The preparation of sanitation standards normally has had gradual development in the various segments of the food industry. It is most gratifying to find a comparatively new industry developing such standards.

There has been a strong impetus behind the recent establishment of a number of small plants for the sole purpose of preforming single-service containers. For a number of years, it was increasingly difficult for small and medium-sized dairy plants to compete with large dairy plants in the packaging and sales of single-service containers. This was undoubtedly one of the reasons for the general exodus from the dairy industry of many small plants. Others, in order to continue in business, resorted to having milk packaged by their competitors with their own names imprinted on the carton.

Although preforming of certain types of milk cartons has been done for many years, it was not until 1947 that the first of the independent milk carton preforming plants was established for preforming the gabled top carton. The cartons were shipped to small and medium size dairies, and the dairy plant in turn was able to fill and seal the cartons in relatively inexpensive equipment by eliminating the costly portion of the equipment, including the former, waxer, and refrigerator sections.

There are two basic types of preformed cartons. One is completely preformed, requiring reopening of the carton prior to filling, the other is preformed, nested and wrapped and the top closed after filling at the milk plant.

Today, 17 independent preforming plants of this type, devoted solely to the forming, waxing, and packaging of single-service containers under strict sanitation controls, have been established, as noted in Table 1.

The need for sanitation and quality control was evident at an early stage. This accelerated a group of preformers of gable top cartons, together with manufacturers of filling and forming equipment and paper board fabricators to establish the Milk Carton Quality Preforming Council in February, 1955.

The fundamental aim of the Milk Carton Quality Preforming Council is the establishment of sanitation and quality programs for the preforming industry. It was decided that the fulfillment of these programs could not be successful without the concurrent development and establishment of proper standards.

In the development of operational standards relating to public health, certain specific problems had to be dealt with as follows:

1. The amount of moisture in the atmosphere had to be maintained at a specific predetermined maximum.
Table 1 – Location of Gabled Top Milk Carton Preforming in Plants in U. S.

<table>
<thead>
<tr>
<th>State</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>1</td>
</tr>
<tr>
<td>Colorado</td>
<td>1</td>
</tr>
<tr>
<td>Georgia</td>
<td>2</td>
</tr>
<tr>
<td>Illinois</td>
<td>1</td>
</tr>
<tr>
<td>Indiana</td>
<td>1</td>
</tr>
<tr>
<td>Iowa</td>
<td>1</td>
</tr>
<tr>
<td>Kentucky</td>
<td>1</td>
</tr>
<tr>
<td>Louisiana</td>
<td>1</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>1</td>
</tr>
<tr>
<td>Mississippi</td>
<td>1</td>
</tr>
<tr>
<td>Missouri</td>
<td>1</td>
</tr>
<tr>
<td>Oregon</td>
<td>1</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>1</td>
</tr>
<tr>
<td>Tennessee</td>
<td>1</td>
</tr>
<tr>
<td>Texas</td>
<td>1</td>
</tr>
</tbody>
</table>

2. The moisture content of the carton had to be exactly controlled.

3. The handling and distribution of adhesives and waxes required special consideration.

4. Since the cartons were not to be filled immediately with milk and thus gain some of the refrigeration from the product, additional refrigeration had to be incorporated after waxing.

5. Sufficient space had to be allocated to store single-service cartons, paper for wrapping, and large corrugated shipping cartons.

6. The building in which the plant was located had to be sanitary in construction to eliminate atmospheric contamination and infestation from insects and rodents.

7. A standard method for determining wax penetration had to be prepared.

8. Equipment normally used for fabricating milk cartons, which were to be filled with milk immediately, had to have a number of substantial changes in order to produce a satisfactory preformed carton.

PLANT OPERATIONAL STANDARDS

Moisture

The problem of excess moisture in the preforming of single-service containers is one that has been given considerable attention and was a determining factor in the use of single-service containers a number of years ago.

Moss, Thomas, and Havens (2) have commented on the effect of moisture as follows:

“As paraffin is an anhydrous substance, any factors which affect the moisture content of the paperboard and especially the surface moisture at the time of paraffining would influence the bacterial reductions due to the paraffin treatment.”

Excessive moisture in the blanks prevents proper drying of the adhesive film during the sealing cycle. This results in a weak bottom, and is a potential source of bottom leakers. When a damp container is submerged in hot wax, the moisture in the board penetrates through the film of wax on the inside and outside of the container, forming pinholes in the wax coating.

The lack of stiffness in the board can cause a concave condition in the side panels, and results in panel cave-ins.

A moisture content of four to six per cent gives the best operating conditions. Since the moisture content of the paperboard is related to the humidity of the surrounding air, it is of extreme importance to control this by maintaining the relative humidity in the storage rooms at specific levels. Table 2 is indicative of the relationship between the moisture content of the blank and room humidity.

