

## **Flexible Retort Pouch Defects**

Identification and Classification

Status  
New

Date  
31/05/2002

### **CHAPTER 2**

#### **GENERAL**

##### **2.1 BACKGROUND**

The retort pouch is a flexible laminated food package that can withstand thermal processing. It has the advantage of offering the shelf stability of metal cans, coupled with the texture and nutrient value associated with frozen foods. The retort pouch has been considered the most significant advance in food packaging since the metal can, and has the potential to become a feasible alternative to the metal can and glass jar.<sup>16</sup>

The U.S. Army promoted the concept of flexible retortable pouches for use in combat rations in the 1950's. The idea was to have a lightweight, easy-to-pack, shelf-stable food container in order to eliminate the heavier traditional can. Research continued through the 1960's. In 1965 the first commercial retort pouches were produced in Italy. In Japan, retort pouch technology has been widely accepted<sup>16</sup> and there are many varied products on the shelf, ranging from sukiyaki to soup.

Examples of some retort pouches are shown in figure 2.1. The retort pouch has a number of advantages compared to a metal can.

1. The thin profile permits a reduced heating time and thus less of a chance to overcook the product while producing better color, firmer texture and less nutrient loss. The manufacturer has reduced energy requirements for pouch production as compared to that for metal cans.<sup>14</sup> The pouch (because of its thinner profile) transfers heat faster to its critical point. During processing, this permits the required amount of heat for proper sterilisation to reach the critical point with minimal overcooking of the product near the peripheral container areas. Thus, for those food commodities subject to quality loss from excessive heating during the process cycle, the flexible container offers the benefit of higher quality together with better retention of the heat-sensitive nutrients.
2. Some pouches have an easy to open notch that eliminates the requirements for can openers and reduces the risk of cuts.
3. Labels can be printed into the laminate, making them permanent.
4. Flexible pouches are easier to distribute and therefore have lower transportation costs and require less disposal space.
5. Storage space for empty flexible pouches is also reduced. A 45 ft.

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trailer holds 200,000 8 oz cans or 2.3 million retort pouches.

The retort pouch system has disadvantages in processing.

1. The first obstacle is that processors often require a large capital investment for the unique machinery. Filling is slower and more complex compared to metal can lines.
2. The thermal process is complex due to the number of critical processing parameters which must be monitored (e.g., residual air, pouch thickness, steam/air mixture). Also, special racking systems may need to be set up in order to provide optimal heating media flow and prevent pouch to pouch contact.
3. Since pouches are more easily punctured they may require over-wrapping for distribution.
4. Specialised equipment such as a burst tester, or a tensile tester is required for leak detection and container integrity evaluation.



Figure 2.1 Examples of Retort Pouches

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### 2.2 POUCH MATERIAL CHARACTERISTICS AND SPECIFICATIONS

The choice of materials for the manufacture of retort pouches is very important. The package must protect against light degradation, moisture changes, microbial invasion, and oxygen ingress and package interactions. The material must have sound structural integrity and be able to withstand retort temperatures as well as normal handling abuse. It must also comply with regulatory requirements. There are approximately 16 basic laminating materials with 100 different possible combinations.

Characteristics essential to a satisfactory retort pouch are:

- ◆ Low gas permeability (oxygen)
- ◆ Low moisture permeability
- ◆ Low hydrophilic properties
- ◆ Heat sealable and sterilisable
- ◆ Constructed of appropriate material (material must be approved by the Canadian Food Inspection Agency (CFIA))
- ◆ Resistant to penetration by fats, oils and other food components
- ◆ Physical strength to resist physical abuse during packing, retorting, storage and distribution (i.e., tearing, pin-holing, fatigue, impact and abrasion)
- ◆ Absence of solvent residues. Chemically inert polypropylene films require manufacturing catalysts, which must be removed with solvents before the film can be used for foods.
- ◆ Bonding materials for the laminates must not migrate into the foods.
- ◆ High light barrier.

A processor may purchase pouches in a number of different forms. The flexible pouches can be a pre-formed three-side sealed pouch or formed as an in-line operation with the filling and sealing combined in a pouch packager. There are several retort pouch filling and sealing systems commercially available. One design is shown in figure 2.3, where the retort pouches are formed from roll stock by folding a single roll along its centerline and heat sealing the sides together. The tubular material is automatically cut to length and the bottom is sealed just prior to the product filling operation.

