ITEM: Half Tray Double Seam Can (Tray Pack Can) MONOGRAPH#: AAA

NSN: None ITEM SPECIFICATION: Mil-C-44340 (Can, Tray Pack)

CHARACTERISTICS OF ITEM:

A. BACKGROUND.

1. In 1969, the U.S. Army Natick Research, Development and Engineering Center (Natick) began investigating the possibility of developing a retortable steam table container (can) for special purpose thermoprocessed foods that would be compatible with military feeding requirements.

2. Natick became interested in such cans while reviewing a report entitled "Sterilizable Semi-rigid Aluminum Food Containers" by Lane and Widmer (1969). The authors reported a Swiss group had developed a line of single serving cans with a perfectly smooth flange that could be heat sealed. This breakthrough in forming cans led Natick to conclude that a hermetically sealed half-size steam table tray can could be fabricated and that such capability could be employed to complement the Combat Field Feeding System (CFFS) *.

* Now called the Army Field Feeding System

3. The CFFS, an Army of Excellence Program, was designed to take advantage of technological advances in food preparation and processing to reduce combat food service requirements for labor, water, and fuel; to shorten food preparation time; and to increase kitchen mobility, flexibility, and responsiveness. The tray pack can was viewed as an ideal candidate to support the CFFS initiative. A variety of menus, incorporating the tray pack can, was proposed for subsequent employment with in the CFFS.

4. The menus consisted of a combination of tray pack entrees, vegetables, starches, and desserts, supplemented with bread, beverages, soups, and cereals, and includes fresh fruits and salads when available. A ten day, two meals per day, cyclic menu based on the concept was formulated by the U.S. Army Troop Support Agency and accepted by Natick, the Services, and the Armed Forces Product Evaluation Committee (AFPEC), as a basis for the tray pack product development and testing program.

5. Initially, the tray pack product development and testing program created 73 tray pack items. Technical requirement documents for these products were provided to the Defense Personnel Support Center (DSCP) for production testing during FY 83-85. Subsequent field acceptance testing of the tray pack products was conducted separately with each Service in FY 84-86. The AFPEC granted final approval for the tray pack which became available for cyclic procurement starting in the second quarter FY 85.

6. Tray pack in-plant inspection, certification, and supervision is the responsibility of the U.S. Department of Agriculture (USDA). The USDA Agricultural Marketing Service (AMS) is responsible at the food processor's plant for the origin inspection of quality and packaging of all tray pack components. The USDA Meat and Poultry Inspection Branch (MPI) of the Food Safety and Inspection Service (FSIS) is responsible for wholesomeness, sanitation, and assurance of specified sterility of the animal origin products.

B. COMPOSITION AND NOMENCLATURE.

1. The tray pack can is unique to the military food inspector in two respects. First, the material composition of the can is significantly different from those cans encountered in historic day-to-day inspection activities. Secondly, the design of the can has a construction profile with numerous distinct features. Therefore, it is important that inspectors become familiar with the composition, construction and landmarks associated with the tray pack can in order to properly assess can integrity.

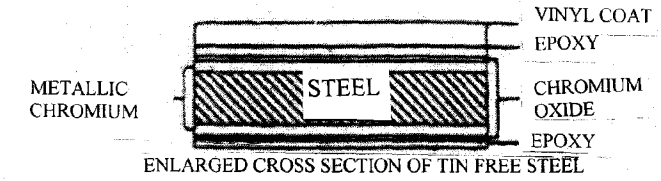
2. The tray pack can is fabricated through a draw (stretching) process in which a flexible coated steel roll stock is "pressed/stamped" into a specific configuration in a single operation. The process utilizes a 110 ton capacity incline press and either a one or five piece, segmented die to obtain the desired shape of the can. The procedure subjects the roll stock material to pressures in excess of 1,000 pounds per square inch. Evidence of this force may be seen on some cans as stretch marks known as "Luder Bands". Their significance is relative to how distinct they appear on the can surface. Very distinct Luder Bands may be an indication of fracturing of the interior coating(s) which may lead to premature deterioration of the product within the can.

3. The current roll stock, which measures .0099 inches thick, is an electrolytic chrome coated tin free steel consisting of several layers of material. Traycans produced prior to med-1985 were lined with a single vinyl interior coat. After 1985, and until February 1989, all cans were lined with an epoxy/vinyl double interior coat produced by Valspar Coating Systems, Inc. This coating system consists of a clear epoxy base coat and a vinyl top coat. For a period of two months, February to April 1989, some cans were manufactured with a double layer epoxy interior coat. Like the Valspar can, the Dexter-Midland (D/M) coated can had a clear base coat and white top coat. The D/M can could be identified in most cases by a <CSC> logo on the side of the can. In April the manufacture of Valspar cans was resumed and could be identified by a <CSC-V> logo on the can.