In order to maintain the paper blanks at five per cent moisture, it is necessary to store them at thirty per cent relative humidity. It is also essential that the storage room be warm.

While controlling the humidity, the moisture content of the blanks will also be controlled. However, it is important that the temperature of the room be at least 70°F. Where blanks are stored at lower temperatures and then removed to a warm, humid atmosphere, it is always possible that moisture from the air will condense on the carton and nullify substantially the effects of proper storage.

Controlling the humidity in a blank storage room is accomplished by condensing the excessive moisture from the air by passing it over refrigeration coils.

To provide good storage, the first essential is a dry room constructed of materials which will resist the passage of moisture-laden air. Effective vapor barriers, such as aluminum, are most efficient for this purpose.

To effectively and economically use a refrigeration method to control humidity, it is necessary to provide good air circulation throughout the storage area. The refrigeration coils can only condense moisture from air which passes over it. Therefore, it is essential that the air circulate freely in order to perform its function of releasing moisture from the container blanks and carrying it to the cooler coil where it is discharged as water after condensing.

Storage methods are also important. Blanks should never be stored on a concrete floor. Cement is porous, readily transmitting moisture from the ground to its surface. Container blanks should be stored on wooden pallets or racks, so that they are at least four inches from the floor, with a six-inch space between stacks and twelve inches between the
RELATIONSHIP
factors must be given further consideration. The
stack and the surrounding walls. This accomplishes
floor area.
circulation so that the stored containers can come to
contact with the concrete; second, it permits free air
humidity existing in the storage room, and third, it
allows sufficient space for proper cleaning of the
room and moisture in the blanks, it is recommended
a state of equilibrium with the temperature and
three things - first, it keeps the blanks from direct
received from the converter, should never be
immedi­
ly preformed. The variation in moisture content
be removed only for short periods of time and the
adhesives kept covered when not in use. Transfer con-
tainers should be kept clean and adhesive appli-
should be of sanitary construction and washed at
frequent intervals.
Where adhesives are pumped from storage con-
tainers to the preforming equipment, the storage con-
tainers must be completely covered at all times. This
is to prevent contamination of adhesives by insects
and dust.

Waxes and Other Surface Protectants
Wax should be stored in a clean, cool room in the
orginal shipping cartons and it is recommended that
the temperature of the room never exceed 90°F. The
wax storage room should be well ventilated in order
to remove the possibility of odor absorption, particu-
larly of petroleum products.

Where wax is not completely used after the day’s
operation, it should be returned to the orginal carton
and placed in the storage room. Open cakes of wax
should not be exposed to atmospheric contamination
for more than very short periods of time.

Wax should be stored on skids at least four inches
from the floor, both in the storage room and the area
adjacent to the preforming equipment. The use of
skids simplifies transportation of wax throughout the
plant and facilitates cleaning.

The most sanitary and economical method of handl-
ing wax is by purchasing it from the refinery in the
liquid state. The wax is kept at predetermined tem-
peratures and automatically fed to the wax tank in
a completely sanitary manner. It eliminates the
unnecessary handling and the many chances of con-
tamination that can occur with block paraffins. In
addition, it assures a more even temperature in the
wax tank.

Refrigeration
The orginal design of carton manufacturing equip-
ment provided sufficient refrigeration to cool cartons
to a limited extent, since the addition of milk at a
temperature of 40°F would serve to complete the
necessary cooling. The lack of these factors results in
an improper setting of the wax, permits the formation
of loose wax, provides a carton with an uneven dis-
tribution of the wax throughout the paperboard suf-
fance, and may cause improper sealing after the pre-
formed carton is filled with milk. The importance of
these factors must be given further consideration. The
even distribution of wax over the surface is undoubted-
ly one of the greatest factors in preventing so-called
“leakers.” The public health significance of leakers

stack and the surrounding walls. This accomplishes
three things – first, it keeps the blanks from direct
contact with the concrete; second, it permits free air
circulation so that the stored containers can come to
a state of equilibrium with the temperature and
humidity existing in the storage room, and third, it
allows sufficient space for proper cleaning of the
floor area.

In order to maintain and control the humidity of the
room and moisture in the blanks, it is recommended
that the plant use a cooler, a heater, a humidistat,
a thermostat and a hygrometer or humidigraph. In
addition, a device for actually determining the mois-
ture on a single or a group of blanks is essential.

Under normal conditions, blanks, as they are re-
ceived from the converter, should never be immedi-
ately preformed. The variation in moisture content
could be considerable. As an example, it is possible
that blanks could leave the converting plant with a
four to six per cent moisture content. However, during
transportation in rainy weather, the moisture level
may rise to as high as ten per cent upon arrival at the
preforming plant, and it will take a number of days
in proper storage, thirty per cent relative humidity,
to return the blanks to their orginal condition. There-
fore it is recommended that blanks be stored under
a controlled atmosphere for at least two weeks prior
to being used.