Control of the laminate quality begins with the component material. Close control of each raw material used in the manufacture of the retort pouch must be ensured by establishing the specifications which the final laminated pouch must meet, and by establishing an effective monitoring program. Two important properties which need to be monitored during laminate fabrication are the basis weight of the laminate and the

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laminated tensile strength

### **2.2.1 Basis Weight of the Laminate**

The basis weight of the laminate is determined by the use of a laboratory balance. A sample of the pouch material is cut from the pouch material and weighed. The equivalent weight of the sample in grams is then converted into pounds per ream.

**Note:** 1 ream equals 516 sheets of paper.

### **2.2.2 Laminate Tensile Strength**

The laminate tensile strength is measured using an Instron or similar tensile tester. The bond strengths of polyester film to foil, and polypropylene film to film are measured to ensure that the retort pouch material complies with the manufacturer's specifications.

Processors generally choose the pre-formed pouches. These have three seals already formed, thus requiring a single heat bar for closing. Pouches are usually transported to the plant in master cartons of 1000 or more units.

Processors inspect empty flexible pouches prior to use for: pouch dimensions, pouch shape, correct material, and manufacturer defects (i.e., delamination, abrasions, tear notch anomalies). These observations should be recorded and those pouches not meeting the manufacturer parameters must be culled out as the hermetic integrity of the pouch may be compromised.

## **2.3 POUCH LAMINATES**

As shown in figure 2.2, most retort pouches are constructed with a 4-ply laminate consisting of a polyester outside layer, a nylon 2<sup>nd</sup> layer, an aluminum foil 3<sup>rd</sup> layer, and a polypropylene inside layer. The aluminum foil can be laminated with either the matte or the shiny side exposed to view. Normally the matte side is to the outside. Some pouch material has polyvinylidene chloride (PVDC or SARAN<sup>®</sup>), ethylene vinyl alcohol (EVOH) or nylon instead of the aluminum foils in the middle layer. The components of the laminate are held together with adhesive, which are usually modified polyolefins such as ethylene vinyl acetate (EVA).

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Each component performs a specific function that is critical to product shelf life stability and container integrity.

In some cases a clear layer, to permit viewing of the product, replaces the foil layer. The materials of choice are generally SARAN® (PVDC), EVOH or nylon. While these plastics are good barriers to oxygen molecules, they are not complete barriers, and therefore the shelf life of the container is reduced substantially.