4. A graphic representation of the roll stock and its comparison to a typical #10 can is shown on the next page. Also given is a review of the layers from the outside to the inside.

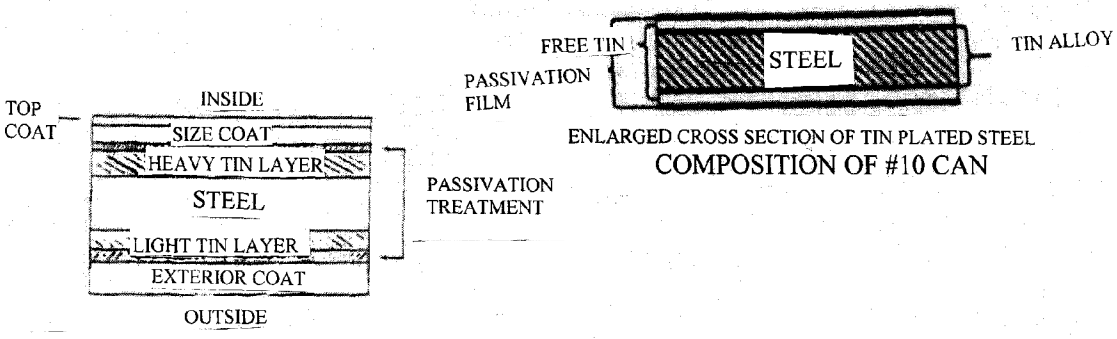
5. The tray pack can measures 12-1/4" x 9-7/8" x 2" and holds 105 ounces of food product, the equivalent quantity of a number 10 can. Landmarks and nomenclatures are shown in Figures 2 and 2A. Their importance is evident, for it is generally at these locations that the roll stock is stressed during the can fabrication process. Consequently, many of the "gray spots" and leaker defects discussed in detail in paragraph E may be associated with these locations.

COMPARISON OF THE TIN FREE STEEL AND TINPLATE CANS



ENLARGED CROSS SECTION OF TIN FREE STEEL

COMPOSITION OF TRAY PACK CAN



ENLARGED CROSS SECTION OF TIN PLATED STEEL

COMPOSITION OF #10 CAN

COMPOSITION OF NEW*
TRAY PACK CAN

FIGURE 1
(REVIEWING THE LAYERS OF THE TRAYCAN FROM THE OUTSIDE TO INSIDE)

a. Single exterior coat of clear epoxy (1.5 mg/in sq).
b. Thin coat of chromium oxide (.7 to 2.5 mg/ft sq).
c. Thin coat of chromium (5 mg/ft sq).
d. Steel base plate: In mid-1984, the thickness of the steel was increased from a 75 pound per base box to the current 90 pound per base box. (Base box weight is the weight of 112 sheets of material (base box) measuring 14" X 20".).
e. Thin coat of chromium (5 mg/ft sq).
f. Thin coat of chromium oxide (.7 to 2.3 mg/ft sq).
g. Base coat of clear epoxy (3.5 mg/in sq).
h. Interior top coat. Valspar: A thin coat of white vinyl which is relatively soft and subject to easy removal by abrasion or scuffing. The whiteness of the vinyl coating may vary from a bright white to shades which favor gray or tan. This variance in color is a result of the cure process which "bakes" the vinyl coating onto the base metal. Dexter-Midland: A white epoxy top coat which is easily stained by product and sometimes presents a mottled appearance.

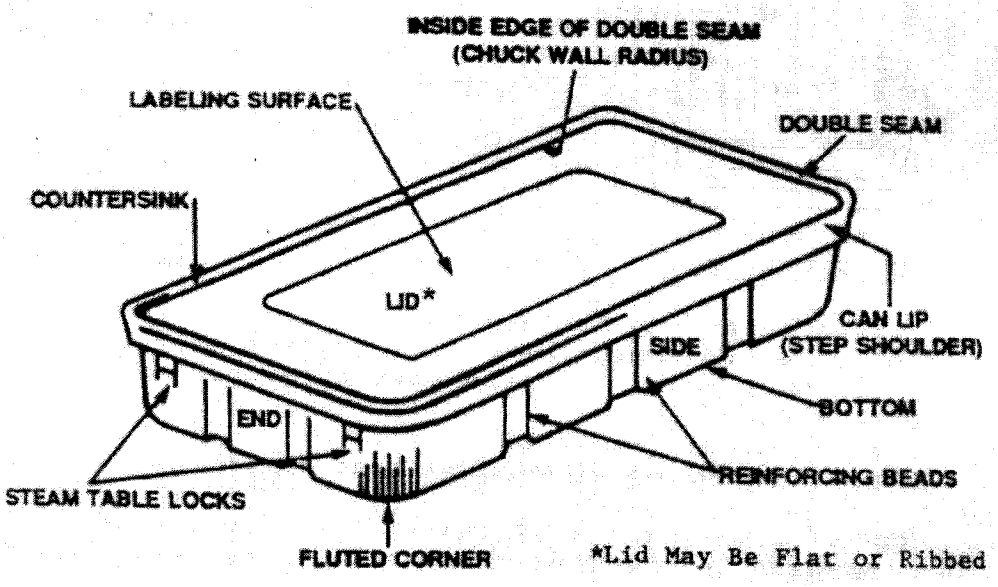
* Presently being developed and tested for production by FY90/91.