Adhesives
Adhesives should be compounded of non-toxic in-
gredients and should be handled and shipped to the
preforming plant in clean, tightly-covered containers,
or bulk transportation tanks.
At the preforming plant, the adhesives should be
stored at a temperature ranging from 50° to 100°F and
kept not more than three months. Material stored
longer than this will show some evidence of separation
and will require thorough agitation before use.

<table>
<thead>
<tr>
<th>Relative humidity (%)</th>
<th>Moisture in the blanks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2.3</td>
</tr>
<tr>
<td>20</td>
<td>4.0</td>
</tr>
<tr>
<td>30</td>
<td>5.0</td>
</tr>
<tr>
<td>40</td>
<td>6.0</td>
</tr>
<tr>
<td>50</td>
<td>7.0</td>
</tr>
<tr>
<td>60</td>
<td>7.5</td>
</tr>
<tr>
<td>70</td>
<td>8.5</td>
</tr>
<tr>
<td>80</td>
<td>9.0</td>
</tr>
<tr>
<td>90</td>
<td>9.5</td>
</tr>
<tr>
<td>100</td>
<td>10.0</td>
</tr>
</tbody>
</table>

*Courtesy of Ex-Cello-O Corporation (3).
of course is obvious. Not only do they create an insanitary condition at the milk plant, in the milk delivery truck, and at the retail store, they also create problems of sanitation in the household refrigerator. Therefore, in the preforming of single-service containers, the refrigeration capacity must be accordingly increased.

Storage

There should be appropriate storage rooms for single-service containers, paper for wrapping and large corrugated shipping cartons, waxes and adhesives.

Building and Maintenance Sanitation

Many items of the Milk Ordinance and Code Recommended by the U. S. Public Health Service (1) and similar requirements of state and local codes must be complied with. These include floors, walls and ceilings, doors and windows, lighting, ventilation, miscellaneous protection including insect and rat control, toilet facilities, water supply, handwashing facilities, construction of containers, waste disposal, bacteriological examination, storage of multi-use containers, handling of containers, storage of single-service containers, personnel health, and personnel cleanliness. In addition, a statement should be added indicating that preformed cartons from points beyond the limits of routine inspection are acceptable if manufactured, fabricated, preformed, stored, and handled under provisions substantially equivalent to the requirements in these standards.

Labeling

There is need for a further clarification of the labeling requirements of most ordinances and codes relating to the identity of the plant at which the cartons are preformed. It has been tentatively suggested that the standards include a requirement for such identity in order to enable milk control officials to readily establish the source of cartons in the case of emergency. This need is evident when it is pointed out that users of preformed cartons may obtain these cartons from more than one source.

Laboratory Analysis

Bacteriological analysis, both disintegration tests of each source of supply and rinse tests, should be conducted monthly in accordance with the latest Standard Methods for the Examination of Dairy Products. This includes both standard plate and coliform counts.

Most preforming plants and milk control agencies have conducted penetration tests on preformed cartons to determine whether the carton is completely and sufficiently waxed. Both methylene blue and iodine solutions have been used for this purpose.

However, there is no available standard method either for determining the length of time the solution is to stay in the carton or a standard of interpretation. Although most cartons will show some slight staining at the flaps and on other surfaces, it has been felt that a good carton is one that shows staining of not more than one-quarter inch on each side of each score line, and no staining at any other surface. As yet, the Milk Carton Quality Preforming Council has not developed a standard for determining wax covering on preformed cartons, but feels that this will be an important part of the final standards.

Plant Inspection Form

A "Prefomed Milk Carton Plant Inspection Form" has been prepared. At present, it is intended to use this form merely as a guide. However, when the standards are completed, they will be available to all milk control agencies.

Carton Standards

The Milk Carton Quality Preforming Council is at present preparing a detailed standard for the dimensions of the carton, both in the blank state and completely preformed. This is extremely important in order to insure the sanitary filling of the container, regardless of the source of the container or the type of filling equipment.

Deviations from a standard may result in breakage of cartons, unnecessary handling of contact surfaces in order to have proper fill, and improper sealing. It is contemplated that most of the dimensions should be maintained within 1/32", and experience indicates that preformers can adhere to this standard.

The top must be sufficiently strong to be opened by the filler plow without damage to perforations, glue joints, or flaps, and where pitcher pour perforations are used, they should not be broken in forming.

Conclusion

It is the intention of the Milk Carton Quality Pre-
forming Council to prepare a complete tentative standard for review by the industry. Following that, it is to be submitted to various milk control agencies for their comments and suggestions. When all of this has been completed, the standard will then be adopted as an official industry code.

References

1. Milk Ordinance and Code Recommended by the Public Health Service, 1953.