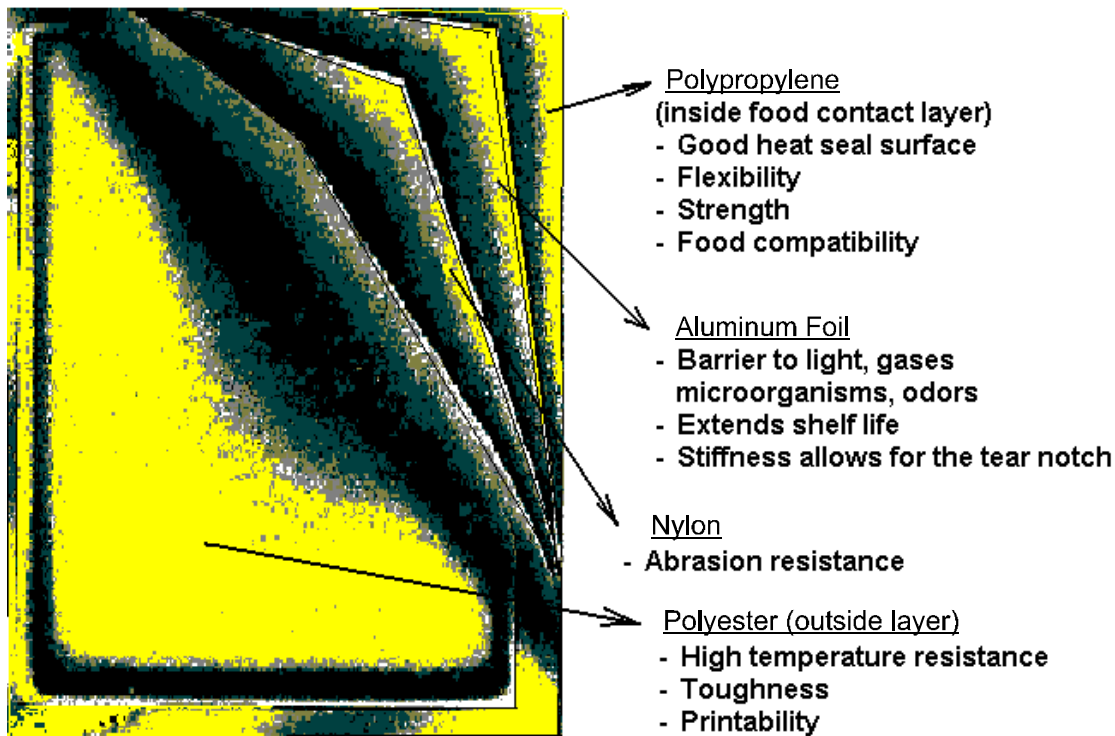


Figure 2.2 Pouch Laminations

#### 2.4 TYPES OF POUCHES

##### 2.4.1 Pre-formed Pouches

The pre-formed retort pouch, which is the type most commonly used by the food processor, has three sides already sealed by the retort pouch manufacturer.

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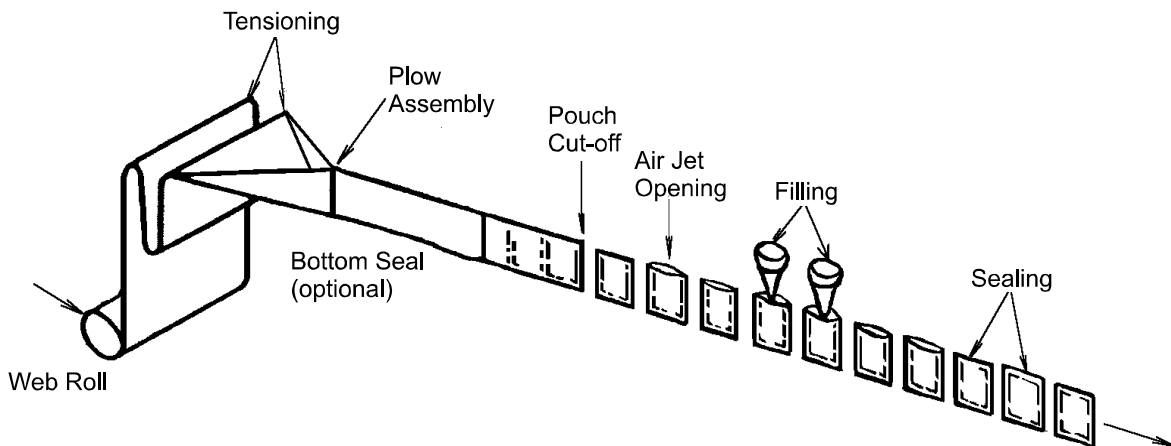
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**2.4.2 In-line Formed Pouches**

As shown in figure 2.3, roll stock laminate is fed through a tensioning device to ensure that the flexible pouch is smooth. A plow assembly then folds the laminate along the centerline, exposing the polypropylene surfaces to each other. (Some roll stock machines bring two separate rolls of laminate together.) The seals are formed using a heat-sealing device and the formed pouches are cut off.

One style of filler, for a liquid product, uses equipment that forms the pouch, fills and heat seals on a production-line basis. After exiting the sealer, the web of formed pouches is cut by a roller knife to separate the individual pouches.



**Figure 2.3 Flow Chart of Bartlett Intermittent Motion Flexible Pouch Packager**  
 (From Lopez, 1987, "Retortable Flexible Containers" in "A Complete Course in Canning and Related Processes - Book II")<sup>14</sup>

**2.5 CONTAINER TERMINOLOGY**

Any discussion or description of container defects requires standard terminology relating to the container components. See figures 2.4 and 2.5 for further details on pouch terminology.

**Body** - the area of the pouch located within the sealed area. The body of the pouch will vary in dimensions.

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**Coding** - lettering or numbering that is permanently marked onto the flexible pouch. Coding applied by the processor indicates the name of the processing establishment and the day, month and year of processing. The coding may be in indelible ink or in any other type of permanent marking (i.e., embossing the cosmetic seal) that is appropriate to the container.