C. TRAYCAN INSPECTION AND EVALUATION.

1. Inspectors should bear cotton gloves when inspecting traycans for closed package defects. Wipe the cans thoroughly with the gloves (or a cloth) to remove dirt and debris which could hide corrosion defects such as gray spots. Turn the can under a bright light so that each view (top, bottom, side and end) may be closely examined for closed package defects. Examine the traycan for vacuum defects as indicated in Figure 5.

2. Prior to opening the traycan for destructive open package inspection, completely heat the contents in accordance with the instructions on the can label. Should a product related defect be identified, record the defect after evaluation of the heated product to ensure the defect is genuine and not a normal characteristic of the unheated product. Wash out the can, if possible, and examine the interior for internal defects (see paragraph D of this Monograph).

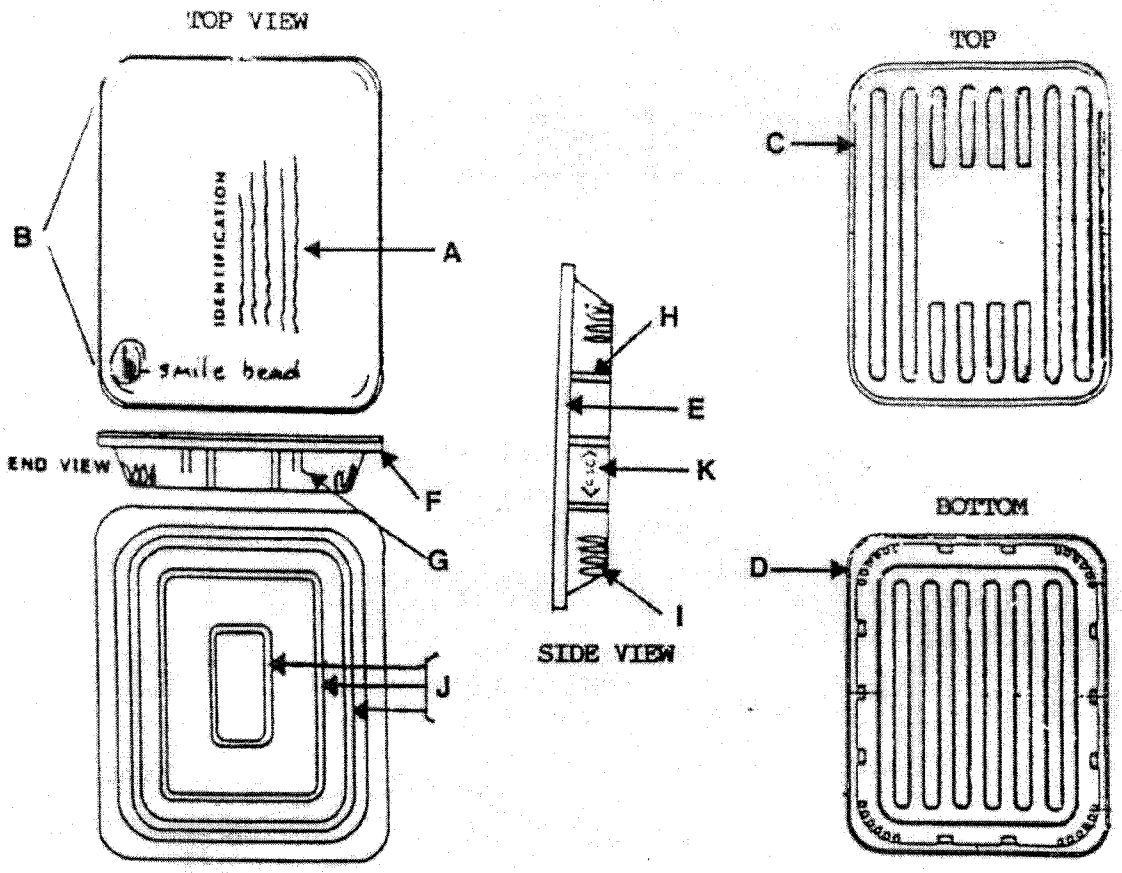
TRAY PACK CAN LANDMARKS/NOMENCLATURE



TRAY PACK CAN NOMENCLATURE

FIGURE 2

TRAY PACK CAN LANDMARKS/NOMENCLATURE (Continued)



