dried. This process removes all traces of lubricant in preparation for coating internally and externally. For food cans, which will ultimately receive a paper label, the external coating is applied by passing them under a series of waterfalls of clear lacquer which protects the surface against corrosion. The lacquer is dried by passing the cans through a thermally heated oven. Following this, the can body now passes through a flanging machine where the top of the can is flanged outwards to accept the can end which will be fitted after the can is filled with product. The flanged can is next passed through a beading machine which forms circumferential beads in the can wall to give added strength to the can. After all the mechanical forming operations have been completed, every can is tested by passing through a light tester which automatically rejects any cans with pinholes or fractures.

The inside of each can is coated with lacquer using an airless spray system. The special lacquer is applied to protect the can itself from corrosion and from the contents interacting with the metal. This lacquer is finally dried in a thermal oven at a temperatures of about 210°C.

At this stage, the manufacture of the empty can is complete and it is packed on a pallet for shipment to the customer for filling. The end which ultimately becomes the top of the filled can is called the “loose end”, as it is supplied “loose” to the customer for seaming on after the can has been filled with product.

5. How two-piece drawn and ironed drinks cans are made

Two-piece drawn and ironed drinks cans may be constructed from either aluminium or tinplate. For this process the coiled metal, as it is unwound, is covered with a thin film of water soluble synthetic lubricant before being fed continuously into a cupping press. This machine blanks and draws multiple shallow cups in each stroke of the press, and makes thousands of cups per minute. The cups are then fed to parallel bodymaking machines which convert the cups into tall cans. This is the drawing and ironing process where the cups are first redrawn to the final can diameter and then forced through a series of rings with tungsten carbide internal surfaces which thin (iron) the can walls whilst at the same time increasing the can height. During this process, the can body is flooded with the same type of lubricant used in the cupping operation. As well as assisting the ironing process, the lubricant cools the can body and flushes away any metallic debris. No heat is applied to the can during this process - the heat generated is from friction as the metal is thinned. After the forming of the can body, the uneven top edge of the can is trimmed to leave a clean
edge and a can of the correct overall height.

Trimmed can bodies are passed through highly efficient washers and then dried. This process removes all traces of lubricant in preparation for coating internally and externally. The clean cans are coated externally with a clear or pigmented base coat which forms a good surface for the printing inks. The coating is then dried by passing the cans through a thermally heated oven. The next step is a highly sophisticated printer / decorator which applies the printed design around the outside of the can wall in up to six colours plus a varnish. A coat of varnish is also applied to the base of each can by a rim-coater. The cans now pass through a second oven to dry the ink and varnish.

The inside of each can is coated with lacquer using an airless spray system. The special lacquer is applied to protect the can itself from corrosion and from the contents interacting with the metal. This lacquer is finally dried in a thermal oven at a temperatures of about 210°C.

Following this, the can body now passes through a necker / flanger machine where the diameter of the top wall is first reduced (necked-in) before the top edge is flanged outwards to accept the can end, which will be fitted after the can is filled with product. After all the mechanical forming operations have been completed, every can is tested by passing through a light tester which automatically rejects any cans with pinholes or fractures.

At this stage, the manufacture of the empty can is complete and it is packed on a pallet for shipment to the customer for filling. The end which ultimately becomes the top of the filled can is called the “loose end”, as it is supplied “loose” to the customer for seaming on after the can has been filled with product.

6. How ring-pull can ends are made

Ring-pull ends may be constructed from aluminium, tinplate or tin free steel. In all cases, both sides of the metal are coated with an organic material and printed if necessary prior to the ends being formed. End shells may be stamped directly from wide coils of metal, or from sheets cut from coils. In all cases, the metal is fed through a press which produces multiple stampings for every stroke resulting in many thousands of end shells being made per minute. The edges of the end shells are then curled over slightly

to aid the final operation of mechanical seaming the end on to the flange of the filled can. After curling, the end shells are passed through a lining machine which applies a very precise bead of compound sealant around the inside of the curl. A video system now checks to ensure that every end shell is perfect. The shells pass through a series of dies which score them and form a hollow upstanding rivet in the centre panel of the shell.

The pull tab is made from a narrow strip of pre-coated aluminium or steel, which is in coil form. The strip is first pierced and cut. The tab is then formed in two further stages before it is ready to be joined to the end shell.

The final operation is to attach the tab to the upstanding rivet on the shell and deform the rivet to make a sound joint between the two components. The finished ends, ready for capping the filled cans, are packed into paper sleeves and palletised for shipment to the can filler.