**Cosmetic seal** - a seal applied by the processor. Its function is to provide an embossing surface or to prevent contamination of the area directly outside of the seal (refer to figure 2.4).

**Laminate** - the multi-layered construction characteristic of retort pouches. In retort pouches there are generally 4 layers that are held together with adhesive layers. Each layer of the laminate contributes in some manner to the container integrity.

**Manufacturer's seal** - the seals applied by the pouch manufacturer. In pre-formed pouches these generally occur on 3 sides of the pouch.

**Processor's seal** - the primary seal applied by the processor. This is intended to complete the flexible pouch's hermetic properties (refer to figure 2.4).

**Roll stock** - laminate used by the processor in the production of an entire pouch.

**Seal** - the hermetic closing of the container that needs to be secure against entry of microorganisms. The hermetic seal is achieved by the fusion of two heat-sealable layers of the laminate material (i.e., polypropylene).

**Seal tensile strength** - maximum force required to tear apart the pouch seal. Results are expressed in kg per linear mm of seal tested (pounds per linear inch of seal). Also called the bond strength of a seal.

**Seal width** - distance across the bonded area of the pouch seal.

**Tear notch** - the small cut-away portion of the manufacturer's side seal that allows the container to be torn open with relative ease (refer to figure 2.5).

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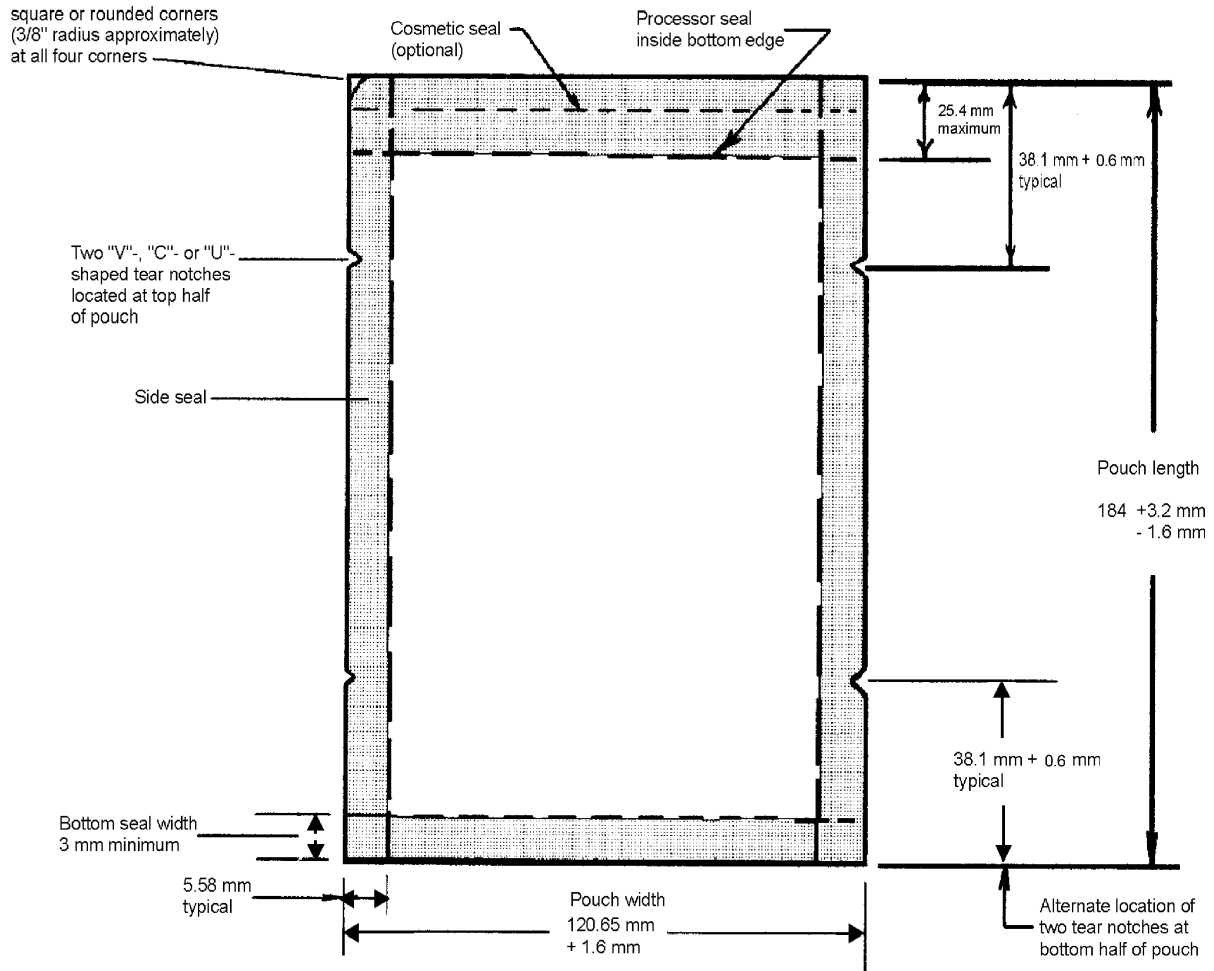