a. Raised labelling surface.
b. Smile reinforcement bead (not present in ribbed lid can).
c. Chuck wall radius (inside edge of double seam).
d. Double seam.
e. Step shoulder (can lip).
f. Step shoulder reinforcement bead (eliminated after July 1986).
g. Steam table locks (eliminated after April 1989).
h. Side wall reinforcement beads (3 along length, 2 along width).
i. Fluted corner.
j. Expansion rings.
k. Can manufacturer's logo (may be present on some cans; applied with a thermosensitive ink which changes color from black to red or brown to blue when subjected to a temperature of 270 degrees F for 20 minutes. This is an indicator of proper retort during processing).

FIGURE 2-A

D. PROBLEMS.

1. In May 1987, reports were received from Panama regarding swollen and leaking traycans. On-site investigation confirmed these reports and identified the problem as the result of external stress cracks or scratches which provided sites for onset of corrosion. The observations were limited to two lots from 1983 and 1984 dates of pack. (NOTE: These tray packs were from production lots which were three to four years old and fabricated from the 75 pound per base box material and with a single layer interior coating.)

2. During early June 1987, DSCP reported that leaking traycans had been identified at seven other locations. Inspection reports and examination of samples confirmed the presence of leakers and also the presence of "gray spots" visible on the exterior of cans. These gray spots (a form of corrosion) differed in appearance from normal red rust corrosion and some became leakers if probed gently with a needle or similar object.

3. A high rate of leakers was found in the 1983 and 1984 DOPs (17.2% an 10.0% respectively), along with an incidence of gray spots of 40.3% and 42.5%. For the 1985 to 1987 DOPs traycans there was a sharp decrease in leakers, ranging from 0% to 0.3%. Gray spots, however, were occurring at the rates of 5% to 11% for those same DOPs. The occurrence of these defects did not appear to relate to product, processor, or storage location. In addition to these corrosion problems, there were apparent swellers or cans with low vacuum as evidenced by the failure of tray pack lids to exhibit the concave appearance that is indicative of vacuum in an intact, properly processed product. This phenomenon (failure of tray pack lids to exhibit a concave appearance) may be indicative of product spoilage.

4. In July 1987, a DoD Task Force was formed to investigate the reported problems concerning tray pack cans and the implications these problems might have on the inclusion of tray pack products in the CFFS. The focus of the Task Force was to identify the causes of the leakers, gray spots, swellers, and extensive external rust found on some cans; recommend corrective action; engineer out problems as appropriate; and provide the can manufacturer and product processors with recommended good manufacturing practices (GMP).

5. The Task Force concluded that the leakers and gray spots were the result of interaction between food product and the base metal of the traycan. This was suspected of being caused by poor handling practices associated with unfilled cans lead to damage (fractures, breaks, scuffs, etc.) of the interior vinyl coating(s) which provided sites for this corrosive reaction to take place. Additionally, it was determined that the swellers were not caused by biological or chemical activity but were due principally to overfilled cans. Finally, the observation of extensive rust found on the exterior of some containers was again attributable to poor container handling practices. Damage to the exterior layers from stacking and handling practices. Damage to the exterior layers from stacking and handling prior to, during and after process and retort provided access to the base metal for moisture to begin the corrosive process.

6. In the two years since implementation of GMPs, gray spots and learkers continued to be a problem in the traycan. DSCP, in conjunction with Natick, conducted an extensive storage study from March to June 1989 of tray pack products over 12 months old. After examining over 27,000 cans, the results supported conclusions that may have explained the continuing traycan failures. Gray spots were found to be container related, not product related and physical damage as the cause of the gray spot phenomenon was not always supported. In many cases, internal microscopic examination of the gray spots showed coating defects as the cause of the defect. When the defect penetrates through both layers of the coating, an electrolytic cell is set up which corrodes through the base metal. Although a higher percentage of defectives were generally found in brine-type products, almost all products were found to be affected. Product packed in Valspar cans prior to February 1989 can be expected to exhibit gray spots 18 to 24 months, and sometimes earlier, after date of pack.

7. On 3 February 1989, Central States Can Company began producing lids from roll stock with the Dexter-Midland (D/M) coating system. By 10 February, D/M coated lids and bodies were being produced by CSC and packed with product. After two months of production, a USDA inspector detected interior rust and blistering during the quality examination of whole corn. Subsequent warranty inspection of lots packed in the D/M and Valspar coated cans revealed various coating defects along with evidence of physical damage (scratches). The defects ranged from a crater-like appearance called fisheyes to blistering, pitted corrosion and rust. Production of D/M traycans was halted on 13 April and Valspar can production was resumed 18 April 1989.

8. At present, there is a single source supplier for tray pack cans to all tray pack food processors. Although the Task Force noted that the incidence of leakers and gray spots was sharply reduced by previous initiatives, the continued failure of the traycan supported a variety of recommendations which were made relative to the can construction and configuration. The can manufacturer, in conjunction with Natick, is developing and testing an alternative which could be in production by mid to late 1990. This can would be tinplate coated steel with an epoxy or vinyl interior lining.

E. TRAY PACK DEFECTS (Definitions and Classifications)

1. Most of the tray pack can inspection guidance contained in Appendix B inspection tables is based upon traditional definitions and classifications contained in the U.S. Standards for Conditions of Food Containers. The discovery of the "gray spot" phenomenon, the lack of concavity exhibited by some tray pack lids, and interior coating defects has generated the need for additional defect definitions and classifications.

2. The following summary is provided to reflect current policy with respect to tray pack defects, their classification, and procedures employed in evaluation of the tray pack can.

a. Gray spots (refer to Figure 3). There are two distinct types of gray spots.

(1) Internal-This type of gray spot is due to internal corrosive factors. The corrosion begins when food product comes in contact with the inside surface of the base material through small breaks or scratches in the inner coating(s). In time, the corrosion continues through the metal and is observed as a gray to black spot. At this point, only the external epoxy coating covers the hole and precludes leakage. This form of corrosion is temperature and time dependent and leakers could result before expected product shelf-life is exceeded.

(2) External-This type of gray spot is due to external corrosion factors. The corrosion starts when physical damage (abrasions, nicks, etc.) to the outer coatings expose the outer surface of the base metal to the atmosphere. At an appropriate temperature and relative humidity, corrosion can progress through the base metal and inner coatings to result in a leaker. This form of corrosion progresses slower than internal corrosion and should not result in leakers until the expected product shelf-life has been exceeded.

(3) The two types of gray spots can be readily distinguished by probing with a pointed object, such as a dissecting needle. Cans with internal gray spots can be easily pierced or have little metal integrity remaining, while those with external gray spots will retain their structural integrity. However, isolated reports have been received where external gray spots (when gentle probing is applied) will make a slight indentation or depression in the base metal but will not penetrate the interior of the can. This has been observed in cans which were approaching or exceeded their expected shelf-life.

(4) Consequently, gray spot defects will be classified as follows:

(a) Gray spots that leak when probed (Major A defect).

(b) Gray spots with weakened base metal (Major B defect).

(c) Gray spots with no weakening of base metal (Minor defect).

b. Vacuum Defects.

(1) Flipper/loose lid (refer to Figure 4). The lid has a wavy appearance and when the lid is depressed at one end, the other end will distend. (Major A defect)

(2) Panelling. Deformation of the can at the bottom corners resulting from excessive mechanical vacuum during processing. Slight paneling is commonly found in some bakery type items and is not considered a defect. (Affects double seam - Major B defect; does not affect double seam - Minor defect.)

c. Swellers.

(1) Hard swellers (refer to Figure 6). Swelling of the tray pack can which distends the lid above the double seam. (Major A defect)

(2) Soft sweller (refer to Figure 7). Swelling of the tray pack can which distends the lid to the degree where a 12 inch straight edge, when placed on top of the lid, will rock back and forth over the distended lid and/or will evidence light under the ends of the straight edge. (Major A defect)

d. Pinhole. A small hole penetrating entirely through the can. (Major A defect)

e. Rust. Corrosion which exhibits the typical reddish brown coloration associated with ferrous material oxidation and in the opinion of the inspection activity cannot be classified as gray spot corrosion.

(1) Pitted rust. Rust that cannot be removed by rubbing with a soft cloth and has "pitted" the can surface. (Major B defect)

(2) Rust stain. Rust that cannot be removed by rubbing with a soft cloth. (Minor defect).

f. Interior defects. These are identified on OPI by emptying the traycan, thoroughly washing and drying while taking care not to scratch the inner surfaces. Examine the interior visually for defects and use a magnifying lens to confirm and classify the defect.

(1) Fisheye (cratering). A film defect in the interior coating which resembles small, thinly coated craters. (Minor defect)

(2) Blistering (solvent pop/flash). A blister-type defect in the coat caused by the release of trapped solvent during the cure process. (Minor defect; Major B defect if pitted corrosion or rust is present)

g. Other defects. Other defects will be classified in accordance with the inspection tables contained in this Appendix.