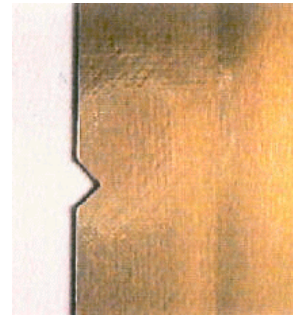
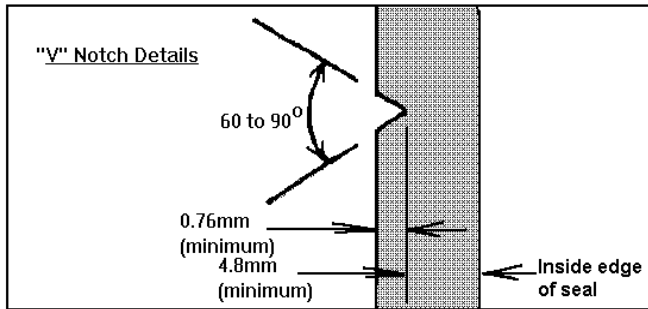
Figure 2.4 Retort Pouch



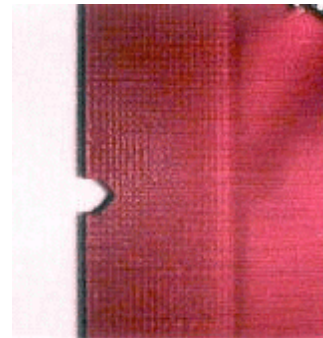
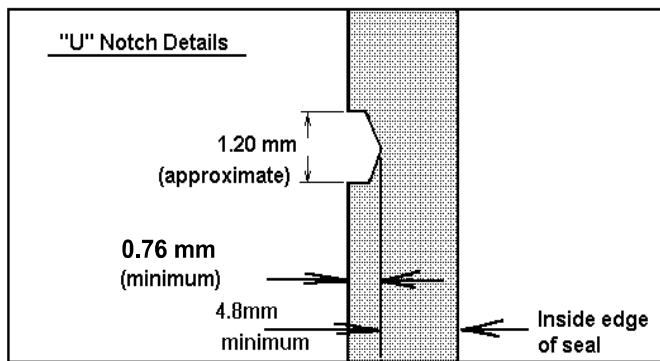
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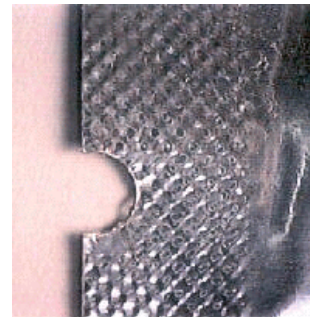
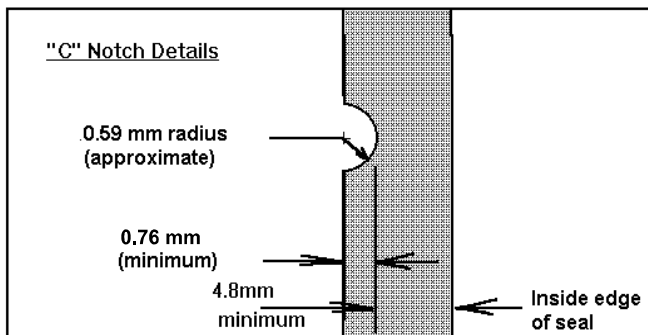
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Example of "V" notch design



Example of "U" notch design



Example of "C" notch design

Figure 2.5 Notch Designs