F. Tray Pack Can Evaluation Procedures

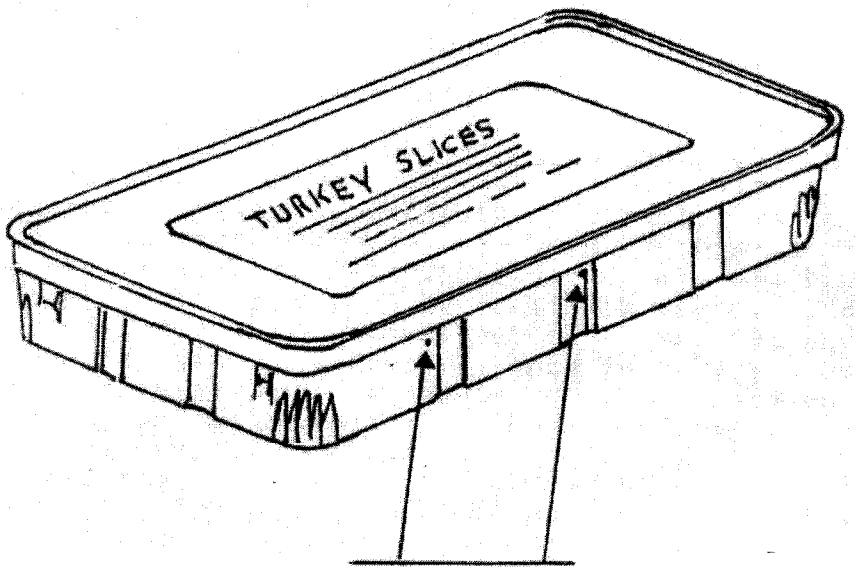
1. Since the inception of the tray pack concept, the traycan has been a "weak link" in the serviceability of the module. As previously discussed, poor manufacturing practices, coating defects and the configuration of the can have all contributed to a traycan which has not lived up to the goal of the designers and/or manufacturer. The development of a tinplate can has a high probability of solving the problem in the future. At the present, however, inspectors must be capable of evaluating tinfree steel traycans already in the system to insure the condition and serviceability of the module is accurately assessed.

2. When inspecting traycans for external defects, it is important to observe all areas of the can under bright light. The best way to inspect the can is in a systematic manner, inspecting each can in the same routine fashion, wiping the can of dirt and inspecting each view of the can (top, bottom and sides) in the same order each time. The gray spot, a common defect found in the traycan, is at time so small it appears as only a speck of dirt until probed. Other defects, such as defective seams, may be more visible but could be missed without thorough examination of the can.

3. Vacuum examination should be performed IAW the procedures in this monograph.

4. Tray pack cans should be heated thoroughly in accordance with the instructions on the can label prior to opening for destructive open package inspection. Examine the product immediately upon opening the heated samples, since exposure to the air will allow product odors and color to dissipate or dull.

GRAY SPOTS



Gray Spots 1/ 2/ 3/

FOOTNOTES:

1/ The spots may appear dark gray to black and can be as small as the size of a pinhead.

2/ Spots may be evident anywhere on the can surface, but may appear more frequently at the can stress points.

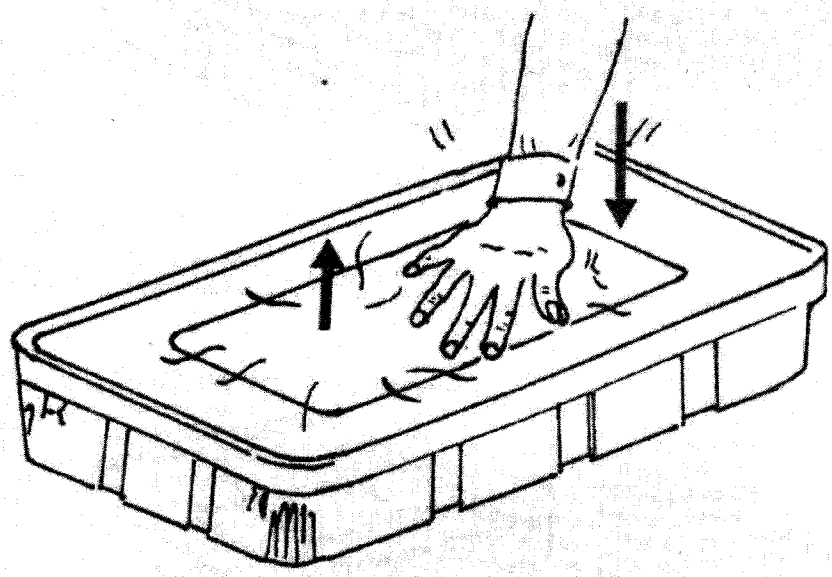
3/ Interior corrosion is determined by gently probing a gray spot with a standard laboratory dissecting probe. As an alternative, a push pin which has a barrel no larger than the size of a standard thumb tack may be used. The amount of pressure used to probe the gray spot should not exceed that required to pierce a single sheet of bond paper. If probing by this method creates a hole in the can, interior corrosion is present.

FIGURE 3

FLIPPER/LOOSE LID

Exert Downward Force,
Then Release

Other End of Can
Lid will Distend
1/ 2/ 3/



FOOTNOTES:

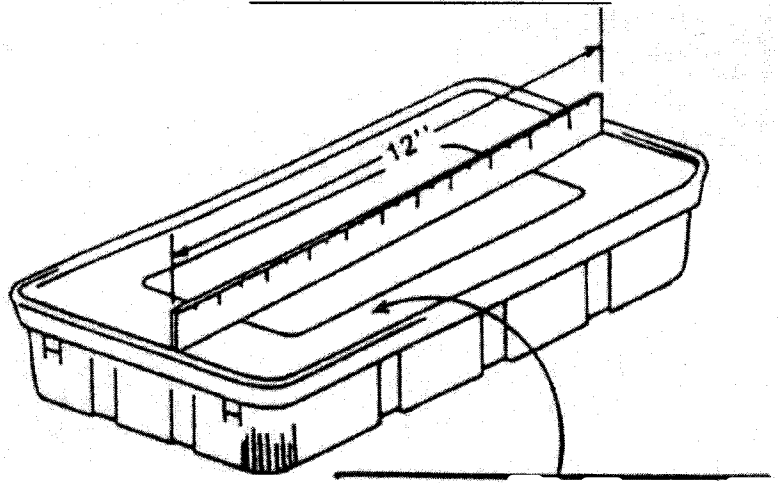
1/ The can lid has a wavy or loose appearance. The characteristic concave surface is not evident.

2/ The lid may remain distended or return to a wavy appearance.

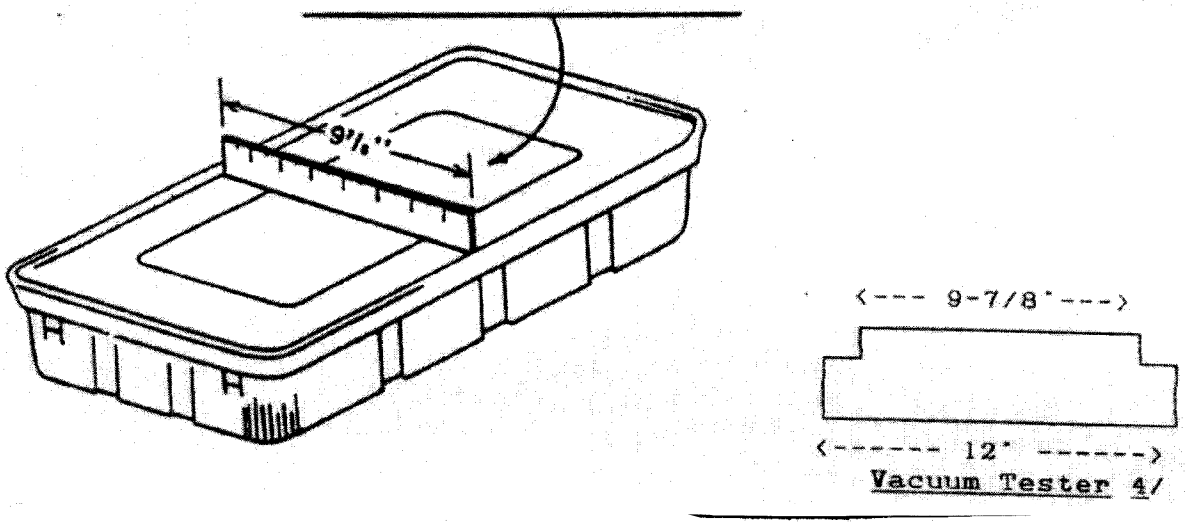
3/ A loose lid container that exhibits concavity at the center of the lid in accordance with the vacuum examination will not be classified as a sweller.

FIGURE 4

VACUUM EXAMINIATION



A Concave Surface Must Be
Exibited At The Center of the Lid
1/ 2/ 3/



FOOTNOTES:

1/ Metal straight edges shall be used.

2/ Both ends of the straight edge must be in contact with the lid at the inside edge of the double seam.

3/ Light shall be evident between the straight edge and the labeling surface.

4/ Locally manufactured using 1/16" thick steel or aluminum.

FIGURE 5

SWELLERS
(HARD SWELLER)

Can Lid Is Distended
Above The Double Seam

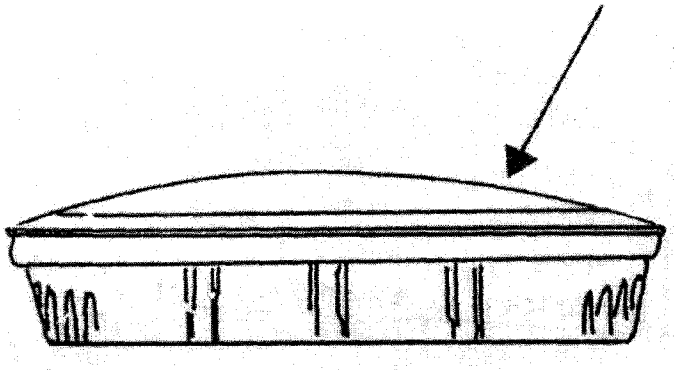


FIGURE 6

SWELLERS
(SOFT SWELLER)

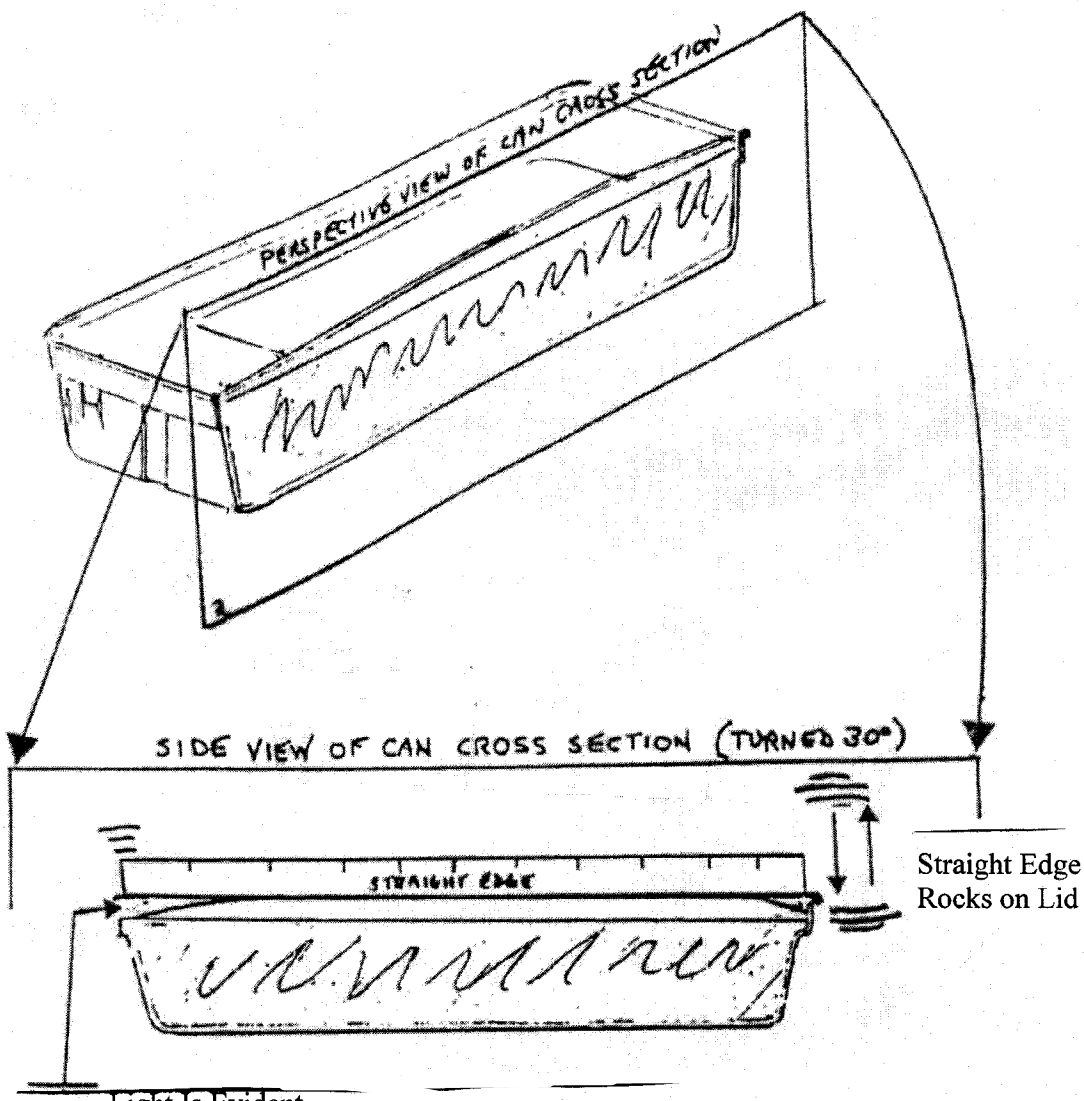


FIGURE 7